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

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
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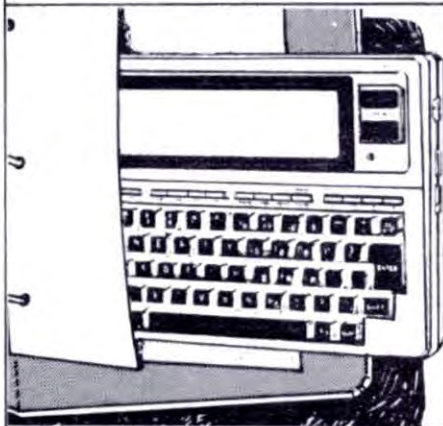
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80 Micro (ISSN 0744-7868) is published 12 times a year by 100101 Inc., 80 Pine St., Peterborough, NH 03458. Phone: 603-924-9471. Second class postage paid at Peterborough, NH, and additional mailing offices. Subscription rates in U.S. are \$36 for one year, \$55 for two years, and \$75 for three years. In Canada and Mexico \$45—one year only, U.S. funds drawn on a U.S. bank. Canadian distributor: Micron Distributors, 409 Queen St. West, Toronto, Ontario, Canada M5V 2A5. BC Canadian Distributor: Computit, 1122 Fir St., Blaine, WA 98230. Foreign subscriptions (surface mail), \$55—one year only, U.S. funds drawn on a U.S. bank. Foreign subscriptions (air mail), please inquire. In South Africa contact 80 Micro, P.O. Box 782815, Sandton, South Africa 2146. All subscription correspondence should be addressed to 80 Micro, Subscription Department, P.O. Box 981, Farmingdale, NY 11737. Please include your address label with any correspondence. Postmaster: Send form 3570 to 80 Micro, Subscription Services, P.O. Box 981, Farmingdale, NY 11737.

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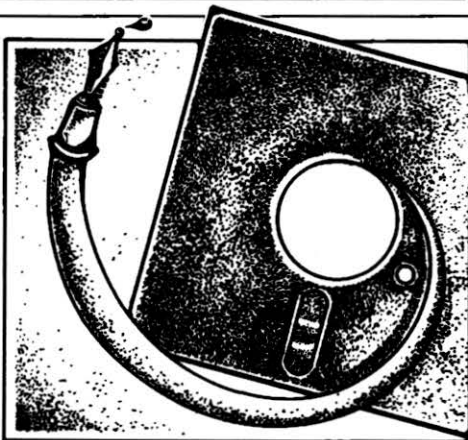
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We've already seen one so-called revolution fail. It evaporated into thin air shortly after Kent State, unable to bear the weight of its own rhetoric. So pardon me if I'm skeptical about this latest revolution supposedly being fomented by the personal computer.

At least, the media and self-styled experts on social change are calling it a revolution. If so, it's got to be the happiest one in the history of the world. It sparkles beneath a California sun that shines like a big yellow smile button. It glows brightly from the pages of *Newsweek* and *The New York Times*, from quarter-million dollar television commercials, from the zippy pop-computer magazines that hang fat and lazy from the newsstands.

Here is one revolution that promises to do you no harm. Nobody gets hurt, nobody gets agitated. With the exception of a few malcontents, nobody even gets upset.

I can't claim to be an expert on revolutions, since I've never been in one. But it's my understanding that a revolution is aimed at the fundamental concepts upon which a political or social structure is built. Take the Industrial Revolution, for example. It caused social and economic upheaval on a massive scale. It shifted power from the land-owners to the factory owners, from the rural areas to the cities, and completely changed the way people lived and worked.

But the microcomputer revolution is another story. It does nothing to challenge the basic relationship between people and their supporting institutions. It does not change the make-up of the ruling class, nor does it alter our perceptions of that class.

Some people say that microcomputers will give us more control over our lives, that computers will let us access information heretofore available only to the rich and powerful. This may, to some extent, be true; if information is power, greater access to information means greater power. But if the average

America's happiest revolution

citizen gains a little, the ruling class will gain a good deal more.

Ultimately, computers will serve to reaffirm the social and political hierarchies in this country. The strong will be stronger and the weak weaker, a trend that hardly can be called revolutionary.

Adam Osborne has been one of the micro industry's most caustic critics. So more than a few people chortled when Osborne Computer Corp. collapsed last summer.

In some respects, Osborne comes out looking like a fool. When he introduced the Osborne, he let loose a barrage of criticism at his fellow manufacturers, predicting in the May 1981 issue of *Microcomputing* that "their unrealistic perspective will trigger disaster with all the tragic ruthlessness that early success had on such companies as Imsai and Processor Technology."

But Osborne's failure was not due to lack of insight. In retrospect, his comments in that article often hit the mark. "Hardware manufacturers must concentrate on driving down the price of hardware," he warned. And further on, he predicted "a new, massive round of hardware price reductions."

Osborne also saw the impact his new

computer would have on the micro market, and predicted "a rapid evolution of new, low-cost portable microcomputers that appeal to individuals and are used with the frequency of typewriters." And, in a forecast fraught with irony, he saw that by 1983 the Osborne would "have a lot of company."

Finally, though IBM had not yet entered the arena, Osborne saw the eventual establishment of industry-standard software and hardware. "Those who stray from industry standards will be forced to leave the microcomputer marketplace," he said.

Osborne's sin was that he was as lousy a businessman as the early losers he criticized. And apparently, the major manufacturers were not as misguided as he thought they were. Ultimately, they changed their ways, learning to see and respond to shifts in the marketplace.

Osborne was an important stimulus to those changes. He may not have practiced what he preached, but he had a major impact on the industry and the way it sold itself. He should be given appropriate credit.

Last week at the Peterborough Diner, I gave the cashier \$2 for a \$1.95 turkey sandwich. The computerized cash register credited me with 9 cents' change. The waitress dutifully gave me a nickel and four pennies.

"Wait a minute," I said, and pointed out that \$2 minus \$1.95 was not 9 cents. She puzzled over the problem for a moment, finally saw the light, and took back the surplus change.

This little tale has several morals. First, we must retain our ability to do simple math.

Second, we must not believe everything the computer says, or let it subvert our common sense.

And third, we must be watchful consumers. As long as human beings punch the buttons, the buyer's motto remains "caveat emptor." ■

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Speaking in hex

You asked for it, though in a round-about fashion and probably without your knowing it. *80 Micro's* readership surveys tell us a lot about your needs. One thing we've noticed is your growing interest in Assembly language. This isn't too surprising since most of you (88.5 percent to be exact) use your TRS-80 for home or hobby applications. And we all know what that means: software programming.

Designing and writing software, especially games, is both fun and rewarding. It can also be frustrating. There's nothing worse than programming a fantastic game in Basic only to have it run as slow as molasses uphill. Screen changes take seconds and your rockets never quite seem to reach their targets in time. This is usually when your interest in Assembly language begins to take root and grow. This issue will nurture that growth.

Communicating with your computer in a high-level language like Basic is like talking with someone who speaks a foreign language. When you say goodbye to a Frenchman, he has to use a dictionary to see that you mean *au revoir*. The computer follows the same process. If you write a Basic instruction in your program, the computer has to translate this instruction to its "native tongue," machine code.

When you use a low-level language like Assembly language, the interpretive process is greatly simplified. The computer operates on Assembly-language instructions much faster because that language is closer to the Z80's machine code.

Assembly-language programs execute up to 300 times faster than Basic. They also require less memory: you can run an Assembly-language program in 4K that normally requires 24K in Basic. And if you ever had an urge to see how the Z80 processes all of those routines in ROM or TRSDOS, Assembly language lets you do that as well.

Assembly language can be intimidating at first with its extensive use of binary and hexadecimal data. But be assured that it's no more difficult to learn than when you mastered Basic years ago. To ease your nerves, and to help build your confidence, we've put together a collection of articles that cover the entire spectrum of Assembly language. Whether you're a neophyte testing the waters, or an advanced programmer doing the backstroke, you'll find something to meet your needs between this month's covers.

For example, Hardin Brothers presents his first installment of *Assembly Language Made Simple* for this issue. In this comprehensive piece he gently introduces you to your first dose of Assembly language. And since everyone loves to learn shortcuts, Bob Bowker continues to share some of his secrets with us. You'll find them in part two of his article, *Assembly-Language Shortcuts* (p.). They are especially useful for those of you who've been introduced to the language.

Other articles of interest include David Haan's technique titled *Assembly Language Disk I/O*, Terry Kepner's feature review, *CP/M III Ways*, and Joseph Trojak's *Finding the Search Solution*, a program that lets you search text files quickly. And when the day ends, you can relax in your easy chair and watch one of over 140 TV channels, made available with help from Dan Keen and Dave Dischert's article, *Channels of Communication*. If you don't want to sit in front of the boob tube all night, there's always the antics of the Gamer's Cafe to keep you smiling. So sit back and enjoy! ■

—S.F.T.
01010000

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

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INPUT

MaxiStat Now StatPac

John Harrell did an excellent job reviewing MaxiStat (September 1983, p. 50).

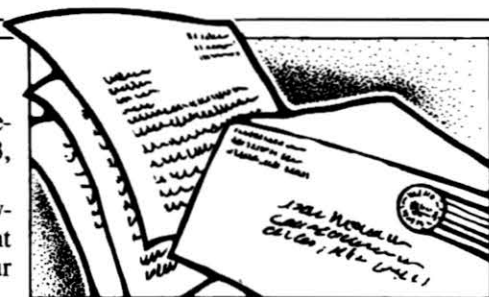
Your readers should be aware, however, that we have made important changes relative to MaxiStat since your review appeared.

MaxiStat is no longer published or marketed by The Business Division. Walonick Associates now markets and supports an updated version of the package under its original name of StatPac.

This update contains substantial changes from the version you reviewed, including more statistics, printing options, and machine-language subroutines for speed.

Anyone interested in further information should contact Walonick Associates.

*David S. Walonick
President, Walonick Associates
5624 Girard Ave. South
Minneapolis, MN 55419*



Printer Fix

The DMP200 printer has one drawback: Its superscripts are low, and the rest of the text after a subscript is noticeably lower than the text preceding the subscript.

To rectify this, change the half-reverse line feed action to a full-reverse line feed followed by a half-forward line feed (see Program Listing 1). This has an insignificant effect on print speed, and it works.

This fix also works on the Radio Shack Line Printer VIII, and with other Radio Shack printers that use the same printer drivers.

To install this modification, define

```
PATCH DMP400/CTL (ADD=BCAC,FIND=1C,CHG=0A)
PATCH DMP400/CTL (ADD=BCB0,FIND=C9,CHG=00)
PATCH DMP400/CTL (ADD=BCB8,FIND=1E,CHG=1C)
PATCH DMP400/CTL (ADD=BB4D,FIND=A5,CHG=B1)
PATCH DMP400/CTL (ADD=BB50,FIND=B1,CHG=A5)
PATCH DMP400/CTL (ADD=BC76,FIND=B1,CHG=A5)
PATCH DMP400/CTL (ADD=BC82,FIND=A5,CHG=B1)
```

OR

```
PATCH LP8/CTL (ADD=BC9E,FIND=1C,CHG=0A)
PATCH LP8/CTL (ADD=BCA2,FIND=C9,CHG=00)
PATCH LP8/CTL (ADD=BCAA,FIND=1E,CHG=1C)
PATCH LP8/CTL (ADD=BB4D,FIND=97,CHG=A3)
PATCH LP8/CTL (ADD=BB50,FIND=A3,CHG=97)
PATCH LP8/CTL (ADD=BC68,FIND=97,CHG=A3)
PATCH LP8/CTL (ADD=BC74,FIND=97,CHG=A3)
```

Program Listing 1. Patch for the DMP200 printer.

```
900 BK$ = CHR$(255)+CHR$(255)+CHR$(255)
910 SP$ = CHR$(128)+CHR$(128)+CHR$(128)
920 TB$ = CHR$(27)+CHR$(16)+CHR$(0)+CHR$(48)
1000 LPRINT CHR$(18);
1010 FOR H = 0 TO 47
1015 LPRINT TB$;
1020 FOR W = 0 TO 127
1030 IF POINT (W,H) THEN LPRINT BK$; ELSE LPRINT SP$;
1040 NEXT W
1050 LPRINT ""
1060 NEXT H
```

Program Listing 2. LPVIII print adjustment.

the user print code as the control-@ key sequence, since the @ key is close to the * key. Use the System Set-up option from the main menu and then the Enter Printer Codes option.

Under the @ key, enter 0 for the units and 27,10,27,28 for the sequence of codes.

You can also change printer driver DMP400/CTL or LP8/CTL by replacing the half-reverse line feed code with the code for a full-reverse line feed followed by a half-forward line feed (second half of Listing 1). This lets you use the control-* code exactly as normal, and there is no interference with any observable function of SuperScript 1.1.

You must type in the patches exactly as shown below, and only to your backup copies of the program (building a do-file is a very convenient way to save on repeated typing).

*Ian McCauley
Department of Biochemistry
University of Western Australia
Nedlands, 6009*

LPVIII Expanded Graphics

In Jim Hanson's letter to Input (June 1983, p. 12), his program to display screen graphics to the LPVIII prints graphics horizontally shortened by one third.

Program Listing 2 is a modification to Hanson's program that solves this problem. Lines 900 and 910 define the block and space print location. Line 920 defines the tab (LPVIII POS command) to center the display on the page.

*Don Moore
P.O. Box 1405
Coconut Grove, FL 33133*

Machine-Specific Programs

I am distressed by the concept, stressed throughout *80 Micro*, that every program published must be compatible with both the Model I and Model III.

Most of the programs in your magazine that run on the Model III also run on a Model I, and it's the same story for many software companies.

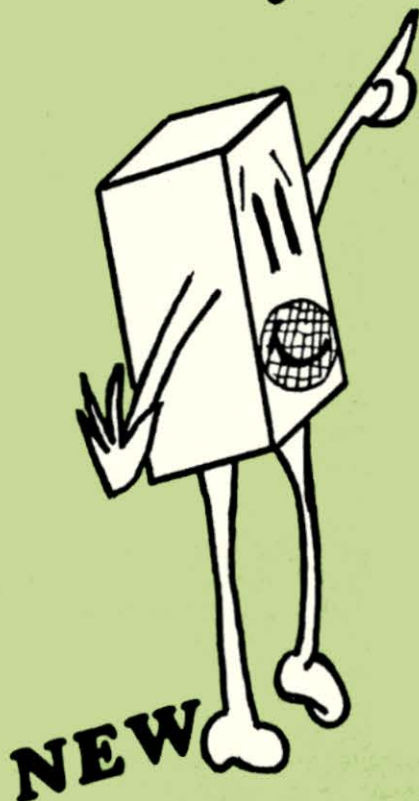
The reasons for this phenomenon are simple and well intentioned: Having the same program work on both machines satisfies twice as many people, means

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ERROR Trap

In our "Buyer's Guide to Disk Drives and Disks" (June 1983, p. 234), we omitted Micro Design. Micro Design (6301 Manchaca Road, Austin, TX 78745, 800-531-5002) markets one 40-track, 5¼-inch disk drive for the Model I, and three systems for the Model III.

Micro Design offers 40-track, single-sided 5¼-inch disk drives with 250K storage capacity (first upgrade is \$399, second internal drive is \$189.95). Also available are 40-track, double-sided disk drives with 500K storage capacity (first drive upgrade is \$474, second drive is \$274), and 40-track, 5¼-inch, double-sided drives with 500K storage capacity (disk drive upgrade is \$495, additional slim line drive is \$295).

In the September Input column (p. 12), we omitted the program listing for Howard Potvin's letter. Program Listing 6 eliminates the extra alpha column headings in John Corbani's Minicalc program (May 1983, p. 140).

Line 470 contains the code to set an Epson printer to 132 characters per inch, and Potvin changed the reference to the number of columns in line 110 from 14 to 15. Line 475 sets unidirectional printing and checks for number of columns.

If you have eight or fewer columns, set Q to 1 and drop to line 480. If you have more than eight, set Q to 9 and go to line 476 to print the first eight columns. Then go to line 480 and print the rest. Line 49 keeps the underline length correct.

These changes print the full 16 columns by 26 rows on one sheet of standard sized paper.

Richard Green's review of Power DOT (October 1983, p. 80) contains a minor error. On page 84, the two angles referred to as 150 degrees are actually 15 degrees.

you have to write only one version of the program, and guarantees that you can keep the software if you upgrade from a Model I to a Model III.

I cannot help thinking, however, that this practice is short-changing owners of Model IIIs and modified Model I's. These programs don't let me use my special features at all.

As an example, Radio Shack obviously designed its Series I Editor/Assembler for a Model I. Only the left shift key works, and I must use the low cassette speed. To generate lowercase characters, I have to depress the shift key.

Ideally you should have two versions of the same program, each designed for its own individual machine. An excellent example of this is Frolic, the machine-language monitor contained in the book *TRS-80—More Than Basic*, by John Froehlich.

Mr. Froehlich wrote two different monitor programs, one for each model, each version using its own model's special features. Why can't major software manufacturers do this as well?

I urge the editors of *80 Micro* to encourage machine-specific program submissions. Once you have such programs, you could convert them, much the same as you do in the Take II column.

I have used both the Model I and the Model III, and it isn't difficult to alter existing generic programs to fully utilize each machine's specialties.

Once people stop bunching together the Model I and III as one machine, the owners of both will be better off. However, the trend does not seem to be in that direction.

A serious flaw in Model 4 Basic is the

necessity of separating each Basic key word with a space. Will programs published in the future in magazines and on disk and tape have spaces between each keyword, to make every program compatible with that machine too? I sincerely hope not.

Mark Allen Reed

Box 459-A

Lyme Center, NH 03769

AIDS-III Space Saver

Although the AIDS-III packages published in the March and April 1983 issues (p. 136 and p. 168, respectively) of *80 Micro* are the most useful to be found, they take up a lot of disk space.

I've come up with a way to save a great deal of disk space and keep several files on one disk.

Make up individual data lists (all starting at line 5000) and save them as ASCII files (use the ,A option). Then make up a menu for the programs you've developed (see Program Listing 3), plug the menu into lines 1-7 of the AIDS package, and you can use the same basic AIDS program to load any number of data files.

After you type in RUN, the program asks if you've loaded a program yet. Answer anything but Y. The program then brings up the menu. By selecting the number of the desired data file, you can merge it with the original AIDS package. At the ready prompt, type RUN, answer Y this time, and press the enter key.

Using this procedure, I'm able to get AIDS-III, MAPS-III, MERGE-III, CALCS-III, and eight data files (saved in ASCII), their descriptor files, and their record files on one disk.

```

1 CLS:PRINT@596, "HAS A PROGRAM BEEN LOADED YET?": INPUT A$: IF
A$="Y" THEN 10 ELSE 3
3 CLS:PRINT@74, "THE FOLLOWING PROGRAMS ARE DEVELOPED:": PRINT@2
02, "1. VIDEO LISTINGS.": PRINT@266, "2. FOOD CABINET INVENTORY.":
PRINT@330, "3. FREEZER INVENTORY.": PRINT@394, "4. FRIENDLY PARTIES
.": PRINT@458, "5. HOUSEHOLD INVENTORY."
4 PRINT@522, "6. SUBORDERS.": PRINT@586, "7. UNDEFINED.": PRINT@65
0, "8. EXIT PROGRAM.": PRINT@842, "SELECT CHOICE...": INPUTN: IFN<
10RN>8 THEN CLS: GOTO 3 ELSE CLS
5 IFN=1 THENPRINT@596, "MERGING VIDEO PROGRAM": MERGE "VIDEODES/F
IL" ELSEIFN=2 THEN PRINT@596, "MERGING FOOD CABINET PROGRAM": ME
RGE "FOODES/FIL" ELSEIFN=3 THEN PRINT@596, "MERGING FREEZER PRO
GRAM": MERGE "FREEZDES/FIL" ELSE6.
6 IF N=4 THENPRINT@596, "MERGING FRIENDLY PROGRAM": MERGE "FRENDE
S/FIL" ELSEIFN=5 THEN PRINT@596, "MERGING INVENTORY PROGRAM": MER
GE "HOUSEDES/FIL" ELSEIFN=6 THENPRINT@596, "MERGING SUBORDER PRO
GRAM": MERGE "SUBSDES/FIL" ELSE7
7 IF N=8 THEN STOP: ENDELSEIF N>8ORN<8 THENCLS: FORI=1TO100: PRI
NT@596, "UNDEFINED...":NEXTI:GOTO3

```

Program Listing 3. Menu for the AIDS-III program.

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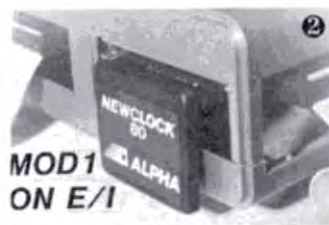


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Now if someone can show me a way to get Basic to run after a merge without typing in RUN, I'd really be happy!

*James T. Krywalski
80 Lockwood Ave.
Buffalo, NY 14220*

AIDS-III Error

An error exists in the lowercase support program modifications that appeared in the August 1983 issue of *80 Micro* (p. 12). The modifications support the lowercase characters, but disable the up-arrow (K1) key so it no longer functions to move the cursor to the previous entry lines.

I corrected this by adding and changing the following program lines to the AIDS-III program, in addition to making the changes that appeared in the August 1983 issue.

```
170 IFIC=91THENIC=6
2000 US=CHR$(91): CC$=US+ CHR$(K2)+
      CHR$(K5)+ CHR$(K6)+ CHR$(K9)
3744 DATA 13,6,10,8,9,27,26,24,25,31,3
```

I use 123 instead of 6 in lines 170 and 3744, but suggest the use of 6. It's shorter and appears to work, although I haven't tested it thoroughly.

Also, line 640 of the August modifications for AIDS-III has a slight error in the last statement. SV = FV\$ should read SV\$ = FV\$ to conform with the original program and the MAPS-III and CALCS-III changes.

*Darrell Lee
The Food and Drug Administration
c/o Administration Building,
Room 1033
1745 W. 1700 South St.
Salt Lake City, UT 84104*

Maze Chase PEEK

The changes in Program Listing 4 are for Leonard Karr's Maze Chase game (August 1983, p. 272). They let you hold one key down and continue to move until you release the key.

*Mike Cessna
610 N. 54th St.
Springfield, OR 97477*

High-Speed POKE

For the Model 4 owner, Model III software operates at the Model 4's higher speed by utilizing the following POKE from Basic:
POKE 16912,104 (to speed up)
POKE 16912,40 (to slow down)

When assembled, the source code in Program Listing 5 permits toggling the

speed-up off and on from the DOS READY command line.

*R. L. Stuart
15434 Sherman Way
Van Nuys, CA 91406*

More on the Model 4

Regarding the Model 4 review, "Once More, with Feeling" (August 1983, p. 100), I've found that other commands not supported by Microsoft Basic 5.0 include Set, Reset, and Point, limiting graphics production.

Also, space delimiters required after reserved words in Microsoft Basic 5.0 don't take up additional memory. The program removes these spaces when it converts Basic commands to single-byte tokens, and they are restored at print or list time.

It is true that the conversion utility (CONV) lets you copy files from TRSDOS 1.2 and 1.3 formatted disks to TRSDOS 6.0 formatted disks. However, this conversion is of minimal help in converting Model III Basic to Microsoft Basic 5.0 because mapping Basic commands to single-byte tokens is entirely different in the two Basics.

Finally, my greatest frustration is the unavailability of the *Model 4 Technical Reference Manual* referred to in the *Model 4 Disk System Owner's Manual*. Without this manual, it's impossible to interface Assembly language with either the Model 4 hardware, or with TRSDOS 6.0.

*Gregory E. Nutt
23 Pendleton Lane
Londonderry, NH 03053*

```
2100 L=PEEK(14400)
2110 IF L=8ANDPEEK(S+PL-64)...
2120 IF L=32ANDPEEK(S+PL-3)...
2130 IF L=16ANDPEEK(S+PL+64)...
2140 IF L=64ANDPEEK(S+PL+3)...
3070 PRINT"      UP ARROW MOVES YOU UP"
3080 PRINT"      DOWN ARROW MOVES YOU DOWN"
3090 PRINT"      LEFT ARROW MOVES YOU LEFT"
3100 PRINT"      RIGHT ARROW MOVES YOU RIGHT"
```

Program Listing 4. PEEK for Maze Chase.

```
00100 ; *****
00110 ; *      SPEED/SRC      *
00120 ; * Speed Toggling Program *
00130 ; * For Model III Software *
00140 ; * Used on TRS-80 Model 4 *
00150 ; *****
00160 ;
00170 ORG      0FF00H      ;PROGRAM LOAD ADDRESS
00180 LD      HL,16912    ;HL POINTS TO SPEED ADDRESS
00190 LD      A,(16912)   ;A=VALUE IN SPEED ADDRESS
00200 CP      104         ;IS IT 104? (HIGH)?
00210 JP      Z,LP1      ;IF HIGH, JUMP LP1 FOR LOW
00220 LD      (HL),104    ;IF LOW, MAKE HIGH
00230 JP      LP2        ;AND JUMP LP2 TO EXIT PGM.
00240 LP1    LD      (HL),40 ;IF HIGH,MAKE LOW (40)
00250 LP2    JP      402DH ;JUMP TO DOS READY
00260 END      0FF00H
```

Program Listing 5. Speedup toggling program for the Model 4.

```
470 IFPEEK(14312)<>61THEN PRINT@960,"PRINTER NOT READY";GOTO 470
ELSE LPRINT CHR$(15)TAB(10) TY$:LPRINT
475 LPRINT CHR$(27) "U":IFMV<8THENQ=1:GOTO480 ELSE Q=9
476 LPRINT TAB(5);:FORR=1 TO 8: LPRINT "      CHR$(R+64) "
";:NEXT: LPRINT: LPRINT: FORA5=1 TO MH+1: LPRINT TAB(5) A5TAB(9)
";:FORR=1 TO 8:T$=MID$(A$(A5),R*15-13,14):GOSUB 510:NEXT: LPRINT
477 IF A5=MHLPRINT TAB(5) STRING$(120,"-")
478 NEXT: LPRINT: LPRINT: LPRINT
480 LPRINTTAB(5);:FOR R=Q TO MV+1: LPRINT "      CHR$(R+64) " ";
: NEXT: LPRINT: LPRINT: FOR A5=1 TO MH+1: LPRINTTAB(5)
) A5 TAB(9);:FOR R=Q TO MV+1: T$=MID$(A$(A5),R*15-13,14):GOSUB 5
10:NEXT: LPRINT
490 IF A5=MHL PRINTTAB(6) STRING$(15*(MV-Q+2),"-")
500 NEXT: LPRINT: LPRINT: LPRINT: RETURN
510 V=VAL (T$): IF V=0 LPRINT "T$;:RETURN
520 LPRINTUSING "#####.###";V;:LPRINT "      ";:RETURN
```

Program Listing 6. Adjustment program for Minicalc.

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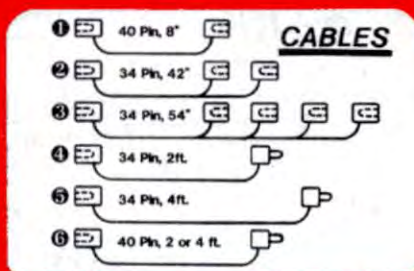
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- Several are just a flat piece of standard colored Lucite. The green tint was not made for this purpose and is judged by many to be too dark. Increasing the brightness control will result in a fuzzy display.
- Some are simply a piece of thin plastic film taped onto a cardboard frame. The color is satisfactory but the wobbly film gives it a poor appearance.
- One "optical filter" is in fact plain acrylic sheeting.
- False claim: "A few pretend to "reduce glare" in fact their flat and shiny surfaces (both film and Lucite type) ADD their own reflections to the screen.
- A few laughs: One ad claims to "reduce screen contrast". Sorry gentleman but it's just the opposite. One of the Green Screen's major benefits is to increase the contrast between the text and the background.
- Drawbacks: Most are using adhesive strips to fasten their screen to the monitor. This method makes it awkward to remove for necessary periodical cleaning. All (except ours) are flat. Light pens will not work reliably because of the big gap between the screen and the tube.



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Selecting Records

I'd like to select records in a variables file when merging with the master file in Scripsit. Does anyone know of a program that will accomplish this? It would also be nice if the selection criteria could accommodate more than OR or AND connectives.

*Paulo Guarinello
Emiliano Pernetá, 837/802
Curitiba, Parana
Brazil*

Up and Running

Can someone help me get MicroSoft's Level II Basic Compiler up and running on a Model III?

*John S. Letcher Jr.
P.O. Box 104
Southwest Harbor, ME 04679*

Line-Renumbering Program

I have a Model III cassette operating system. After writing lengthy programs in Basic, I desperately need a line renumbering program. Does anyone know where I can get such a program?

*Robert Leland
737 Knollwood Lane
San Dimas, CA 91773*

Sell Me Yours

I can't find Microsoft's Extended



Searching for answers

muMath for the Model III anywhere. Does anyone know where I can get a copy? If you're willing to sell yours, contact me.

*Kenneth Meyer
1314 Ault View Ave.
Cincinnati, OH 45208*

Needs a Conversion Program

I have been using a Wang 2200 B system for several years, and now that I have a Model II, I have no way to access my engineering programs on the Wang

disks. I'd like to know if there's a reformatter/conversion program available that can exchange data files from Wang to TRSDOS and vice versa.

*Julio E. Sosa
P.O. Box 6-473
Panama City
Republic of Panama*

A Call from Nature

I'm a teacher at a natural resource college, and I'd like to hear from others on how they use their TRS-80s in the natural resource fields. Also, I'd like to know how to get double-width characters in Assembly language.

*Robert Johnson
274 Grey St.
Brantford, Ontario N3S 4W8
Canada*

Footnotes¹

I'm looking for a Model I footnote program integrated with Scripsit that features pagination, formatting, and numbering. Can anyone help me?

Also, has anyone figured out how to save either a Basic or ASCII file onto tape from the Atari 400 and then read that tape into a Model I?

*E. Judson Jennings
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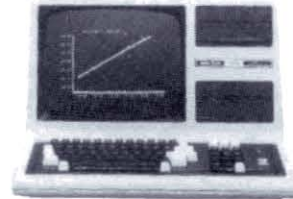
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Now You Can Talk

There is an error in Program Listing 5 of Douglas Payne's article, "Talk to the Big Guys" (September 1983, p. 230). In the program UT5, lines 1490, 1510, 1580, 1630, 1650, 1700, 1720 have been incorrectly printed as DEFB ' '. You must change them to read DEFB '27H' for the program to work correctly.—Eds.

Blackjack

The last part of line 1230 and all of line 1240 is missing in Program Listing 4 of my "Model II Casino" article (August 1983, p. 148). These lines should read:

```
1230 PRINTCHR$(2);:PRINT@L," "
:PRINT@L+80," ":PRINT@L+160," "
:PRINTCHR$(1);:RETURN
1240 PRINTCHR$(2);:L=683:GOSUB1230
:RX=R6:GOSUB1160:T$=M$(R6)
:GOSUB1200:PRINTCHR$(1);:RETURN
```

```
IRAND: PUSH HL
      CALL RANDOM ;reinitialize random numbers
      POP HL
      LD A,(HL) ;and so on
```

Figure 1. Calling Random.

Also, in the "Black Friday" conversion program (Take II, July 1983, p. 342), the last equals sign in line 510 should be an asterisk.

Byron Lott
913 Inverness Way
Sunnyvale, CA 94087

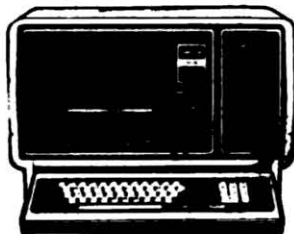
A Random Breakout?

There is a minor problem with J.B. Harrell's "Fortran Breakout" article (July 1983, p. 186). The IRAND function in USRLIB/MAC isn't very random after the first two or three calls (to be sure, I checked the routine with TASMOM). It does have an easy fix, however. Just call RANDOM every time (see Fig. 1).

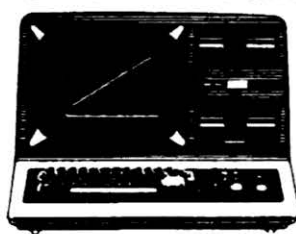
In addition, three bytes can be saved for each of the one-command calls (CLS, RANDOM, GETCH) by simply setting the entry equal to the address (ex. CLS EQU 01C9H).

Mary Jo Kostya
Oppenheimer Str. 17
D-6000 Frankfurt 70
Federal Republic of Germany

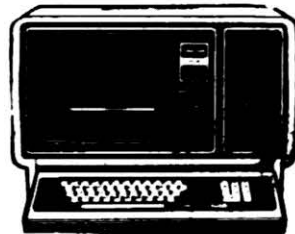
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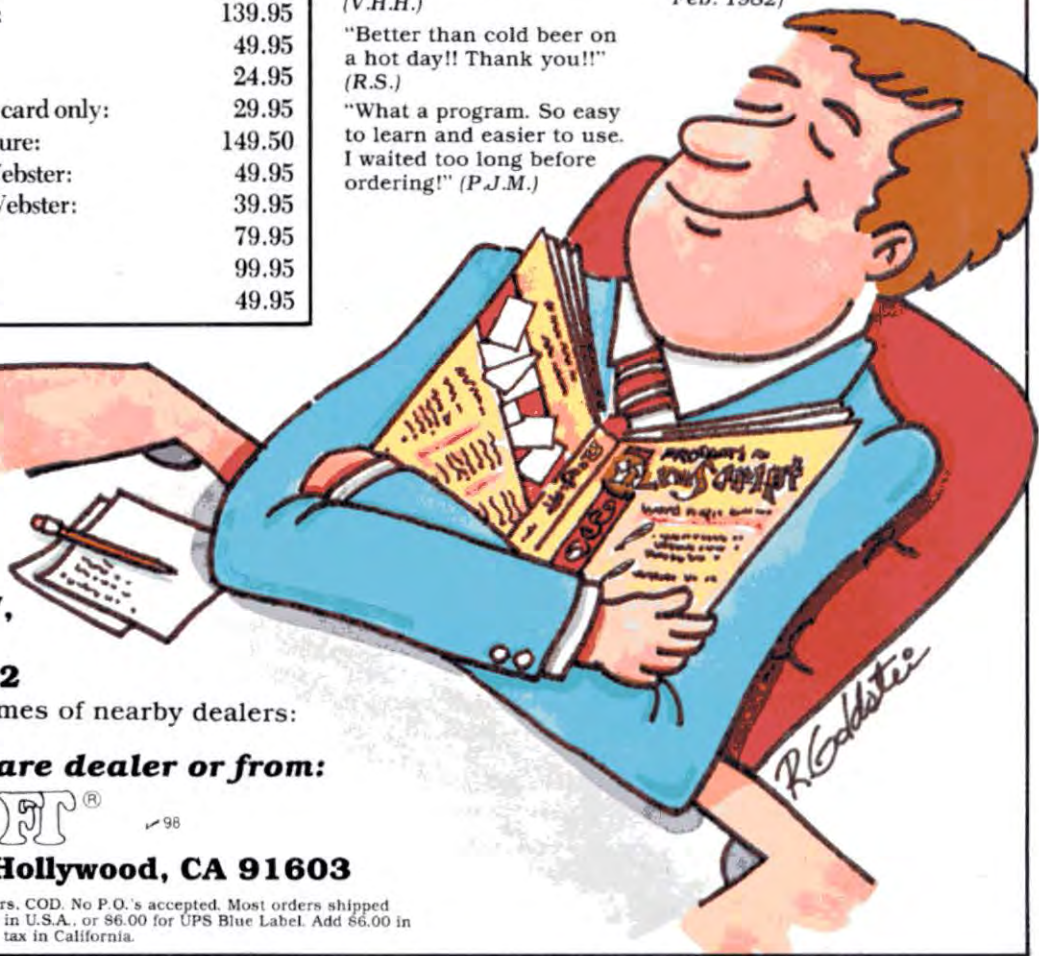
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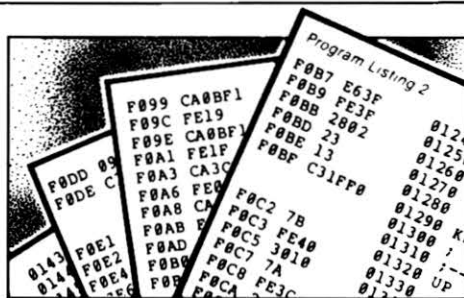
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Last month, I explained a simple utility that displayed all current variables in a running Basic program. This month, as promised, I'll explain how to add a new feature to that utility: the ability to display the current value of any current variable.

After the program displays each screen of active variables, you'll be able to either press the enter key to go on to the next page or type in a variable name. If you enter a variable name, its value appears on the screen until you press a key; then you again face the choice of pressing the enter key or typing in another variable name.

Much of Program Listing 1 is identical to last month's program. Realizing you probably won't want to type in the same program again, I've marked all new or modified lines with an asterisk at the beginning of the comment column. Some line numbers have changed, but if a program block doesn't have any marked lines, you won't need to change anything in the source code. You will, however, have to delete lines 2550 and



Displaying the values of variables

2610-2670 from last month's program. After you've added the new lines, type N100,10 and be sure you end up with the same last line as the listing.

The first major change in the program, aside from some new EQU statements and a new ORG address, occurs in lines 960-1040, where I've added a

flag-handling routine. This program uses ROM routines to read and decipher the keyboard. However, the entire program starts with decoding a special combination of three keys: the shift, down-arrow, and V keys. If the utility is active (displaying variables) and the operator again pushes the control/V key combination, the program doubles back on itself recursively. The screen and cursor buffers are overwritten, and the program ends up in an endless loop.

To avoid such problems, line 970 reads a flag that shows whether the utility program is currently running. If the program sets the 1-byte flag to zero, it ignores control/V and invokes the regular keyboard driver. If the utility program sets the flag to any other value (generally OFF hexadecimal (hex)) it knows that it's not currently running and lets itself be invoked. The utility sets the flag to zero when you enter the program and resets to OFF hex during the Done routine as the program returns control to Basic.

The flag avoids the problems that recursion would create, but it can cause another problem: Some ROM routines that the program calls generate an error condition. If an error occurs, the ROM routine reports the error on the screen and returns control to Basic's READY prompt, bypassing the normal flag reset in Done. The flag remains set at zero and you won't be able to use the utility because it reacts as if it's already being used. To reactivate the program, you have to POKE any non-zero value into the flag's location (0BFFF hex if you don't change the ORG value).

The second addition to the program is the routine called NOKEY. I found that I occasionally fail to release the control/V key sequence quickly enough, so one of the keys is read as part of the variable name. The NOKEY routine guards against this by refusing to let the program start until you've released all the keys. The B register is used as a counter to help delay the NOKEY reading to avoid keybounce. If you still have a problem with spurious key reads, increase the time of the loop by using BC as a counter.

The ENDSCR routine is almost entirely new and contains the crux of this

Address	Description
RST 18 hex	Compares the values in the DE and HL register pairs. Sets flags to show results: Carry HL<DE No Carry HL>=DE Zero HL=DE Not Zero HL<>DE
0049 hex	Waits for single keyboard input—returns ASCII value of input key in A register. Uses AF and DE registers.
01C9 hex	Clears screen, resets cursor to top of screen, sets 64-character mode, and turns off cassette port (Basic's CLS routine).
033A hex	Displays character in A on screen at next print position. Uses AF.
05D9 hex	Inputs line from keyboard. On entry, HL points to buffer to hold input, B holds maximum number of characters to input. You terminate input by pressing the enter or break key. On output, HL points to start of text, B equals actual input length (except terminator), C holds original value of B, A holds ASCII value of terminating character, C flag is set only if input is terminated with the break key.
0A9A hex	Current value in HL is loaded into Basic's workspace/accumulator, and the variable type flag is set to 02 (integer).
0ACC hex	Value in workspace/accumulator changed from integer to single precision.
0FDB hex	Converts value in work workspace/accumulator into display form, and returns address of resulting string in HL.
2540 hex	Loads value of variable into workspace/accumulator. On entry, HL points to first character of variable name. On exit, HL points to first character following variable name.
2B75 hex	Output a string to current output device. On entry, HL points to first character of string, which must end with a zero byte.

Figure. ROM routines used in the variable display programs.

month's modification. After correctly positioning the print cursor, the program prints a CHR\$(IF hex) on the screen. That control character clears the screen from the present print position to the end of the screen. This is necessary to erase any characters left from a previous variable and value display.

Then, after the program displays the prompt message, line 2830 points HL at an input buffer and sets B to the buffer's length in preparation for accepting a typed-in variable name. Since both DOS and Basic have input buffers, you may wonder why they weren't used instead of dedicating space to a third buffer. I didn't use the DOS buffer because there is no guarantee it will be in the same position with different DOS systems, or with different versions of the same DOS. I left the Basic buffer alone because you might want to call up the variable display while writing or editing a line of Basic and not wish to return to a line filled with garbage.

After you set up HL and B, the program calls the ROM routine LINEIN. This routine accepts keyboard input of a string up to the maximum length set in register B. With each keystroke, the character appears on the screen and is stored in the buffer to which HL points. The routine reacts normally to backspacing and other control characters. On return, the B register contains the number of characters actually entered except for the terminating character (enter or break). If you press the break key, the program sets the carry flag.

If you press the break key during variable input and set the carry flag, the program loops back to the prompt and again awaits operator input. If B equals zero, you pressed the enter key without any additional characters, so the screen clears and control returns to the display routines.

If you input any additional characters, the program assumes it has a variable name in the buffer. First, the program establishes a new cursor position. Then it prints the variable name followed by an equal sign. The program points HL at the variable name again and calls the ROM routine VALACU.

VALACU (2540 hex) is a complex routine that takes the variable name at which HL points, evaluates that variable, transfers its value to the low memory accumulator, and sets a flag to indicate the variable type (integer, string,

Program Listing 1. Current variable display.

```

00100 ;*****
00110 ;*
00120 ;* Current Variable Display *
00130 ;*
00140 ;* On <Shift> <Dwn-arrow> <V> *
00150 ;* shows two screens (or more)*
00160 ;* 1st -- all defined, simple *
00170 ;* variables *
00180 ;* 2nd -- all defined array *
00190 ;* variables *
00200 ;*
00210 ;* After each screen, values *
00220 ;* of current variables may *
00230 ;* be listed. *
00240 ;*
00250 ;*****
00260 ;
00270 ;
00280 ;Listing of routines and addresses:
00290 ;
033A 00300 PRINT1 EQU 033AH ;PRINT 1 CHAR.
2B75 00310 PRINT EQU 2B75H ;PRINT STRING
01C9 00320 CLS EQU 01C9H ;CLEAR SCREEN
0A9A 00330 HLACUM EQU 0A9AH ;HL=> RAM ACCUMULATOR
0ACC 00340 ACINSN EQU 0ACCCH ;ACCUM. VALUE INT=>SINGLE
0FBD 00350 ACUSTR EQU 0FBDH ;ACCUM => ASCII STRING
05D9 00360 LINEIN EQU 05D9H ;ROM LINE INPUT ROUTINE
2540 00370 VALACU EQU 2540H ;VALUE OF VAR.=> ACCUM
40AF 00380 VTFLAG EQU 40AFH ;VARIABLE TYPE MARKER
0049 00390 WAITKY EQU 0049H ;GET SINGLE KB INPUT
0400 ;
4016 00410 KBDVR EQU 4016H ;KB DRIVER ADDRESS
4020 00420 CURSAD EQU 4020H ;CURSOR POSITION ADDRESS
0430 ;
3804 00440 ROW3 EQU 3804H ;P-W KEYBOARD ROW
3840 00450 ROW7 EQU 3840H ;ENT & ARROWS KB ROW
3880 00460 ROW8 EQU 3880H ;SHIFT KEYBOARD ROW
0470 ;
3C00 00480 VIDEO EQU 3C00H ;TOP OF SCREEN
3F7B 00490 ENDDSP EQU 3F7BH ;LAST LINE FOR DISPLAY
3F88 00500 PRTPOS EQU 3F88H ;ADDR. FOR PROMPT DISPLAY
0510 ;
4411 00520 MEMTOP EQU 4411H ;MEMTOP FOR MOD.III DISK
0530 ; use 4049H for MODI Disk, 40B1H for tape systems
0540 ;
40F9 00550 SVT EQU 40F9H ;BEG. OF VARIABLE LIST
40FB 00560 AVT EQU 40FBH ;BEG. OF ARRAY LIST
40FD 00570 FREE EQU 40FDH ;BEG. OF FREE SPACE
0580 ;
0590 ;
0600 ; First, patch routine into keyboard
0610 ; driver, being careful to save current
0620 ; driver address, and reset MEMTOP.
0630 ;
B9C5 00640 ORG 0B9C5H ;CHANGE ORG TO RELOCATE
0650 ; this address for top of 32K RAM
0660 ;
B9C5 2A1640 00670 SETUP LD HL,(KBDVR) ;GET CURRENT DRIVER ADDR.
B9C8 11DDE9 00680 LD DE,TEST ;GET ROUTINE ADDR.
B9CB DF 00690 RST 18H ;COMPARE DE & HL
B9CC 280C 00700 JR Z,SET10 ;GO IF ALREADY SET
B9CE 22F0B9 00710 LD (RETURN+1),HL ;SET RETURN ADDR.
B9D1 ED531640 00720 LD (KBDVR),DE ;SET 'TEST' AS KB DRIVER
B9D5 1B 00730 DEC DE ;DE-TEST-1
B9D6 ED531144 00740 LD (MEMTOP),DE ;SET MEMTOP
B9DA C32D40 00750 SET10 JP 402DH ;RETURN TO DOS
00760 ;
00770 ; Line 750 should be JP 1A19H for tape systems
00780 ;
00790 ; Now test for <SHIFT> <DOWN-ARROW> <V>
00800 ;
B9DD 3A4038 00810 TEST LD A,(ROW7) ;GET DWN-ARW ROW
B9E0 E610 00820 AND 10H ;IS IT DWN-ARW?
B9E2 280B 00830 JR Z,RETURN ;GO IF NOT
B9E4 3A8038 00840 LD A,(ROW8) ;GET SHIFT ROW
B9E7 B7 00850 OR A ;SET FLAGS
B9E8 2805 00860 JR Z,RETURN ;GO IF NO SHIFT KEY
B9EA 3A0438 00870 LD A,(ROW3) ;GET P-W ROW
B9ED E640 00880 AND 40H ;CHECK FOR V
B9EF CA0000 00890 RETURN JP Z,0000H ;SETUP PUTS VALUE HERE
00900 ;
00910 ; <Shift> <down-arrow> <V> have been pressed.
00920 ; Check flag status.
00930 ; Save all registers.
00940 ; Save screen & then clear it.
00950 ;
B9F2 CD25BB 00960 CALL PUSHAL ;SAVE ALL REGISTERS
B9F5 3AFFBF 00970 LD A,(FLAG) ;GET FLAG REGISTER
B9F8 B7 00980 OR A ;SET F REGISTER
B9F9 2806 00990 JR Z,NOTNOW ;GO IF ZERO
B9FB AF 01000 XOR A ;SET A TO ZERO
B9FC 32FFBF 01010 LD (FLAG),A ;SET FLAG REGISTER
B9FF 1805 01020 JR NOKEY ;AND GO
01030 ;
BA01 CD2EBB 01040 NOTNOW CALL POPAL ;RESTORE REGISTERS
BA04 18E9 01050 JR RETURN ;GO TO NORMAL KB DRIVER
01060 ;
BA06 06FF 01070 NOKEY LD B,255 ;SET FOR TIMING LOOP

```

Listing 1 continued

THE NEXT STEP

Listing 1 continued

```

BA08 3AFF3B 01080 NOKEY5 LD A,(3BFFH) ;*CHECK FOR ANY KEY
BA0B B7 01090 OR A ;*SET FLAGS
BA0C 28FA 01100 JR NZ,NOKEY5 ;*LOOP UNTIL ALL KEYS UP
BA0E 10F8 01110 DJNZ NOKEY5 ;*LOOP FOR KEY BOUNCE
;
BA10 11FDBB 01130 SAVE LD DE,SCRBUF ;DE==> SCREEN BUFFER
BA13 21003C 01140 LD HL,VIDEO ;HL==> SCREEN
BA16 010004 01150 LD BC,400H ;BC = SCREEN LENGTH
BA19 EDB0 01160 LDIR ;MOVE SCREEN
BA1B 2A2040 01170 LD HL,(CURSAD) ;GET CURRENT CURSOR ADDR.
BA1E 22FDBF 01180 LD (CRSBUF),HL ;AND SAVE IT ALSO
BA21 CDC901 01190 CALL CLS ;CLEAR THE SCREEN
BA24 21883F 01200 LD HL,PRTPOS ;GET PRINT POSITION
BA27 222040 01210 LD (CURSAD),HL ;MOVE CURSOR AWAY
;
01220 ;
01230 ; Now get list of simple (not array) variables and print
01240 ; each on the screen.
01250 ;
;
BA2A DD2AF940 01260 LD IX,(SVT) ;IX==>VARIABLE LIST
BA2E 21003C 01270 LD HL,VIDEO ;HL==> SCREEN
BA31 FD21E2BB 01280 LD IY,TYPES ;IY==> VAR. TYPE TABLE
BA35 E5 01290 VAR10 PUSH HL ;SAVE SCREEN PTR.
BA36 DDE5 01300 PUSH IX ;MOVE VAR. LIST PTR
BA38 E1 01310 POP HL ; TO HL
BA39 ED5BFB40 01320 LD DE,(AVT) ;GET END OF VAR. TABLE
BA3D DF 01330 RST 18H ;CP HL:DE
BA3E E1 01340 POP HL ;RECOVER SCREEN PTR.
BA3F 303E 01350 JR NC,ARRAY ;GO IF NO MORE VARIABLES
;
01360 ;
BA41 DD4600 01370 LD B,(IX) ;GET VARIABLE TYPE
BA44 DD7E02 01380 LD A,(IX+2) ;1ST LETTER OF VAR. NAME
BA47 77 01390 LD (HL),A ;PRINT IT
BA48 23 01400 INC HL ;BUMP POINTER
BA49 DD7E01 01410 LD A,(IX+1) ;2ND LETTER OF VAR. NAME
BA4C B7 01420 OR A ;SET FLAGS
BA4D 2802 01430 JR Z,VAR20 ;GO IF ZERO
BA4F 77 01440 LD (HL),A ;ELSE PRINT IT
BA50 23 01450 INC HL ;AND BUMP POINTER
BA51 78 01460 VAR20 LD A,B ;GET VARIABLE TYPE
BA52 3D 01470 DEC A ;DECREASE BY TWO TO
BA53 3D 01480 DEC A ; ALIGN WITH TABLE
BA54 3259BA 01490 LD (IYPTR+2),A ;USE FOR OFFSET
BA57 FD7E00 01500 IYPTR LD A,(IY+0) ;GET TYPE SYMBOL
BA5A 77 01510 LD (HL),A ;PUT ON SCREEN
BA5B 23 01520 INC HL ;BUMP POINTER
BA5C 23 01530 INC HL ;AND AGAIN FOR SPACE
;
01540 ;
BA5D DD23 01550 INC IX ;GET PAST HEADER
BA5F DD23 01560 INC IX ; WITH THREE
BA61 DD23 01570 INC IX ; INCREMENTS
BA63 DD23 01580 VAR30 INC IX ;MOVE PAST VAR. INFO
BA65 10FC 01590 DJNZ VAR30 ; DEPEND ON VAR. TYPE
;
01600 ;
01610 ;Check screen
BA67 117B3F 01620 LD DE,ENDDSP ;LAST PRINT POS.
BA6A DF 01630 RST 18H ;CP HL:DE
BA6B D437BB 01640 CALL NC,ENDSCR ;GO IF SCREEN FULL
BA6E 7D 01650 LD A,L ;GET LSB OF SCREEN PTR.
BA6F E63F 01660 AND 3FH ;MASK BITS 6 & 7
BA71 FE3C 01670 CP 3CH ;END OF LINE?
EA73 38C0 01680 JR C,VAR10 ;RETURN IF NOT
BA75 114000 01690 LD DE,40H ;LINE OFFSET
BA78 19 01700 ADD HL,DE ;HL==> NEXT LINE
BA79 7D 01710 LD A,L ;GET LSB
BA7A E6C0 01720 AND 0C0H ;MASK OUT BITS 0-5
BA7C 6F 01730 LD L,A ;HL==> START OF NEXT LINE
BA7D 18B6 01740 JR VAR10 ;GET ANOTHER VARIABLE
;
01750 ;
01760 ;Now show arrays
01770 ;
;
BA7F CD37BB 01780 ARRAY CALL ENDSR ;NEW SCREEN FOR ARRAYS
BA82 DD2AFB40 01790 LD IX,(AVT) ;IX==>ARRAY TABLE
BA86 DDE5 01800 ARR10 PUSH IX ;TRANSFER PTR TO
BA88 E1 01810 POP HL ; TO HL
BA89 ED5BFD40 01820 LD DE,(FREE) ;DE==>END OF ARRAYS
BA8D DF 01830 RST 18H ;CP HL:DE
BA8E 3075 01840 JR NC,DONE ;GO IF END OF TABLE
;
01850 ;
BA90 DD4600 01860 LD B,(IX+0) ;GET VARIABLE TYPE
BA93 DD7E02 01870 LD A,(IX+2) ;1ST LETTER OF VAR. NAME
BA96 CD3A03 01880 CALL PRINT1 ;PRINT A
BA99 DD7E01 01890 LD A,(IX+1) ;2ND LETTER OF VAR. NAME
BA9C B7 01900 OR A ;SET FLAGS
BA9D 2803 01910 JR Z,ARR20 ;GO IF 0
BA9F CD3A03 01920 CALL PRINT1 ;ELSE PRINT IT
BAA2 78 01930 ARR20 LD A,B ;GET VAR. TYPE VALUE
BAA3 3D 01940 DEC A ;SUBTRACT TWO TO
BAA4 3D 01950 DEC A ; ALIGN WITH TABLE
BAA5 32AABA 01960 LD (IYPTR2+2),A ;ADDRESS TABLE
BAA6 FD7E00 01970 IYPTR2 LD A,(IY+0) ;GET TYPE SYMBOL
BAA8 CD3A03 01980 CALL PRINT1 ;AND PRINT IT
BAAE 3E28 01990 LD A,'(' ;PAREN. CHAR.
BAB0 CD3A03 02000 CALL PRINT1 ;AND PRINT IT
;
02010 ;
BAB3 DD4E05 02020 LD C,(IX+5) ;GET # OF DIMENSIONS
BAB6 DD5E03 02030 LD E,(IX+3) ;DE WILL HAVE OFFSET
BAB9 DD5604 02040 LD D,(IX+4) ; TO NEXT ARRAY
BABC DDE5 02050 PUSH IX ;TRANSFER IX VALUE TO
BABE E1 02060 POP HL ; HL REGISTER
BABF 19 02070 ADD HL,DE ;ADD OFFSET

```

Listing 1 continued

single precision, or double precision). If the variable is a string, its VARPTR address is loaded into the accumulator instead of its value.

Next, the program checks the variable type flag. If the type flag equals 3, the variable is a string, and control passes to STRDSP in line 3140. Otherwise, the ROM routine ACUSTR, which I described last month, changes the variable's value into an ASCII string and the program prints that string. Then the ROM routine WAITKY (0049 hex), which waits for any keyboard input, is used to freeze the display until you press any key before the program loops back to END10. WAITKY takes the place of last month's GETENT, which is no longer included in the program.

If the variable is a string, IX points to its VARPTR address (line 3210). Then the program loads B with the string's length and HL with its location in memory. Because the string is not terminated with a 00 hex byte, you cannot use the normal Print routine. Instead, the program calls the PRTSTR routine at line 3280 to print the string.

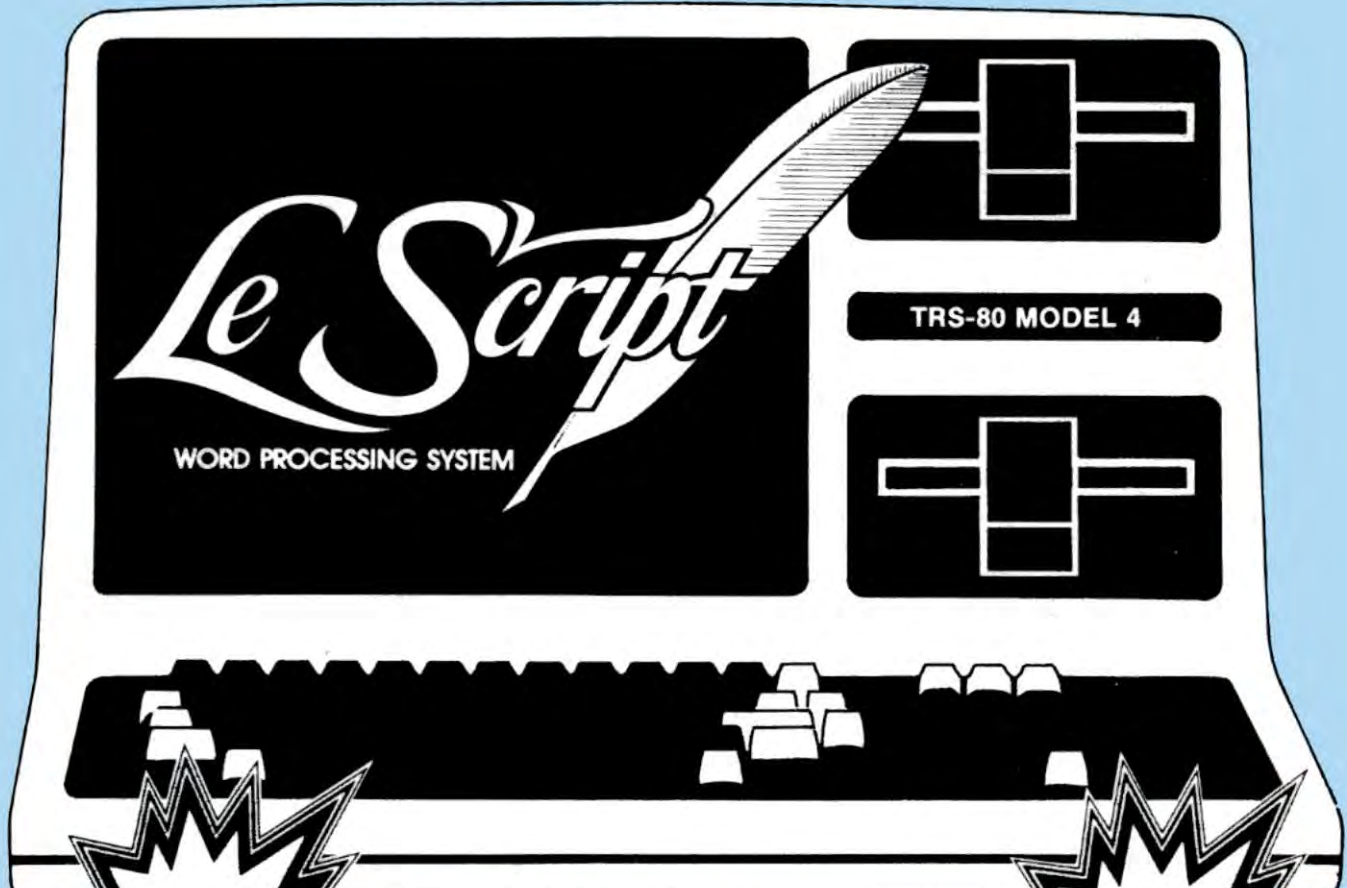
PRTSTR first checks the string's length. If it is zero, control returns immediately without any further processing. Otherwise, the program prints the string with a DJNZ loop until B is decremented to zero.

For quick reference, the Figure summarizes the ROM routines and low-memory pointers used by this month's and last month's programs. Before you add the ROM routines to your own programs, you must exercise caution. Some ROM routines (2B75 hex is a notorious example) only work properly if Basic is initialized. If you use a tape system, you never have to worry because Basic is initialized automatically when you turn on the power.

However, if you use a disk system, you can use programs with ROM routines only if you've loaded Disk Basic since you turned on the computer. If you find a program, particularly a magazine program, that doesn't work as it should, try going to Disk Basic, returning to DOS, and rerunning it.

The problem is that ROM Basic was written to be expanded in two ways. Each expansion necessitates an exit from ROM to a patch point in low memory. The first type of expansion is the addition of Disk Basic command verbs (CMD'', INSTR, OPEN, DEF,

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Listing 1 continued

BAC0 110500	02080	LD	DE,5	;OFFSET FOR HEADER
BAC3 19	02090	ADD	HL,DE	;HL=> NEXT ARRAY
BAC4 E5	02100	PUSH	HL	;SAVE ADDRESS
	02110 ;			
BAC5 0606	02120	LD	B,6	;BUMP IX 6 TIMES
BAC7 DD23	02130	ARR30	INC	IX
BAC9 10FC	02140	ARR30	DJNZ	; SO IX=> SIZE OF
	02150 ;			; 1ST DIMENSION
BACB 41	02160	LD	B,C	;GET # OF DIM.
BACC CB20	02170	SLA	B	;MULTIPLY BY TWO
BACE DD23	02180	ARR40	INC	IX
BAD0 10FC	02190	ARR40	DJNZ	;BUMP POINTER
	02200 ;			;UNTIL PAST DIM SIZES
BAD2 41	02210	LD	B,C	;GET # OF DIM. AGAIN
BAD3 DD2B	02220	ARR50	DEC	IX
BAD5 DD2B	02230	DEC	IX	; DROP IX UNTIL IT
BAD7 DD6E00	02240	LD	L,(IX+0)	; POINTS TO NEXT DIM.
BADA DD6601	02250	LD	H,(IX+1)	;GET LSB OF DIM SIZE
BADD 2B	02260	DEC	HL	; AND MSB
BAD E CDB2BB	02270	CALL	ASCPR	;CORRECT FOR 0 ELEMENT
	02280 ;			;PRINT AS ASCII
BAE1 3E2C	02290	LD	A,',	;GET COMMA CHAR.
BAE3 CD3A03	02300	CALL	PRINT1	;AND PRINT IT
BAE6 10EB	02310	ARR50	DJNZ	;REPEAT FOR ALL DIM.S
	02320 ;			
BAE8 212040	02330	LD	HL,CURSAD	;HL=>CURSOR POS'N
BAEB 35	02340	DEC	(HL)	;MOVE BACK OVER LAST ", "
BAEC 3E29	02350	LD	A,',	;GET CLOSE PAREN.
BAEE CD3A03	02360	CALL	PRINT1	;AND PRINT IT
BAF1 3E20	02370	LD	A,'	;NOW AN ASCII SPACE
BAF3 CD3A03	02380	CALL	PRINT1	;AND PRINT IT
BAF6 2A2040	02390	LD	HL,(CURSAD)	;GET CURSOR POS'N
BAF9 117B3F	02400	LD	DE,ENDDSP	;END OF PRINT AREA
BAFC DF	02410	RST	18H	;CP HL:DE
BAFD D437BB	02420	CALL	NC,ENDSCR	;GO IF SCREEN FULL
	02430 ;			
BB00 DDE1	02440	POP	IX	;IX=> NEXT ARRAY
BB02 C386BA	02450	JP	ARR10	;GO TO WORK ON IT
	02460 ;			
BB05 CD37BB	02470	DONE	CALL	ENDSCR
BB08 21FDBB	02480	LD	HL,SCRBUF	;ASK FOR ENTER
BB0B 11003C	02490	LD	DE,VIDEO	;HL=>SCREEN BUFFER
BB0E 010004	02500	LD	BC,400H	;DE=>SCREEN
BB11 EDB0	02510	LDIR		;BC = SCREEN LENGTH
BB13 2AFDBF	02520	LD	HL,(CRSBUF)	;MOVE TO SCREEN
BB16 222040	02530	LD	(CURSAD),HL	;GET OLD CURS. POS'N
BB19 3EFF	02540	LD	A,@PFH	;AND RESTORE IT
BB1B 32FFBF	02550	LD	(FLAG),A	;VALUE FOR RECUR. FLAG
BB1E CD2EBB	02560	CALL	POPAL	;RESET RECURS. FLAG
BB21 AF	02570	XOR	A	;RESTORE REGISTERS
BB22 C3EPB9	02580	JP	RETURN	;A & Z-FLAG SHOW 0
	02590 ;			;RETURN TO BASIC
BB25 E3	02600	PUSHAL	(SP),HL	;HL ON STACK; SAVE RET
BB26 C5	02610	PUSH	BC	;SAVE ALL REGS
BB27 D5	02620	PUSH	DE	
BB28 DDE5	02630	PUSH	IX	
BB2A FDE5	02640	PUSH	IY	
BB2C E5	02650	PUSH	HL	
BB2D C9	02660	RET		;ORIG. RET ADDR. TO STACK
	02670 ;			
BB2E E1	02680	POPAL	POP	HL
BB2F FDE1	02690	POP	IY	;GET RET. ADDR.
BB31 DDE1	02700	POP	IX	;RESTORE ALL REGS.
BB33 D1	02710	POP	DE	
BB34 C1	02720	POP	BC	
BB35 E3	02730	EX	(SP),HL	;GET ORIG. HL
BB36 C9	02740	RET		
	02750 ;			
BB37 CD25BB	02760	ENDSCR	CALL	PUSHAL
BB3A 21883F	02770	END10	LD	HL,PRTPOS
BB3D 222040	02780	LD	(CURSAD),HL	;SAVE REGISTERS
BB40 3E1F	02790	LD	A,1FH	;HL=>PRINT POSITION
BB42 CD3A03	02800	CALL	PRINT1	;SET CURSOR ADDRESS
BB45 21C8BB	02810	LD	HL,MSG	;IF=CLEAR TO END OF FRAME
BB48 CD752B	02820	CALL	PRINT	;*PRINT IT
BB4B 21E9BB	02830	LD	HL,VARBUF	;HL=>PROMPT MESSAGE
BB4E 0614	02840	LD	B,20D	;PRINT IT
BB50 CDD905	02850	CALL	LINEIN	;HL=>INPUT BUFFER
	02860 ;			;*B=MAX. INPUT LENGTH
BB53 38E5	02870	JR	C,END10	;*GET KEYBOARD INPUT
BB55 78	02880	LD	A,B	;*GO IF <BREAK> HIT
BB56 B7	02890	OR	A	;*GET INPUT LENGTH
BB57 200A	02900	JR	NZ,END20	;*SET FLAGS
BB59 CDC901	02910	CALL	CLS	;*GO IF VARIABLE REQUESTED
BB5C CD2EBB	02920	CALL	POPAL	;ELSE CLEAR SCREEN
BB5F 21003C	02930	LD	HL,VIDEO	;RESTORE REGISTERS
BB62 C9	02940	RET		;HL=>SCREEN TOP
	02950 ;			;AND RETURN
BB63 C5	02960	END20	PUSH	BC
BB64 0608	02970	LD	B,8	;*SAVE VARIABLE LENGTH
BB66 3E20	02980	LD	A,'	;*FOR 8 SPACES
BB68 CD3A03	02990	END30	CALL	PRINT1
BB6B 10FB	03000	DJNZ	END30	;*A=ASCII SPACE
BB6D C1	03010	POP	BC	;PRINT
BB6E 21E9BB	03020	PUSH	HL,VARBUF	; * 8 SPACES
BB71 E5	03030	LD	HL	;*RECOVER LENGTH COUNT
BB72 CDA7BB	03040	CALL	PRTSTR	;HL=>BEGINNING OF VAR.
BB75 3E20	03050	LD	A,'	;AND SAVE IT
BB77 CD3A03	03060	CALL	PRINT1	;*PRINT VAR NAME AS STRING
BB7A 3E3D	03070	LD	A,'='	;*A=ASCII SPACE
				;*AND PRINT IT
				;*A= EQUAL SIGN

Listing 1 continued

LOAD, and so on). The execution address for each of these new verbs already exists in ROM, but the operation code does not—DOS must supply it. When you boot up a tape system, each Disk Basic command patch point is filled with the L3 error's address.

The second type of patch point to DOS is completely different. Several ROM routines, including many of the output routines, include a call to a low-memory address. When you use a tape system, a return instruction (0C9 hex) is loaded into each of those addresses; when you load Disk Basic, either a return, or a jump to a special Disk Basic routine is loaded into each address. However, when you first boot up DOS, no values are specifically loaded to those patch points and any program that calls them will probably find itself wandering off into oblivion.

The purpose of the second set of patch points is to let DOS writers add new, more powerful features to Basic. But if you are writing Assembly-language programs meant to be compatible with disk systems and run under DOS, and you want to use ROM routines, you should close any patch points your program might come across with a 0C9 hex byte before the ROM routines are called. The patch points are at addresses 41AC hex, 41AF hex, 41B2 hex, and so on up to 41E2 hex, on both the Models I and III.

Defining Variables

Besides showing the current active variables, this month's program can help you improve your Basic programming. Your programs store all simple variables in memory below all array variables. If your program uses arrays, they have to be moved every time you define or use a new simple variable. If one of your first program lines dimensions all arrays, it will slow down your program considerably by the pauses necessary to shift the arrays up in memory whenever you use a new simple variable. Your program will run faster if you define all simple variables before you dimension arrays.

There are two ways to define simple variables at the beginning of the program. The first, and more structured, is to give each a pre-set value (such as A=0, B=2, and C=.479). However, if you're going to set many of the variables to zero, or if the program will set

them as it uses them, you can define simple variables the same way you define arrays: with the DIM command. DIM A,B,C defines, and sets up space for, the three variables listed.

Therefore, a sensible order of commands at the beginning of a program would be:

- Clear sufficient string space;
- Define or Dimension simple variables;
- Dimension array variables.

The second lesson to be gained from variables displays is that the order of variables in memory makes a difference. Whenever Basic has to deal with any variable, it searches the appropriate table from the beginning. If it finds the variable, it continues to process the current command. If it can't find the variable, it (usually) must make room for it and add it to the table.

If your most frequently used variables are at the bottom of the table, they will be found faster and your program will run more quickly. To place them at the bottom of the table, be sure to define them first.

One interesting side note—if you ask Basic for the value of a simple variable that you have not previously defined, it searches the SVT and, failing to find the variable, answers zero for a numeric variable or "" for a string variable. However, it will *not* add the variable to the SVT.

If you ask Basic for the value of an element in an array that you haven't previously defined, Basic first creates the array in the AVT, using the default value of 10 for the maximum of each index, and then reports that the value of the array element is zero or "". Be careful when you use arrays; they can fill up memory quickly. The innocuous looking statement:

```
DIM A$(7,8,8,8)
```

requires 46,666 bytes, and uses up almost all available memory in a 48K tape-based Model III.

Random Numbers

In my own programming and in questions from readers, the subject of random numbers has come up several times. There seems to be a misunderstanding about what a random number is and how random numbers are generated internally in Basic.

Listing 1 continued

```

BB7C CD3A03 03080 CALL PRINT1 ;*AND PRINT THAT
BB7F E1 03090 POP HL ;*HL=>VARIABLE AGAIN
BB80 CD4025 03100 CALL VALACU ;*VARIABLE'S VALUE=>ACCUM.
;
BB83 3AAF40 03120 LD A,(VTFLAG) ;*GET VARIABLE TYPE MARKER
BB86 FE03 03130 CP 3 ;*IS IT A STRING?
BB88 280B 03140 JR Z,STRDSP ;*GO TO STRING ROUTINE
;
BB8A CDBD0F 03160 CALL ACUSTR ;*TURN VALUE INTO STRING
BB8D CD752B 03170 CALL PRINT ;*AND PRINT IT
BB90 CD4900 03180 END40 CALL WAITKY ;*WAIT FOR KEYSTROKE
BB93 18A5 03190 JR END10 ;*AND REPEAT
;
BB95 DD2A2141 03210 STRDSP LD IX,(4121H) ;*IX = STRING'S VARPTR
BB99 DD4600 03220 LD B,(IX+0) ;*B=STRING LENGTH
BB9C DD6E01 03230 LD L,(IX+1) ;*MSB OF ADDR.
BB9F DD6602 03240 LD H,(IX+2) ;*HL=>STRING
BBA2 CD47BB 03250 CALL PRSTR ;*PRINT THE STRING
BBA5 18E9 03260 JR END40 ;*AND GO
;
BBA7 78 03280 PRTSTR LD A,B ;*GET STRING LENGTH
BBA8 B7 03290 OR A ;*SET FLAGS
BBA9 C8 03300 RET Z ;*RETURN IF NO LENGTH
BBA7 7E 03310 PRT10 LD A,(HL) ;*GET CHARACTER
BBAB CD3A03 03320 CALL PRINT1 ;*AND PRINT IT
BBAE 23 03330 INC HL ;*BUMP POINTER
BBAF 10F9 03340 DJNZ PRT10 ;*LOOP UNTIL DONE
BBB1 C9 03350 RET ;*RETURN TO CALLER
;
BBB2 03360 ;
BBB2 03380 ASCPRT EQU $ ;PRINT HL VAL ON SCREEN
BBB2 EB 03390 EX DE,HL ;SAVE HL REG.
BBB3 CD25BB 03400 CALL PUSHAL ;SAVE REGS.
BBB6 EB 03410 EX DE,HL ;RECOVER ORIG HL VALUE
BBB7 CD9A0A 03420 CALL HLACUR ;HL=> ACCUMULATOR
BBBA CDCC0A 03430 CALL ACINSN ;ACCUM INT=> SINGLE PREC.
BBBD CDBD0F 03440 CALL ACUSTR ;MAKE ACCUM INTO STRING
BBC0 23 03450 INC HL ;SKIP LEADING SPACE
BBC1 CD752B 03460 CALL PRINT ;PRINT VALUE
BBC4 CD2EBB 03470 CALL POPAL ;RESTORE REGS.
BBC7 C9 03480 RET
;
03490 ;
03500 ;
03510 ; Now table, message, & buffers
03520 ;
BBC8 56 03530 MSG DEFH 'Variable Name or <ENTER> ' ;*
BBE1 00 03540 DEFH 00H ;END OF MSG MARKER
;
BBE2 25 03550 TYPES DEFH '$' ;LIST OF VARIABLE TYPE
BBE3 24 03570 DEFH '$' ; MARKERS
BBE4 21 03580 DEFH '!' ;
BBE5 0000 03590 DEFH 00H ;PAD WITH 3 SPACES
BBE7 00 03600 DEFH 00H ;
BBE8 23 03610 DEFH '$' ;
;
0014 03620 ;
03630 VARBUF DEFS 20D ;*BUFFER FOR VAR. NAME
03640 ;
0400 03650 SCRBUF DEFS 400H ;BUFFER FOR SCREEN
03660 ;
C002 03670 CRSBUF DEFS 2H ;BUFFER FOR CURSOR POSN
03680 ;
BFFF FF 03690 FLAG DEFH 0FFH ;*RECURSION FLAG
03700 ;
B9C5 03710 END SETUP ;END OF PROGRAM
00000 Total Errors

```

```

LOOP LD A,(3BFFH) ;LOOK FOR KEYSTROKE
OR A ;SET FLAGS
JR Z,LOOP ;LOOP UNTIL STROKE FOUND
LD A,R ;ELSE GET R VALUE
AND 7FH ;MASK OUT BIT 7
;A HAS RANDOM NUMBER

```

Program Listing 2. Trigger routine for reading the R register.

First, generating a random number is simple on a Z80-based machine. The Z80 uses the R register internally to signal memory refresh cycles. During the decoding and execution of every machine-language instruction, Z80 increments the R register, places it on the address bus, and generates a memory

refresh signal. Since this occurs while the Z80 is processing a program instruction, it takes no extra execution time and is generally transparent to the running program.

If, at an unpredictable time, the Z80 reads the R register, its current value is a random number. For the read's time to

be truly unpredictable, some event must trigger it, that, even if repeated frequently, would take much longer than several machine cycles to occur. One such triggering event might be a key pressed by the computer operator.

Try the following experiment to see how the computer generates random numbers. Take a digital watch that has a stopwatch function and can record hundredths of a second. Start the watch, wait a moment, and then press stop. Record the digit in the hundredths column. Now try to repeat the experiment and stop the watch with the same value in the hundredths column. Slow human reflexes combined with the stopwatch button's resistance make the digital stopwatch a reasonable random number generator for numbers between zero and 9 in the hundredth's column. No one could purposely stop the watch with the same digit showing each time.

The Z80 updates the R register much more frequently than the relatively slow hundredths of a second display on a

digital watch. Because bit 7 of the R register never changes (you can set that bit by loading a value into R), reading the R register at random times produces a truly random number between zero and

"The Z80 updates the R register much more frequently than the... display on a digital watch."

127. By pressing a key, you can trigger a read, and the code would look something like Program Listing 2.

When you execute the Basic command Random, it also uses the R register, but in a different manner. The entire code for RANDOM is:

```
LD  A,R      ;GET CURRENT R
                VALUE
LD  (40ABH),A ;SAVE IT
RET                    ;END OF ROUTINE
```

The exact instant when Random is executed is certainly unpredictable: It depends on your loading a program that contains the Random command, typing RUN, and pressing the enter key. The only mystery in those three lines of code is why the value is stored in 40AB hex.

The RND function in Basic produces pseudo-random numbers. The values produced seem random, but you could easily predict the next random number if you knew the present state of the computer. Pseudo-random numbers are generated by taking a "seed" value and performing a specific series of arithmetic operations on that value. The new seed value becomes the new pseudo-random number.

The computer stores the random number seed in both the Models I and III at memory locations 40AA hex, 40AB hex, and 40AC hex. The specific algorithm used to generate each successive seed is unimportant here; what is important is that if you know the current seed value and the algorithm, you can accurately predict the next pseudo-random number. In some types of modeling, it's important to be able to use the same set of random numbers repeatedly

in a program to test various hypotheses. To see how such a program might operate, run the following:

```
10 FOR I=1 TO 5
20 POKE 16554,1
30 POKE 16555,2
40 POKE 16556,3
50 FOR J=1 TO 8
60 PRINT RND(100),
70 NEXT J
80 PRINT
90 NEXT I
100 GOTO 100
```

Lines 20, 30, and 40 establish the current seed value, thus determining the series of pseudo-random numbers generated.

It should be clear now how the Random command operates. It takes a truly random value—the current value in R—and uses it to re-seed the pseudo-random number generator. The software pseudo-random number generator always generates the same series of values; the computer uses the Random command to start that series at a random spot on the list. The total list of pseudo-random numbers is long enough that you will probably never have a program that will notice a repetition of values.

If you wish to generate your own pseudo-random numbers in machine language, you'll need to do some research about different pseudo-random algorithms. You will find a great deal of disagreement among the experts about which algorithm is best, and what constitutes a truly random pseudo-random number (if such a beast exists). The ideas are interesting, but the mechanics soon become extremely complex.

Authors' Forum

As I mentioned last month, readers who subscribe to CompuServe may take part in open discussions of topics covered by "The Next Step." GO PCS-117 to the Software and Authors Special Interest Group (SASIG) and leave your questions or comments addressed to me on the message board. Feel free to join in any discussions started by other readers. ■

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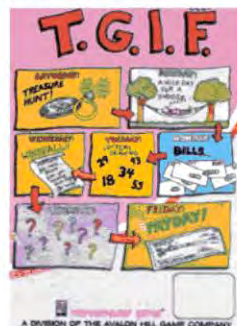
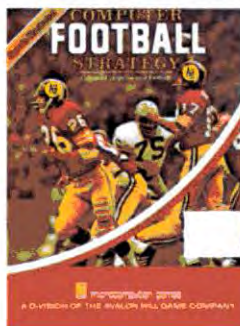
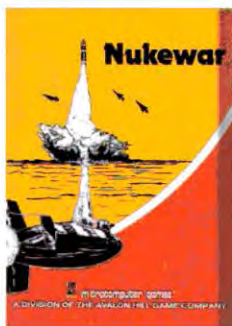
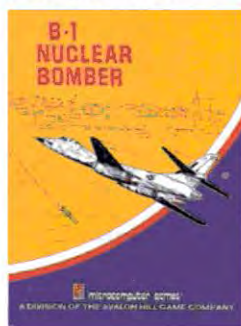
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I've got good news and bad news. The bad news is that this will be the last edition of The Color Key; the good news is that next month, I'll be taking over the Re:FLEX column in *HOT CoCo* and expanding its coverage to include both FLEX and OS-9 software.

While most of the previous action in the area of alternative operating systems centered on FLEX, every indication is that the long-delayed OS-9 software will have a broad range of supporting applications programs for the serious user.

I recently spent an afternoon with Sue and Paul Searby of Computerware, discussing some of their plans for new products. It comes as no surprise that they will market a rather complete line of OS-9 business software, and you can bet that other suppliers will do the same.

Since that's where much of my interest lies, I'm looking forward to working with and writing about the new system. I expect to be in the thick of it by the time you read this column.

And by the way, the fact that Radio Shack is advertising Basic09 for the Color Computer is the best news to come out of Fort Worth in a while. I can hardly wait.

Unfinished Business

Some bugs are subtle and some are just plain dumb, and one of the latter kind has surfaced in my Expgraph program (September 1983, p. 30). Let's see if I can make amends.

You might recall that Expgraph creates a high-resolution graph of expenditures as a function of time for periods of up to a year. The program automatically scales the dollar axis to maximize the resolution of the graph, while restricting the major interval to an integral multiple of \$2, \$5, or \$10 times some power of 10. It also extrapolates the rate at which you spend money, so the user can compare the prediction for year's end with a budget target.

The bug appears in the routine that converts the value used for the expenditure-axis interval to a string in preparation for drawing it on the high-res screen. As I learned when working with one particular set of project cost figures, I should have included code to force this interval to be an integer.

Final words on the CoCo

As things stand, the program is capable of arriving at an interval of, say, \$50000.01. This in turn would appear on the graph, sans decimal point, as a scale factor: \$5000001. Very sloppy, to say nothing of downright wrong.

The solution is simple enough. Change the first half of Expgraph line 1140 from

```
CS=STR$(C)
```

to

```
CS=STR$(INT(C))
```

to enjoy classy displays.

Sorry about that.

What Do You Really Use?

A number of people have written with similar questions: How can I possibly use all the software I review? Why does anyone need 15 data file managers, half a dozen word processors, and three or four spreadsheets? In fact, do I use the stuff at all, or do I give it a quick once-over before consigning it to the wastebasket?

Fair enough. I confess that until I began to get some reader feedback, it never occurred to me that people would think everything I reviewed favorably I'd automatically add to my own collection of everyday tools. I should be flattered, I guess.

Actually, my correspondents are quite right; limits exist to what anyone really needs, and limits to what anyone can

profitably use. It makes little sense to spend all your time learning new command sequences so you can have the latest wrinkle in a particular type of program—unless you need that wrinkle. Therefore, my standard software library changes fairly slowly.

At the same time, I think it's incumbent on me to thoroughly wring out the products I review. I try to spend enough time with each program to explore all its major features.

That takes a fair amount of time, and occasionally it isn't possible to exercise every option of a complex product. Naturally, when reviewing software I only report on the features and commands that I have actually used.

I rely on a fairly standardized set of procedures to test the major types of programs: word processors, file or data-base managers, spreadsheets, and so forth. For example, I test spreadsheets with some dummy research and development (R&D) project budgets, departmental salary plans, and IRS forms. These simulate my principal real-world applications, and give me an opportunity to see how each new review subject handles a typical set of operations.

I often have to depart from my routine to explore novel features of a program, though, and such explorations sometimes convince me to add a product to my stable.

That's how I decided to start using Derringer Software's Pro-Color-File (P.O. Box 5300, Florence, SC 29502) for my heavy-duty data file management. Its particular capabilities for computation and report generation address some of my special needs, so I thought it worth converting many of my files to Pro-Color-File format.

This involves a fair amount of effort, and I certainly wouldn't recommend that everyone start from scratch whenever a new program shows up. My point is that in trying to keep my reviews honest, I have the opportunity to be tempted to buy more software than the typical user. As a result, I probably get involved in more file modification and rewriting than a sane person would tolerate.

I don't always change every file over to accommodate a new product, since I



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SOFTTRENDS

THE COLOR KEY

have some duplication in my working collection.

Now I'll answer the question I raised as the title of this section. Please remember the strong personal component in this business before you write to squawk about my choices. I've favorably reviewed plenty of software that failed to make me switch for my own use.

I have used Telewriter (Cognitec, 704 Nob Ave., Del Mar, CA 92014) for the bulk of my word processing ever since its inception. When the current version, Telewriter-64, became available, its ability to right-justify text caused me to

"CoCo users are lucky where spreadsheets are concerned."

abandon my second word processor.

I previously used Trans Tek's C.C. Writer (194 Lockwood Lane, Bloomington, IL 60108) for anything resembling formal correspondence, but now I had no motivation for continuing with two programs for one job.

Telewriter's new-found ability to produce ASCII files doesn't hurt, either. Now it's much easier to use auxiliary programs such as spelling checkers; I use Spell 'N Fix (Star-Kits, P.O. Box 209, Mt. Kisco, NY 10549). I can read and edit files generated by some other programs, too.

The whole topic of file compatibility between programs is something of a sore spot with me, incidentally, and I'll return to it later.

I've already mentioned using Pro-Color-File for heavy file management. This is an area in which I indulge myself a little; I have two other file managers in my household.

I still use Trans Tek's C.C. File for casual, unstructured applications like my file of addresses and phone numbers of CoCo vendors. Some of the entries include reminders of what the vendor produces, others do not, and the whole thing is gloriously loose. Ditto for my family's file of favorite restaurants. C.C. File's lack of structure and limited command set are especially welcome since I call on it sporadically without reference to the documentation.

I also have specific applications for Radio Shack's Color File. For some time, I have used it to maintain a text file I call COCOFACTS, which contains notes about various aspects of Color Computer operations.

This is where I keep track of all the PEEKs and POKEs I use in programming. How else would I remember where the Next-Data-Item pointer is? Color File's two-level indexing scheme and on-screen prompts seem right for these applications.

In principle, I could probably handle all my file management chores with one program. I have used Homebase (Homebase Computer Systems, P.O. Box 3448, Durham, NC 27702) and can vouch for its ability to handle data and text files.

The trouble is, I've become comfortable with my existing three-tier system and don't feel like adding a fourth component or translating all my data files. The urge I had to unify my word processing is lacking here.

CoCo users are lucky where spreadsheets are concerned. For a while the Spectulators, disk and ROM pack, were pretty much the whole story, and their capabilities were relatively limited. Then Trans Tek's C.C. Calc acted more like VisiCalc *et al.*, but was hampered by being written in Basic.

Then this spring Elite Calc (Elite Software, Box 11224, Pittsburgh, PA 15238) became available, and suddenly unmodified CoCos have a full-blown spreadsheet. In the meantime, FLEX users could call on the big-league power of Dynacalc (Computer Systems Center, 13461 Olive Blvd., Chesterfield, MO 63017).

I've used all four, and still have both Elite Calc and Dynacalc files in abundance. I could happily switch to 100 percent use of either program, but other considerations (see the end of this column) make me want to stay sharp on both. That's not too tough; Elite Calc has a simple command syntax, while Dynacalc's resembles that of SuperCalc, the CP/M-based spreadsheet I use regularly at my office.

Those are my big guns—the programs I use almost daily. Of course, a lot of utilities come into play for special purposes: Master Control (Soft Sector Marketing, 6250 Middlebelt, Garden City, MI 48135) and Colorkit (Arizin, P.O. Box 8825, Scottsdale, AZ 85252) to name two.

THE COLOR KEY

I've also been experimenting with several math and business graphics packages and expect to become a steady user of one or more, but it's early to declare my allegiance. My reviews have been appearing here and in *HOT CoCo* on a fairly regular basis; look for more on graphics over the next two or three months.

Odds and Ends

I'd like to return to the question of the Color Computer versus other serious 8-bit machines. The CoCo programs I use (and many of their major competitors) are the equals of the better-known applications programs for other computers. I use CP/M software almost daily, but that doesn't mean it overwhelms me.

Both Elite Calc and Dynacalc are better in some respects than early versions of Supercalc, which is itself arguably better than VisiCalc. It has taken the newer Supercalc 2 to incorporate some features of the CoCo programs: the ability to sort a spreadsheet by row or column data, for example.

Teletwriter-64 is far easier to use than WordStar, and does a perfectly satisfactory job on anything but the most specialized text processing. For that matter, Super Color Writer (Nelson Software Systems, 9072 Lyndale Ave. South, Minneapolis, MN 55420) can take on WordStar, too.

As for file and data-base managers, I haven't done enough work with CP/M material to form a definite opinion. I know that dBase II is very powerful but quite complex—more complex than Pro-Color-File, Homebase, or several other top CoCo file managers. The CP/M program might do all kinds of exotic tricks, but for the moment I feel that CoCo users have some competitive software at their command.

What troubles me, though, is that it's a real chore to use the output of one program as the input to another. Life would be a lot simpler if I could pop an Elite Calc data file into Radio Shack's Disk Graphics to produce a bar chart, or if I could get such a chart into a Teletwriter report.

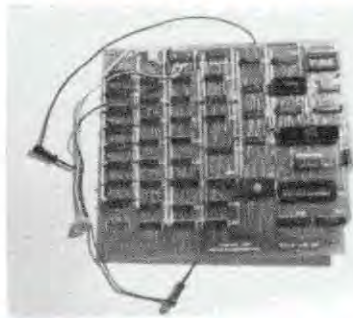
Of course it's possible to write a conversion program for almost any specific application, but wouldn't it be nice if CoCo programs talked to one another with less fuss?

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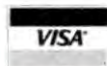
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programs to prepare indices and footnotes, for example. I don't think this desire for well-integrated software is a fetish of mine alone. The best feature of Apple's Lisa is its elaborate suite of business programs, and integrated packages like 1-2-3 promise to be huge sellers in the IBM PC community.

Clearly, someone else cares about this problem. The existence of a standardized operating system helps, and maybe the official blessing of OS-9 will result in better-integrated software for Color Computers.

Super CoCo

The 64K Color Computer and the Color Computer 2 are now appearing in Radio Shack catalogs, and the first samples of the Dragon 32 are out. The former and the latter have some appealing features, but neither is perfect.

Therefore, I'd like to share a few fantasies with you and set down some of my thoughts for a dream machine. This isn't a truly radical proposal, just some ideas I'd like to see incorporated into a next-generation Color Computer.

I'll start with a baseline machine having 64K of RAM and the best of the full-travel keyboards. Now, how about adding an official clock speedup to 1.8 MHz. Maybe the operating system would have to shift in and out of high gear for I/O, but this shouldn't concern the user. Add an internal muffin fan if necessary to preserve IC lifetimes.

The machine needs a few user-definable keys like the ones on the Model 100 and some of today's add-on keyboards. I hope software vendors would prepare patch areas so you could add customized definitions for such keys to their programs. One of the things WordStar does right is allow control/digit key to represent a series of keystrokes, making it much easier to enter frequently used command sequences.

"I'd like to share... my thoughts for a dream machine."

A baseband video output for use with a monitor could be a monochrome signal, and would be used primarily for word processing and an 80-column spreadsheet. The Dragon 32 has baseband and RF outputs already.

I'd like better A/D converters. Eight-bit resolution would be nice, to increase today's 64 resolvable analog input levels to 256. An integral Centronics parallel port should go along with the RS-232. Let's get serious about printing, and do away with the external boxes and PC boards.

I want gold-plated cable connectors everywhere. Weak links like the CoCo's disk controller connectors aren't charming idiosyncrasies; they're embarrassing flaws.

Dedicate a second 6809, with perhaps another 64K of its own RAM, to control the display. I'm not kidding; at least one such machine already exists in Japan. It would be great to have this kind of power for graphics of all kinds. Consider the possibilities of 40 PMODE 4 pages, for starters.

One of the nicest things about designing dream machines is that you don't have to worry about cost.

The End

It's the end of the road, ladies and gentlemen. I've enjoyed writing The Color Key, and I hope that many of you will find something of interest in the new FLEX/OS-9 applications column.

I don't intend to abandon the rest of the CoCo world. One of my major current projects is a book in which I'll treat applications software in more detail than the column/review format permits.

With any luck at all, the book will be out in the autumn of 1984. The publisher is Scott, Foresman.

In the meanwhile, I'll see you in *HOT CoCo*. ■

Contact Scott Norman c/o The Color Key, 80 Micro, 80 Pine St., Peterborough, NH 03458.

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Perhaps the most powerful asset of any 16-bit microcomputer is its ability to become an office or interoffice hub that other terminals can access. Its multi-user and multi-tasking capabilities blur the fine line that separates minicomputers from microcomputers.

Terminals, commonly referred to as work stations, are typically less expensive than complete computer units. Using several terminals to tie into one host computer allows many people to take advantage of the main computer simultaneously.

The host computer, in its standard configuration, has a hard disk drive connected to it. All of the terminals can access information stored on the same hard disk.

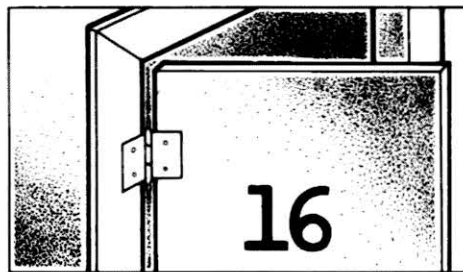
Currently, Radio Shack offers two ways to add external remote work stations to the Model 16. These networking systems are called Arcnet and Xenix.

Arcnet

Arcnet, an acronym for attached resource computer network, lets you connect up to 255 computers to the Model 16.

The terminals can use all of the peripherals connected to the host machine. These include both floppy and hard disk drives and printers. You cannot use the host machine, called a file processor, as a terminal. Its keyboard and video display aren't available to the operator.

Arcnet also runs on the Models II and 12. It doesn't require the MC68000



Arcnet and Xenix hubbub

board, but every computer in the system must have an Arcnet circuit board installed. Have your local Computer Center do this.

Hubs, similar in function to a TV antenna splitter, join the work stations and the host machine together. One cable connects to a hub's input and provides several outputs to feed other work stations. Passive hubs let you connect together four units up to 200 feet from the hub.

Active hubs boost the data signals with internal circuitry so you can place terminals as far away as 2,000 feet from the hub. Combining many active and passive hubs together yields a maximum distance of four miles between the farthest work station and the host computer.

Obviously, Arcnet is a good choice for multi-user applications where work stations are located in different buildings (such as a college campus).

The owner of multi-user work sta-

tions must run the necessary cable wires through the buildings. Radio Shack computer technicians help with the installation of their computers in an Arcnet system but you must get an electrician to prepare the necessary wiring.

We haven't had the opportunity to work with an Arcnet system and welcome comments from readers who use one. Our understanding is that it operates at a speed of 2.5 million bits per second. With that kind of speed you feel as if you are the only user on the host computer.

Xenix

The second multi-user system currently available is TRS-Xenix, or simply Xenix. In contrast to Arcnet, which is a hardware configuration, Xenix is software based and requires no special circuit modifications on any of the system's microcomputers. Since it uses the MC68000 microprocessor, you need a Model 16, 16B, II/16, or 12/16 to run it.

Unlike Arcnet, the host computer's video and keyboard are available as a work station. However, you can connect only three terminals (including the host) at one time. The other one or two terminals interface by way of the two RS-232 jacks on the back of the host computer. A null modem adaptor does the job along with RS-232 cables.

Under Arcnet, each work station is a complete computer, not just a data terminal. Xenix requires that only the host machine be an independent computer.

As of this writing, you need a hard disk drive to run the system, but a floppy

Assembly-Language Corner

Prior to displaying any information on a video screen, it's usually necessary to clear the screen and position the cursor at a point where you want to begin printing. This month we take a look at some of the supervisor routines available to perform these screen formatting functions.

The video character generator circuit in the Model 16 is identical to that of the Models II and 12. Therefore, all graphics characters and ASCII codes are compatible.

Normally the screen format of these computers gives us 80 character positions horizontally and 24 vertically.

The video generator is capable of printing characters in a larger mode. While the vertical count remains 24, you can double the width of each letter. Thus, in the large character mode, a maximum of 40 letters fits on a horizontal line.

Also at our disposal is an inverse

A-L Corner continued on next page

version is in the works. Naturally such a version is limited due to less disk space on a floppy.

Xenix's basic structure builds around Western Electric's popular and established Unix operating system. Xenix comes from a thoroughly tested program in the field for 10 years.

Since more than one person can work on the same disk file at the same time, imagine the disaster if two people try to write the same record to a file simultaneously. Fortunately, Xenix designers

took this into consideration. The program doesn't allow two users to write information to the same record and accidentally lose data.

Xenix divides the computer's RAM into separate sections for each user. In this way, each of the two or three users can run programs independently. One can run payroll while another works on accounts receivable, for instance. Xenix runs with a minimum amount of 256K RAM. However, certain combinations of programs run simultaneously may

require 384K or even 512K.

Both Arcnet and Xenix have their pros and cons. Your choice depends on your business's particular needs. Xenix doesn't require you to make any hardware modifications to existing computers; Arcnet does. But Arcnet handles up to 255 computers; Xenix accommodates only three. With Xenix, the remote work stations need only be data terminals such as Radio Shack's Model DT-1. Under Arcnet, each work station must be a computer. ■

A-L Corner continued from previous page

video option. Normally the background of the screen is unlit or black and the letters light up (green or white, depending on your machine). You can reverse this to cause the background surrounding a letter to light up and the letter itself to appear as a darkened area within the block.

Built within the disk operating system is a routine (referred to as a supervisor call) that you can use to establish the size of the letters and the normal/inverse printing font.

Placing a zero into byte-offsets 6 and 7 of the SVC block (a buffer area you set up to pass values to the DOS routine) switches the video size to the 40-character-per-line mode. A value of 1 placed there produces 80-character lines. In byte-offsets 8 and 9, a zero indicates inverse video and a 1 indicates normal printing.

The supervisor number that identifies this routine from other supervisor calls is 7. Always place the identifying supervisor number in byte-offset zero of the buffer. The set-up to call this routine looks something like this:

```
LDA      .A0,SVC BLOCK
MOVW    @A0,#7
MOVW    6@A0,#1
MOVW    8@A0,#1
BRK     #0
RET
SVC BLOCK
RDATA B 32,0
```

Use the move-a-word (movw) command to load the necessary values into the buffer area. This is an indirect addressing mode where register A0 stores the address pointing to the location of the SVC block buffer.

With the values you use in the example, prepare a normal screen format—80 characters per line and no inverse video.

Supervisor call 7 automatically performs two other functions. It clears the screen (similar to the Basic CLS command) and it homes the cursor—moving it to the top leftmost position on the screen.

You can use another supervisor routine to clear the screen. This is call number 8 which sends a character to the video display. Examine the machine's ASCII code chart in the owner's manual and note that the decimal number 30 is a control code for clearing the screen. By sending this ASCII code to the routine that prints a character on the display, you can clear the screen. However, unlike the last routine, this doesn't set up the inverse/normal and 80/40 screen formats.

```
LDA      .A0,SVC BLOCK
MOVW    @A0,#8
MOVW    6@A0,#30
BRK     #0
RET
SVC BLOCK
RDATA B 32,0
```

Positioning the Cursor

Before printing any letters or graphics characters on the video display, you may want to position the cursor at a specific point to start printing. Supervisor call number 10 lets you place the cursor at any printable location on the screen.

You must move values for the horizontal (x) and vertical (y) coordinates into the SVC buffer area to instruct the computer as to the row and col-

umn on which you desire to place the cursor.

Place the value for the row position in byte-offsets 6 and 7. The row position refers to the number of lines down from the top of the screen. Offsets 8 and 9 store the column position. This is the number of character positions from the left-hand side of the screen.

Since there are 24 lines down the screen and 80 positions across, halving these values to 12 and 40 places the cursor in the center of the screen.

```
LDA      .A0,SVC BLOCK
MOVW    @A0,#10
MOVW    6@A0,#12
MOVW    8@A0,#40
BRK     #0
RET
SVC BLOCK
RDATA B 32,0
```

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Figure 1. Monty and Eric play Scrabble.

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Our reviewers use a five-star rating system. One star represents the low end of this spectrum, while five stars represent the spectacular and high end of the spectrum.

★★★★

Monty Plays Scrabble
Tandy/Radio Shack
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by Eric Maloney
80 Micro staff

Monty Plays Scrabble isn't going to win any tournaments. But it's good enough to give the average player a run for his money, and challenging enough to give the experienced player a stimulating practice partner.

To play Monty, you need a Scrabble board and a good dictionary. Either you or the game can pick the tiles. The program provides a board on the screen, showing you where it placed its word and letting you indicate where you want yours.

Among other features (see Table 1), Monty gives you four skill levels, keeps track of the score, and lets you save a game in progress. A game takes about one hour and 40 minutes to play.

But enough detail. What kind of Scrabble does Monty play?

At first, I was disappointed. I won my first game by the depressing score of

468 to 288, and took the next five as well. The average tally was 431 to 302. This, I thought, is no way for a computer with a 54,000-word vocabulary to perform.

But Monty surprised me in game seven, reeling off three seven-letter words en route to a 440-383 win. And while it hasn't beaten me since, it has occasionally given me a game worthy of a capable human partner.

A Typical Game

The best way to demonstrate Monty's abilities is to recount an actual game. This one is our eighth, and is fairly typical. We play at the highest (Scholar) level, and Monty goes first. Figure 1 shows the final board.

1. My letters: FTAODRT. Monty starts off with CAY, whatever that is. I counter with FART. (So who says Scrabble has to be polite?) "Good play!" Monty responds. He says that a lot, even for words like IT. Score after one turn: 16-26, my lead.

2. Letters: *IINODT. Some good possibilities here—DICTION comes immediately to mind. I wait patiently while Monty thinks; it takes him about three minutes of disk I/O to make a move.

After much grinding and gnashing, he plays MOAN, MAY, OR, and AT for 22 points. Not too bad. Since I have no place to put DICTION, I play

DICTION instead for a quick 65. "Very great word!" Monty exudes. Monty might have an elephantine memory, but he has yet to learn how to use adverbs well. Score: 38-91.

3. Letters: ETEEOID. Monty's revenge. I need to get rid of some of these E's. Too bad EDICATION isn't a word. What's taking Monty so long? I could spin off a game of Galaxy Invasion in the time he needs to think.

"Aha!" he exclaims. That must mean he's done. He lays down GAP, AD, and PI for 19, and opens up the triple word score. Unfortunately, I can't use it for anything. I play DECEIT and GAPE for 23. Score: 57-114.

4. Letters: RHQPOOE. Stuck with the Q—and with no U in sight. "I'll be ready soon," says Monty. I've heard that line before. Think I'll go change my oil. He finally plays BUM, BO, and UN. Wait a minute—UN??? Monty's played some weird words, but this one's a bit too much. Seeing, however, as I don't have an official Scrabble dictionary, I let it go.

Figuring that two can play the weird word game, I put down HOOPER, HUN, and OM. But wait—Monty challenges OM! Is it a word? he asks. I look it up in my Webster's, and sure enough, there it is. "Monty regrets his error," he says. Score: 76-160.

5. Letters: IEARGDQ. Monty loses his turn for an unsuccessful challenge.

Taking full advantage, I play AGED, BOA, and HUNG for 25. Score: 76-185.

6. Letters: IEARGLQ. This rack looks suspiciously familiar. Monty starts thinking. I go out for dinner and a drink. I return to find that Monty has played BUNG. Isn't he a character in *The Wizard of Id*? I play GLARE. Score: 97-207.

7. Letters: OKSVXQI. Talk about a constipated rack. Monty plays TOWEL for 26. I counter with XI, XI, and IT for 31. XI is one of my favorite Scrabble words, and I'm delighted to be able to play it twice on one move. Score: 123-238.

8. Letters: OKSVTQC. It's getting worse. Monty plays IDS and XIS for 18. I put down LOCK for 30. Vowels! I need vowels! Score: 141-268.

9. Letters: ERSVTQE. That damned Q! Monty plays RUIN for 15, I can't take it any more and exchange my Q, getting an A in return. With my luck, I'll pick up the Q again later. Score: 156-268.

10. Letters: ERSVTAE. Monty plays YARNS for 24. Getting rid of the Q pays off—I play AVERTERS for 62. Score: 180-330.

11. Letters: OLIEEQW. There it is

- 1 Exchange tiles
- 2 Pass or forfeit
- 3 Save game to disk
- 4 Current totals
- 5 Check your tiles
- 6 Change skill level
- 7 End the game

Table 1. Monty plays scrabble options.

again. Monty plays JEE for 26. I play WILIER for 18. Score: 206-348.

12. Letters: VIZNOOQ. I shout at the Q to stop torturing me. Monty dives into the well of contemplation; I go reshingle the house. He finally puts down HATSFUL for 26. He picks up the remaining tiles, thus sticking me with the Q for all eternity. I play AZO for 32. Score: 232-380.

13. Letters: NVIOQ. Monty plays EASE, ETA, DOS, and WE. DOS! This is too much. I play VIOL for 14. Score: 257-394.

14. Letters: QN. The end is near. Monty goes through his usual gastrointestinal tremors and lays down VI*A for 12 points. That, as they say, is that.

Final score: 280-383.

Final Comments

Clearly, a huge vocabulary doth not a Scrabble player make. You need to be a good strategist, too. Monty is not; it is apparently programmed to go for the highest possible point total, whether that means throwing away an S, breaking up a potential seven-letter word, or opening a triple-word score for its opponent.

Monty wins an occasional game, but it is through brute force rather than cunning.

Still, you don't need a great opponent to exercise your own Scrabble skills. Monty gives you enough of a challenge to keep you from getting bored. And it sends you to your dictionary enough times to increase your own vocabulary. In recent games, it has spun off such words as indium, llano, uta, rabbet, vug, aff, eme, and dommir.

One final note: Monty Plays Scrabble allows you only one back-up. This is a serious problem with a program that accesses the disk some 200 times per game. Monty could have a short life if you don't figure out a way to break the protection scheme and give yourself a full supply of copies. ■

★★★★½

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by John Dunkelberg

The Statistician is an excellent statistical and forecasting system that contains a wide variety of simple and sophisticated statistical analyses. The program is especially useful for business forecasting and complex statistical analysis. The Statistician is also an excellent tool for an instructor in an elementary or advanced statistics course.

The Statistician is completely menu driven so it's easy to use, even for a microcomputer novice. Thirty minutes after reading the documentation, I was running my first regression.

Multiple Regression

One of my principal reasons for ac-

quiring The Statistician was the multiple regression package. The Statistician contains five different regression procedures including Stepwise, Ridge, Backward Elimination, and All Subsets regressions. I haven't seen Ridge, Backward Elimination, or All Subsets procedures in any other statistical package for micros.

You can create large models with up to about 50 independent variables. This is enormous, especially when compared to the Radio Shack statistical analysis program that only allows five independent variables.

The output (see Table 1) closely resembles that of mainframe packages and includes t values for the individual coefficients as well as their standard errors. Also, the program includes the Durbin Watson statistic, which is useful in residual analysis and is found on few other statistical programs for microcomputers.

You can list or print the variance/covariance and sums of squares matrix as well as the correlation matrix of the estimates. Residual analysis is also

good. You plot residuals or list them with the actual and predicted values on the screen or printer.

Another feature I like is that the program saves the predicted values to disk. This lets you estimate simultaneous equations models. In addition, the Sort utility ranks the residuals by actual or predicted values of the independent variable.

I tested The Statistician's accuracy on the Longley data, a benchmark for testing statistical accuracy. I found The Statistician superior to the mainframe programs tested by Longley in 1967. The program's accuracy was amazing.

Data

The Statistician provides an easy data entry and editing system. You specify the number of variables, then the program displays the appropriate number of fields on the display. By pushing the appropriate arrow keys, you move around the fields or up and down through the rows of data.

All files that the editor writes out

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Version 2.0

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REVIEWS

become part of your data base and any of the programs in the package can use them. The edit program contains a good data report formatting system that automatically centers titles and headings and aligns data.

One of the most important components of the package is the data transformation function. It takes some time to become accustomed to this particular program, but it's worth it. Using any of the 24 transformations, you modify data or create new variables as functions of existing variables.

The transformation capability is essential for non-linear multiple regression and many techniques in exploratory data analysis. Using this feature, you can easily create the necessary variables for a polynomial or interaction regression model.

Some of the data transforms are quite unusual but occasionally useful: for example, the additive and multiplicative accumulators. These accumulators calculate the cumulative sum and product of a vector.

Some of the transformations are designed for time series modeling. In particular, the *n*th order lag lets you create lagged data of any specified order.

Other Features

The descriptive statistics component computes the following numerical descriptive measures: mean, median, geometric mean, harmonic mean, variance, standard deviation, maximum and minimum values, mean absolute deviation, and range. In addition, the program produces excellent frequency histograms (see Fig. 1).

DEPENDENT VARIABLE-->PRICE/DAT

		COEFFICIENT	STD. ERR.	T-VALUE
CONSTANT	B 0	33482	32100.7	1.04303
FEET/DAT	B 1	-30.2504	21.2985	-1.42031
AGE/DAT	B 2	-608.578	450.463	-1.35101
BEDS/DAT	B 3	17597.7	7304.79	2.40906
BATHS/DAT	B 4	27221.1	6765.33	4.02362
GARAGE/DAT	B 5	-5487.06	6052.39	-.906593
RESORT/DAT	B 6	40420.5	7913.66	5.10769

SOURCES OF VARIATION	ANOVA SS	DF	MSE
REGRESSION	1.67561E+10	6	2.79268E+09
ERROR	5.5722E+08	8	6.96525E+07
TOTAL SS	1.73133E+10	14	

F= 40.0945
R SQUARED= .967816
DURBIN WATSON STAT. = 2.35218

Table 1. The Statistician's output.

1 LINE = 1 OBSERVATION(S)

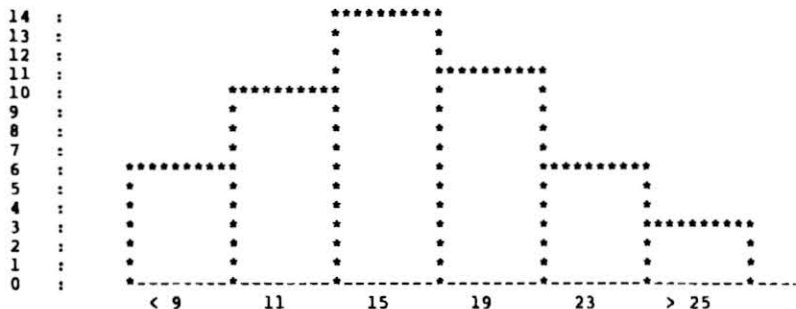


Figure 1. Frequency histogram.

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The program also permits several types of hypothesis testing, including tests on a single mean, single variance, and difference in means (paired and unpaired). The paired difference test uses the differencing functions in the transform package, then performs a test of a single mean on the differences. One-way ANOVA measures the difference in unpaired means.

The ANOVA provides one- and two-way analysis of variance; however, the program doesn't support multiple observations per cell in the two-way analysis.

The nonparametric component contains six commonly used nonparametric tests: Median, Mann-Whitney, Wilcoxon, Kruskal-Wallis, Spearman's Rho, and the Runs Test.

The forecasting program is one of the strongest available. It performs no less than eight different time series models, including moving averages, single and double exponential smoothing, sinusoidal models, Holt's two-parameter linear exponential smoothing, Winter's exponential smoothing model, and adaptive filtering.

It calculates the mean squared error and the mean absolute deviation of the forecast. The Statistician also produces tables and plots of the predicted, actual,

and forecasted values on the screen or printer.

The program generates random variables from seven different types of distributions: Normal, Gamma, Exponential, Uniform, Poisson, Binomial, and Geometric.

Another component that particularly applies to teachers and students of statistics is the sampling program. You can get sampling distributions from any data set. The program obtains all random samples of a given size if you have sufficient disk space on your system.

The documentation is well-written and tutorial in nature. Since the system is menu-driven, it's more than adequate. I quickly obtained answers to my few questions with a telephone call.

Conclusion

A second version of The Statistician with enhancements is due for release in September. The new version will cost \$295, and a regression subset will be available for \$145.

The Statistician is an excellent program for anyone interested in performing statistical analysis. Moreover, if you've already purchased statistical software, you certainly should consider acquiring The Statistician; it contains many features that just aren't available in any other package. ■

of the commands you have chosen.

Program Description

Newbasic's commands fall into three general areas: graphics commands, program development aids, and command enhancements.

Fully half of Newbasic's commands are for graphics and sound generation. Additionally, several of the enhancements and program development aids lend themselves to rapid and easy handling of screen graphics. The graphics handling abilities of Newbasic are quite impressive.

You can draw circles, ellipses, and arcs by using a single command. You can even construct figures larger than the video display, although you can display only a portion of such a figure at any one time.

The command you use is Circle. You can modify Circle with up to seven parameters, specifying the center point, radius, rotation angle, and, in the case of ellipses, the radius along each of the X and Y coordinates.

The Draw command draws straight lines. You can state 15 different parameters to modify this command. These parameters let you draw lines vertically, horizontally, or at angles that bisect the X,Y coordinate.

You can draw straight lines at any other angle by specifying the starting and ending points of the desired line. If you like, you can define the starting and ending points as points off the screen.

In effect, you can draw on a grid measuring 255 by 255. The upper left corner of the video screen is 0,0 and the lower right corner of the screen is 15,63. One of the nice effects of this is that you can make graphics rotate around this universe of 255 by 255, but they are in view only when the figure is in the portion represented by the screen.

Draw is not limited to producing single straight line segments. By using several parameters with the command, you can specify complicated figures with a single Draw.

The most interesting parameter for Draw is the X parameter that lets you define a figure as a string expression. For example, you can draw a simple rectangle with the command DRAW "R20,D20,L20,U20" (which means draw a line right 20 graphics blocks, down 20 graphics blocks, and so on). Alternately, you can define the rec-

★★★★

Newbasic 2.1

Modular Software Associates
209 18th St.

Huntington Beach, CA 92684

Models I, III, and 4 (in Model III mode)
\$39.95

by Richard Green

Newbasic 2.1 is an enhancement to Disk Basic for the TRS-80 Models I, III, and 4. Newbasic includes 49 new Basic commands. You can add any or all of them to Basic at your discretion.

The program comes on a 35-track, single-density Model I disk. This disk contains programs for both Model I and Model III users. Model III users have to run the Convert utility before they can make a working copy of Newbasic. The disk also includes four sample programs written in Newbasic

that display its capabilities.

The distribution disk does not contain a Newbasic program. It has two programs, Creator I and Creator III, each of which builds a Newbasic program for the appropriate computer. When you run the Creator program, it presents you with each Newbasic command, a brief description of that command, and the opportunity to include or discard that command for the Newbasic disk you're making.

Once you make all the choices, the program tells you the total size of the Newbasic program you've made. You must then specify a file name under which to save the Newbasic program.

Newbasic executes exactly as Disk Basic does. You must boot the system, answer the options required by the operating system you're using, then specify Newbasic instead of Basic. From here on, Newbasic operates identically with Disk Basic, but with the inclusion

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tangle as a string: `BOX$="R20,D20,L20,U20"`. Then you can reproduce the rectangle anywhere in the program with the command `DRAW "XBOX$"`.

You can do a little more magic by specifying scale, which can cause the box to be larger or smaller by factors of $\frac{1}{4}$, with a maximum range from 1 to 255. In other words, the normal size rectangle (scale defaults to 4) could be up to 63 times as large by setting the scale to 255 with the command `DRAW "S255,XBOX$"`.

Over 20 other graphics commands exist, including `GSAVE` to save a graphics memory into a disk file and `GLOAD` to place the graphic file back into memory. `PGET` saves a specific graphic into a memory array, `PPUT` restores the array back into the video memory, and `Paint` fills in a specified video area, making it all white or all black.

These and the other graphics commands make possible the fastest graphics you can get in a Basic program. Combine the fast graphics animation with the five-octave range (from D below middle C to E three octaves above middle C) of the sound commands and you can achieve truly spectacular games effects.

The program development aids in Newbasic include 12 new commands. One of these, `QUICKEY`, enables single-key entry of 39 different Basic commands. For example, when you use `QUICKEY`, holding the clear key while pressing the 4 key causes `CHR$(` to appear immediately on the screen.

Holding the clear key while pressing the 5 key displays `INKEY$`, and pressing C displays `CMD"`. It takes a while to become accustomed to `QUICKEY`, but once you gain familiarity with it, you'll find it a real time saver.

Another nice feature, the `DEFKEY`, lets you use any 10 keys to call an entire string of characters. One key can call a maximum string length of 127 characters. All 10 keys can call a total of 221 characters.

`NTRON` is a program tracing routine that lets you set a specific range of program lines you want traced. Additionally, you can specify any expression that you wish traced, and `NTRON` returns the value of that expression each time the program encounters it.

Yet another tracing function is

`SPOOLON` used in conjunction with the `PON` command. `PON` sends everything displayed on the screen to the printer. Preceding `PON` with `SPOOLON` sends everything from the screen to a disk file. You can then redisplay the disk file on the screen or send it to a printer. This way, you can make a permanent copy of the working of a program.

The handiest program development command is `LOC.` `LOC.` followed with a string you want found searches a Basic program for that string. For example, if you want to find and change `X$` to `Z$` in a program, you could find `X$` with the command `LOC."X$"`.

Newbasic searches for the first occurrence of `X$` in the program with which you are working. You can change `X$` to `Z$`, then look for the next occurrence of `X$` with the command `LOC.` If you want, you can do this for the entire program.

Among the Basic enhancements are the commands `Call`, `DPEEK`, `DPOKE`, and `Do...Until`. You use `Call` to call a machine-language subroutine. With this command it isn't necessary to use `DEFUSR` to identify the subroutine. You can locate the routine in high memory at will.

You can follow `Call` with the exact memory location of the routine in either hexadecimal (hex) or decimal form. Alternately, you can follow `Call` with an expression that corresponds to the routine's location. You can use any number of routines with this command.

Think of `DPEEK` and `DPOKE` as double `PEEK` and `POKE`. These commands return and insert 2 bytes into memory at the specified location and at that location plus one. The number returned is in the most significant byte, least significant byte form.

`Do...Until` lets you loop a routine that continues as long as the test following `Until` isn't met. The `Until` test can be any logic or arithmetic expression that you want tested. You can nest up to 10 of these loops (one `Do...Until` expression inside another).

The manual for Newbasic is a spiral-bound book showing each command. It includes an explanation of the command and one or more specific examples of its use.

The explanations are reasonably simple, but you'll need some knowledge of Basic and of programming to understand

them. This isn't a serious flaw, as few neophyte programmers have any use for a set of enhancements like Newbasic.

The manual's best feature is its installation instructions. These step-by-step instructions tell you how to install the program, with specific instructions for `TRSDOS`, `LDOS`, `DOSPLUS`, and `NEWDOS80`.

Conclusions

Newbasic seems to be a reliable program. Try as I might, I couldn't get it to crash. Nor was I successful in finding any bugs in the time I was able to use Newbasic.

The program development tools I discussed are fairly valuable. The trace functions could have saved me hours of debugging time if I'd had them in the past.

The spooler functions are much easier to use with a Basic program than the spooler that comes with `NEWDOS80`. And once you've become familiar with the use of `QUICKEY`, it saves hours of typing when you are keying in a Basic program.

If you're writing a program that requires any amount of screen graphics, Newbasic greatly simplifies your task. However, the graphics commands take some practice to use easily. Most have several optional parameters, and the results of the parameters can be surprising.

`Circle` is initially confusing. It begins drawing each circle from the three o'clock position on the screen. For the last 23 years, in flying and in reading blueprints, I've used the 12 o'clock position (top of the screen) as zero degrees for circles and arcs. It took quite a while for me to consistently get the results I expected from the `Circle` command.

Once you become accustomed to the commands, they are fairly easy to use. You'll probably need to keep the manual handy if you're attempting complicated graphics, but straight lines are a snap. With a little practice, you'll find that setting up formatted screens for user input is actually easy with Newbasic.

The program's greatest value, however, is as a game development tool. The rapid graphics and sound generator make near-arcade results easily achieved. ■

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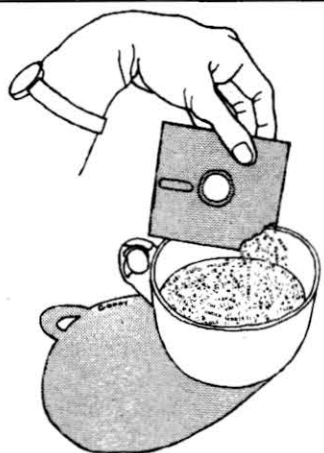
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by William J. Schauer

Instant Assembler, a complete Assembly-language development system, provides many enhancements to the Radio Shack Editor/Assembler. It's a good system for beginning Assembly-language programmers, and an adequate system for advanced programmers.

Instant Assembler is unique from other editor/assemblers in that it assembles code as you type it in, line by line. This way, you catch mistakes without the tedium involved in re-editing to correct errors that occur on assembly and later debugging the program for logic errors.

Instant Assembler contains an editor to create your source files, a built-in symbolic debugger, and a linking program that lets you create separate modules and link them together into a single program.

I tested the program under TRSDOS 1.3 on the Model III, and under LDOS 5.1.3 on my MAX-80. The manual states that the program runs under most popular DOSes for the Model III.

This package includes a program disk and a 65-page user's manual. The program disk is a TRSDOS data disk. For those of you with a single drive system, the disk self boots into a special pro-

gram that transfers the programs to your system disk.

The programs include the Instant Assembler program, three versions of the linking loader, a stand alone version of the debugger program, and a program to restart the assembler with the source file in place (if you have to reset during a debugging session). The main program, DSKIAS, contains the editor/assembler and a built-in debugger.

In the traditional method of creating an Assembly-language program, you enter your source code with an editor, then run the assembler. The assembler checks the syntax of each source statement, and generates machine code or an error message. You then re-edit the source file to eliminate errors and try the assembler again.

Once you have an error-free source file, the assembler generates object code, the machine code for execution. Since neither the editor nor the assembler checks for logic errors, you must debug the object code. Most operating systems include a debug program.

The author of the Instant Assembler takes a different approach to Assembly-language programming. This program assembles the source line when you hit the enter key while in the edit mode.

It checks for proper Z80 syntax of the opcode and operand data, and it looks for any duplicate use of the label. It also checks the range of relative jumps. If you have any errors in the line, the system reports the error and places you in the line edit mode with the cursor at the first character in the offending field.

After you finish your source file, you can assemble it directly into memory and debug your program with the built-in debugger. Since the source file is still in memory, you can also debug using the symbol names in your program.

If you discover an error, you can return to the editor mode, correct the bug, and try again. Having all these programs in memory at one time helps speed up the process of developing an Assembly-language program.

The Assembler

The assembler portion of the program is actually both editor and assembler. The editor accepts text from the keyboard and places it in the proper fields for the assembler. The input data is in the form of Z80 mnemonics and comments.

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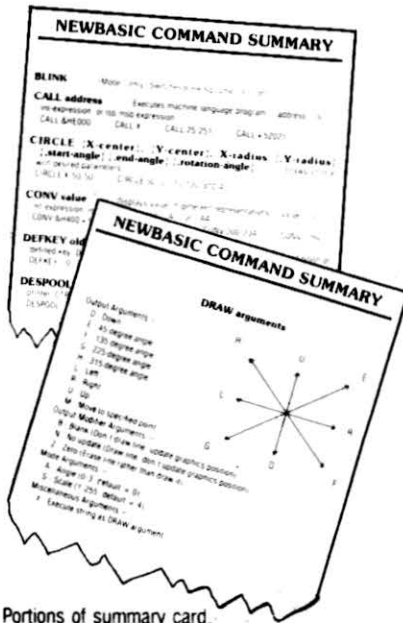
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"NEWBASIC is a very useful tool for anyone programming in BASIC... At \$39.95, NEWBASIC offers a lot for the money." — Basic Computing; July, 1983

"Why weren't some of NEWBASIC's commands part of standard (Disk) BASIC?" — R. Haley; Castro Valley, CA

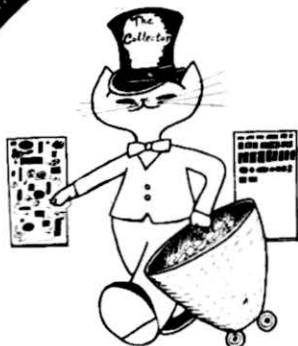
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1000	180.6	3.6	50.2
2000	713.3	7.8	91.4

(Typical garbage collection delays.)

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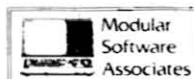
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The manual covers each of the 37 editor commands in enough detail to let even a beginner operate the program. If you're familiar with the TRSDOS Basic line editor, you already know how to use most of the line editing commands.

The assembler expects the input line to follow a fixed format. You can enter an optional six-character label as the first field. If the first character of the label is the ampersand, other program modules can use this label. In Z80 talk, this label is global or public. If the label doesn't have an ampersand, it's known only to the current program module.

The next field is a four-character opcode field that can contain any known Z80 opcode. It can also contain two undocumented Z80 opcodes that let you access the upper and lower halves of the index registers separately.

The last field, the operand field, can contain up to 45 characters and include any type of operand data or comments. If you want a comment, enter a semicolon followed by your comment. However, you don't need to align your comments; the editor does this automatically.

The editor/assembler works quickly and efficiently to help you produce Assembly-language source code. On a global level, the editor has commands to insert code, delete lines, and move blocks of code from one area to another.

It's possible to list your source code to the display or the line printer. When you send code to the printer, the program paginates it, but doesn't add a title to your list. You can also save code to the disk or tape. You can save source code in the Instant Assembler compressed format (a semi-assembled code) or in standard Radio Shack EDTASM format.

If you choose the latter, the program saves the source in ASCII format with line numbers. You can then edit this code with Radio Shack's EDTASM.

You can also include other sections of source code in your current program by using the Merge command, which appends one Instant Assembler file on disk to one in memory. As the program adds the source code, it checks for Z80 syntax errors, just as if you entered the code from the keyboard.

Other assembler commands let you read the disk directory, delete a file from the disk, and find instructions in the code that reference a certain label.

Another command lets you assemble your code directly to memory so you can debug it as soon as you finish without saving and then reloading it with a debugger program. You can also save your object code to disk or tape when you have a finished product.

The assembler allows only a few pseudo-ops, including the Z80 types of DEFM for messages, DEFB for byte data, DEFW for word data, DEFS for storage allocation, and EQU for symbolic equates. These have some surprising limitations.

You cannot use the EQU pseudo-op to define byte data. A statement like:

```
LINEFEED EQU 10
LD A, LINEFEED
```

is not allowed in this assembler. You can assign only word length (16-bit) equates.

You can postfix symbols with an expression, but the range is limited to -31 to +287. This means that LD HL,(BEGIN + 31) is allowed, but an expression like LD HL,(THEEND BEGIN) isn't allowed.

The storage allocation is limited to 4,095 bytes in a single DEFS statement, but you can use multiple statements to obtain greater allocation areas. The last limitation is that a DEFM statement can only define a string of 43 characters due to the length of the operand field.

You can break your message string up into several statements of 43 or fewer characters. The assembler also does not recognize any ORG, End, or DEFL pseudo-ops. The assembler automatically supplies ORG and End when you list the program.

The Debugger

After you assemble your program into memory, you can switch to the built-in debugger program called MicroMind. This program is also furnished in a stand-alone version. MicroMind has over 21 commands. As with the assembler, the manual explains each in detail.

The main routine used in the debugging process is the Step command. This mode lets you step through your program in half steps, each step broken up into a Fetch and then an Execute cycle. You can step through any area of the program including sections that might be in ROM.

When you enter the step mode, the program asks you for the first address. After you enter a valid address, the program fetches the Z80 opcode at that address. The CRT displays the machine instruction, the disassembled code, and the contents of all registers and most flags.

When you hit the enter key, the program executes the instruction. The display keeps the old information and shows the new register information. This lets you compare the before and after effects of the instruction as the program executes it. Some commands let you fast step up to 99 steps, and execute through a call that has already been tested.

MicroMind also supports traditional breakpoint debugging. This lets you set a break location in your code, then run the program until you reach the break location. The display then shows the current state of the registers. The breakpoint is not restored when you reach it; restoring a breakpoint requires a separate command.

Two blocks of memory appear on the display at all times. These blocks are 19 bytes long and you can set them to start anywhere in memory. This is handy if you want to keep an eye on a buffer in which you're changing data.

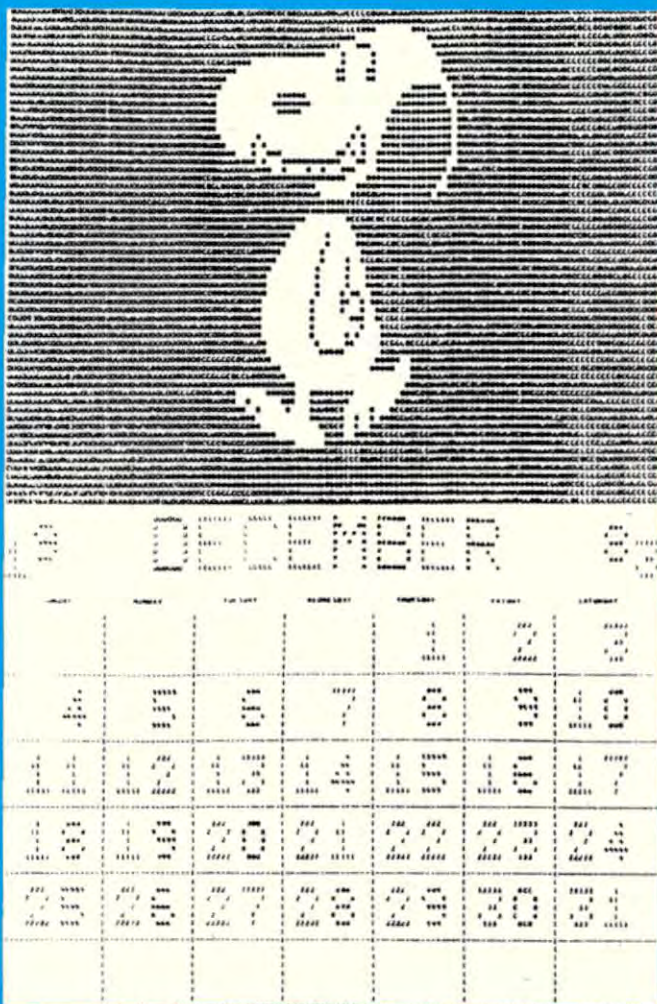
MicroMind also lets you display a block of memory in ASCII so you can detect string information. The display is 50 characters long (five lines of 10 each), and you can move it forward or backward with the up- and down-arrow keys. Other commands let you modify memory and the processor registers.

Instant Assembler includes some utility routines in the debugger program. The Find Number routine lets you search memory for any 1- or 2-byte sequence.

The Disassemble command shows you the Z80 mnemonic code starting at any first address and incrementing by one instruction each time you press the enter key. The program sends this information to the screen or to your printer. The debugger also has Hex-to-Decimal and Decimal-to-Hex number conversion routines.

The MicroMind program is easy to use and a good debugging tool. It's much better than Radio Shack T-Bug and good competition for the disk-based debug program included with TRSDOS. The disassembler feature is

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nice because you can see your code as you write it in source as well as in machine code.

The only objectionable item in the debugger is that the Z80 prime registers aren't included in any of the displays. To view these, you must execute an exchange opcode and display the registers again.

The Linking Loader

An old computer saying states: "A program expands to fill available memory." Well, in case it does, the Instant Assembler package has a program to help you manage large programs.

With the Linking Loader, you can break your source files up into related sections, define entry labels by prefixing the ampersand to them, and combine the entire program at the end to create your final object code.

The Instant Assembler contains several versions of the linker to create programs that start at the top of memory and work their way down, or start in low RAM and work toward the top of memory. All the linkers use the Instant Assembler source as their input file. You must save your modules in compressed format to use this feature.

As you load each module, the program checks it again for proper Z80 syntax, for ranges of relative jumps, and for duplicate labels. At the end of

the loading session, you receive a summary of error count and a list of undefined labels.

You can also search for the location of any symbol with the Symbol command. This lets you find the absolute address of any global symbol. If you like, the linker sends a list of all global symbols and their addresses to the printer. After you have all your source modules linked, you can save the resultant object code on tape or disk.

Conclusion

The unique feature of this assembler is the instant assembly of your source code as you enter it. This is a good feature for a new Assembly-language programmer, because it immediately eliminates simple syntax errors from your source code.

The editor lets you save your source code in the Instant Assembler compressed format or in Radio Shack EDTASM format. If you choose to save your programs in compressed format, you can save about two and a half times the number of bytes of the EDTASM format on your tape or disk.

The only serious problems with the assembler are the limitations on the range of expressions and the restriction to 16-bit equates. These problems become severe for commercial applications, but might not affect the average

home user or beginner.

The MicroMind debugger is easy to use and rivals almost any other debugger available for the Model III. The source code linker lets you break up the program into smaller sections, and later combines them into a single object program for execution.

The documentation includes a complete description of each command and examples of how to use each one. The manual uses a sample program as an example of all other portions of the development system, including the debugger and the Linking Loader.

Because of some compatibility limitations between this assembler and the Radio Shack EDTASM assembler, the manual devotes a chapter to adapting your programs to EDTASM. It would be more helpful if the author of the program corrected these limitations rather than discussing how to program around them.

In general, the Instant Assembler is a good Assembly-language development system. It provides many enhancements to the Radio Shack EDTASM system.

It also works quickly and improves user efficiency by having the editor/assembler and debugger in memory along with your program. This is a good starter system for beginning Assembly-language programmers, and a usable system for advanced programmers. ■

★ ★ ½

Model 100 Games #1
SilverWare
 P.O. Box 21101
 Santa Barbara, CA 93121
 24K Model 100
 \$24.95 cassette

by Eric Grevstad
 80 Micro staff

If you've been waiting for high-quality, fast, machine-language games for your Model 100, keep waiting. In the meantime, SilverWare (a spinoff of *CLOAD* and *Chromasette* magazines) has converted a quartet of simple Basic programs for the portable—one or two of which are modestly entertaining if you have modest expectations.

The cassette includes two copies each of two adventures and two graphics-

oriented games. All loaded easily on the first try; the documentation includes a handy table showing their locations on a Radio Shack CCR-81 recorder's tape counter, as well as the memory requirements for each.

The games, Blockade and Reversi, can share RAM with other programs on the menu, but each of the adventures, Alexis and Frankenstein, fills most of a 24K machine.

By that criterion, Alexis (18,500 bytes) wins the Not Worth Killing Everything But ADRS.DO Award. The plot is interesting: As the imprisoned son of the late king, you must escape the usurping General Tarkaan, sail to each of four neighboring islands to collect an army, and then return to battle Tarkaan, surviving in effect four adventures and a combat strategy game.

But Alexis combines this sophisticated premise with the clumsy syntax and

limited range of an antique (1980, perhaps) Basic adventure. Given the 100's 40-column screen, even terse two-word commands are too long to fit on the same line as the windy "What is your command, Alexis?" prompt.

Other nagging lines—"You can't go that way, Alexis"; "You have boarded the boat, Alexis"—make the name begin to sound like fingernails on a blackboard.

Alexis has annoying random elements, too: Sometimes Pluto gives you the Crystal Sphere of Hades if you bring him the giant pearl, but sometimes he's cranky and demands something else.

While sailing from island to island, you have to keep an eye on the weather and type WAIT if it looks stormy. Even if you do, the program occasionally kills you off, saying "You should have waited."

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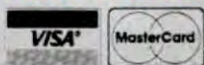
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puzzles will be sorely disappointed. Alexis begins his odyssey in a jail cell, where the guards put him without removing the skeleton key he carries.

On the first island, I worried about natives or monsters but found only stuttering strings: "Alexis, you are on the shores of the island of Skiros on the island of Skiros."

By contrast, while no one would call Frankenstein a great adventure—simple two-word commands ("Unlight candle"), slow Basic that lets you type in a command before the display's processed your previous one—it's a pleasant few hours' exercise.

Frankenstein (15,000 bytes) is relatively easy, but has a couple of clues or items that form a good introduction to adventuring logic. I can't recommend it for children, though, because it involves digging up and hacking at corpses. As the last surviving relative of Victor Frankenstein, you must finish his work and activate the monster, who's short a few parts.

But once you get into it—scurrying between the mansion, the graveyard, and the old mill; trying to get at and open the safe; and dodging quicksand, werewolves, and finally the awakened monster—Frankenstein is ghoulish fun.

Like Alexis, however, it might tempt portable players to cheat. For people used to Model I/III disk adventuring, it's all too easy to hop into Basic for a simple LIST. (That's how I learned the trick of getting past the wolf; I'd never have been gruesome enough to think of it myself.)

Both Frankenstein and Alexis have one wonderful feature, the best thing about Model 100 adventuring—you can save a game in progress to RAM (your position is stored as a bunch of numbers in a 350-byte do-file), replacing disk or cassette I/O with "Save game" or "Load game" and a tap of the enter key.

Key work isn't so easy in Blockade (6,500 bytes), a semi-Centipede game in which you steer a snake around the screen, trying to reach targets and grow-

ing longer as you do so. The targets appear and disappear randomly, sometimes for no longer than an LCD flicker; each is worth a random one to nine points.

Hit the wall or your tail, or your opponent in two-person games, and you lose five points. Blockade then displays your current score and restarts with new snakes.

The word that springs to mind, especially after the opening instructions take eight seconds to appear, is "slow"; only the fastest of three speeds is at all interesting, and sluggish response makes maneuvering difficult. Rather than the Model 100's arrow keys, the Esc, tab, /, and shift keys steer single players up, down, left, and right respectively.

Two-player games are awkward. Not only is the 100's screen hard for two people to see at once, but the second player has to use the apostrophe, slash, comma, and period keys to steer, reversing the order (left hand up/down, right hand left/right) of the other arrangements

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or the Model III arrow keys.

As if that weren't enough, the game drags on until someone reaches 100 or -100 points, or until a player leads his opponent by 100 points. This can take some time. The playing options and default values (one player, sound, medium speed) are nice touches, but Blockade remains basically a dull game.

Reversi, on the other hand, is the same old Othello that's been on micros for years, but the Model 100 version is a first-rate use of 5,250 bytes. The documentation is poor—I'd never played Reversi before and learned by trial and error—but the game is neat, simple, and fiendishly challenging.

On a Model I or III, Reversi was interesting. Scaled to fit in your lap, it's an ideal armchair or plane-ride diversion.

While two can play, Reversi is best as a solitaire duel against the 100. A # sign, steered around an 8-by-8 grid with the arrow keys, lets you enter your move,

capturing enemy pieces between two of yours. Then the 100 takes its turn, moving the # sign around the board as if considering moves before making its choice and capturing even more pieces.

Games become grim, vicious fights for the crucial edge and corner spaces; toward the end, the lead swings wildly back and forth until a musical salute announces the victor. I've managed several wins and a tie, but I'm by no means through playing. Of the four SilverWare games, Reversi is the only one I'm keeping in my Model 100.

I can recommend Reversi because it takes new life in a lap-sized version, but the other Model 100 games have no real attraction except portability. Probably soon there'll be adventures with plots as elegant as the save-to-RAM feature, or arcade games that aren't anchored by plodding Basic. The Model 100 will be a great game computer. It just isn't one quite yet. ■

DB-25P plug.

Using the Microspooler

The microspooler hooks up to most standard printers, but lack of standardization in the printer industry might give you problems in getting the right kind of cable for your printer. Consolink is helpful if you need advice or help in building your own cable.

It's simple to hook up a parallel printer and microspooler. With the serial microspooler or printer, you have to set a few switches. The serial ports also have selectable baud rates. The manual is easy to follow and tells you exactly what to do.

When you first turn on the microspooler, you can perform a self-test. Press and release the reset button while holding in the copy/pause button. This is a software test of ROM (read-only memory).

If this test is successful, your printer tells you ROM is OK and how much memory is available. Now you can start filling your buffer.

The minute you start sending data from your computer to the printer, the microspooler fills up and control returns to the computer. The printer starts printing simultaneously. The status readout changes from 00 to 01 (1K) and so on as you send data.

When you stop filling the buffer, the readout decreases until it reaches 0 when the printer finishes printing. Reset the buffer to 00 if you don't want an extra copy. While the printer is running, you can press the copy/pause button if you need to change the paper or make adjustments.

When printing is complete, press the copy/pause button for one more copy of whatever is in the microspooler's memory. It's also possible to preset the number of copies (up to 99) you want before you start printing. Press the copy/pause button until the desired amount of copies appears on the readout.

You also have the option of pausing after every copy. The microspooler also has a pause on form feed function.

I found the microspooler simple to install and easy to use. It's a helpful tool if you have a lot of printing to do. The microspooler frees you and your computer to do other things while the printer works. All in all, the microspooler is a good buy. ■

★★★★

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by **Mare-Anne Jarvela**
80 Micro Technical Editor

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The microspooler is small: 6.3 inches high by 2.6 inches wide by 8.3 inches deep. It's a white box with black edges that weighs two pounds, 15 ounces and stands vertically to save space.

A two-digit numeric display on the front is the status readout that tells you how much data is in the spooler or how many copies are left to run. On the front you'll also find the copy/pause button and the reset button.

"The microspooler stores data until the printer is done, letting you continue your work."

The back has two ports, one for input and one for output. The on/off switch is also on the back. Connectors for parallel ports are 36-pin Centronics compatible; the input port is the receptacle and the output port is the plug. For serial ports, the input port is the DB-25S receptacle and the output port is the

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REVIEWS

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Using Scripsit

William J. Haga

Wadsworth Electronic Publishing Co.

10 Davis Drive

Belmont, CA 94002

Softcover, 250 pp.

\$21.95

by S.F. Tomajczyk

80 Micro staff

It's said that you can't teach an old dog new tricks. It seemed true until I began reading *Using Scripsit* by William Haga. That's when I realized that, although I've actively used Scripsit for the past year, I haven't really been using it.

Using Scripsit is truly user-friendly. It represents what a reference book should be: comprehensive and informative concerning the subject matter, readily accessible for locating specific information, and most importantly, communicative in an understandable fashion.

The book discloses everything you ever wanted to know about using Scripsit's capabilities on your Model I or III. The information applies only to Scripsit versions 3.2 and 1.0, so if you have Scripsit on a Model II the book won't be of any use to you.

Using Scripsit employs a hands-on approach to learning to get the most out of Scripsit. You should read it with your computer in front of you. William Haga presents each procedure in numbered steps that tell you what to do, what your video display looks like when you do it, and how the printed result looks on paper.

You'll never feel lost or confused. And to make certain that you won't, Haga includes exercises to test your growing skills in using Scripsit.

At the end of each chapter, a Common Mistakes section lists the problems and solutions you're most likely to encounter. Also, the left margins are filled with comments that clarify the text, provide helpful and humorous tidbits, and direct you to other sections of the book for further information.

At a Glance

The first section of *Using Scripsit* is an introduction aimed at the first-time user. In Chapters 1-7, Haga methodically takes the reader through the fundamentals of disk use, writing and formatting the video screen, saving and retrieving Scripsit files, basic editing commands, and formatting and printing a document.

The second part of the book deals with more complex applications for the experienced user. Chapters 8-15 include valuable information and explanations of Scripsit that you'll refer to time and time again. They cover block moves, search and replace routines, creative formatting, and chain loading.

They also clarify the forbidding headers, footers, and page numbering system, as well as clearly explain the Hot Zone of Scripsit's hyphenation function, and how to save a half-ruined printout without reprinting the entire document.

The best is yet to come: In the remaining three chapters, Haga shows you how to merge VisiCalc with Scripsit, create personalized form letters, use Scripsit to write computer programs in Basic, and print documents in special formats.

Continued on p. 61

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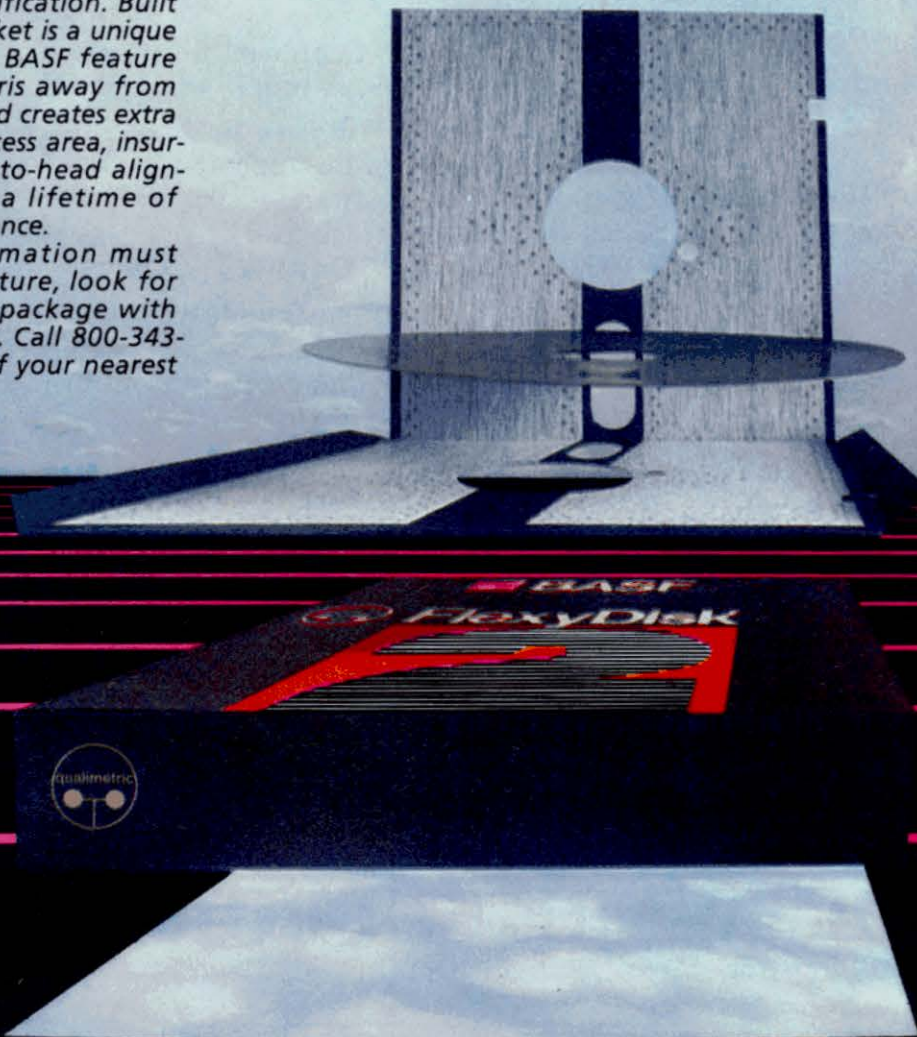
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Continued from p. 56

He explains, step by step, how to send Scripsit files by phone across town or across the globe, and how to manipulate your operating system's password protection system to protect your Scripsit files from prying eyes.

When I reached the end of Chapter 18, I was convinced that William Haga had a sadistic streak in him. Why else would he continue to throw so much valuable information at me in his appendixes?

One appendix provides the symptom, cause, and solution to errors you frequently encounter. It covers everything from Scripsit error messages to printer difficulties, and from drive unit problems to DOS troubles.

Another appendix lists reference sources that include computer magazines, books and manuals, and independent sources of equipment and software. And yet another appendix functions as a glossary for Scripsit users! The author had done the impossible: I actually learned some new tricks.

What exactly did I learn? Well, did you know that Scripsit has a widow sup-

pressor? That you can change the screen width to up to 132 characters? That with the Search command you can find several variations of a word for spelling errors? That Scripsit can hyphenate wrapped-around words with its hyphenation block?

That you can create a paragraph pantry to easily and quickly customize form letters? Or that you can chain files together in order to print and number an entire document? I didn't until *Using Scripsit* told me. Now *80 Micro's* technical editors ask me for advice on Scripsit.

With the information in this 250-page book, I've found Scripsit to be much more powerful than I thought. Now I use it to finish office paperwork more quickly, write and edit chapters in my book, create and print form letters and memos, and write Basic computer programs.

For the skeptics out there, *Using Scripsit* does have its drawbacks, but they are trivial. For instance, I feel that the chapters concerned with screen edit-

ing should have been introduced earlier in the book.

This would let you go from booting up Scripsit, writing and formatting the video display, to screen editing, saving the file, and formatting and printing the document. Trivial, but it would make for a more useful chronological reference.

The only legitimate complaint I have deals with the omission of an easy reference sheet that lists in abbreviated form all the Scripsit commands and functions so you don't have to browse through the entire book for an obscure command.

Such a sheet would save a lot of anguish and time. Haga does, however, include an incomplete facsimile that lists only the screen format defaults. Useful, but not what I was looking for.

Using Scripsit is comprehensive, well-written, and useful. Every Model I/III owner with Scripsit, whether a first-time user or an old dog, can benefit and learn from this book.

It belongs next to your computer and its operating manual. *Using Scripsit* will soon become your most valuable guide. ■

★★★★★

**CP/M 2.2, MBasic 80
on the Mapper I (48K)/III (64K)
Omikron Systems
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by John B. Harrell III

Omikron Systems distributes hardware and software for TRS-80 computers that allow full implementation of the CP/M operating system—not another attempt to work around the TRS-80 internal memory structure. I used the Mapper and its software almost daily for three months. The system performed flawlessly—no glitches, surprises, or snags.

Because the hardware used in this modification is part of another review (see "CP/M III Ways," p. 122), I'll consider only the CP/M 2.2 operating system and the MBasic 80 interpreter

distributed with the hardware modification as the starter system.

CP/M Operating System

CP/M isn't just another disk operating system; it's the most widely distributed operating system for the 8080 microprocessor. CP/M derivatives now exist for the 8086 family and the 68000 family of 16-bit computers. Radio Shack's introduction of the Model 4 with CP/M reinforces the fact that CP/M has become the de facto industry standard in operating systems.

The CP/M operating system is a monitor and control program for microcomputer systems that use floppy or hard disks for back-up storage. It is estimated to be in use in over half a million microcomputer systems throughout the world.

The system distributed with the Omikron Mapper I/III modification is CP/M 2.2. CP/M is logically divided into four parts: the Basic input/output system (BIOS), the Basic disk operating system (BDOS), the console command processor (CCP), and the transient program area (TPA).

These component parts provide features found in many other systems available for TRS-80s. For example, the BIOS provides system-dependent primitive operations necessary to access the disk drives and to interface with the standard system peripherals, BDOS is the disk management part of CP/M, and the CCP provides the interface between the operator and the system.

CP/M commands break down into three categories: built-in commands, transient commands, and user-implemented commands. See Table 1 for the commands in the first two groups (standard on CP/M system disks. The latter group are those commands programmed by the user in Assembly language and executed from the disk (similar to CMD files).

In addition to the standard Digital Research software and documentation, Omikron provides many specialized features particular to the TRS-80 implementation. This documentation is provided in *The Omikron Mapper Owner's Manual*. This contains all the instructions on the Mapper's installation and the documentation for the many special

features required for TRS-80 systems.

One example of the customization Omikron provides is a sophisticated keyboard driver that maximizes the capabilities of the CP/M software interfaced with the TRS-80. Features include full keyboard debounce, a single-key control key, upper-/lowercase support with caps lock, and production of the full 128 characters in the ASCII set.

Several of the keys have control functions for single-key ease.

Omikron provides serial and parallel printer drivers to support all printer installations. The default printer driver is parallel, supporting the majority of Radio Shack hardware configurations. The routine Serial.COM (provided by Omikron) establishes the serial driver and initializes the RS-232 interface to

the default conditions established with the sense switches.

The video driver emulates a Soroc IQ120 video terminal on the TRS-80. It provides full upper-/lowercase support and maintains full graphics capabilities. Also, the video driver provides a routine that allows cursor addressing (positioning the cursor to a specific location on the screen).

Omikron provides two versions of SYSGEN and Format on the distribution disk. The manufacturer specially tailors a version of each utility to the 5¼- and 8-inch disks normally used with CP/M on the TRS-80s.

OMCOPY.COM is a disk copy routine provided by Omikron to allow more rapid back-ups. The standard routine, Peripheral Interchange Program (PIP), provides a method to copy all files from one disk to another. The operation is similar to the "back-up by class" LDOS uses or the "copy by file" NEWDOS80 uses.

To circumvent the delay inherent in this method, OMCOPY provides a track-by-track back-up of one disk to another. Options allow copying only user files, only system information, or the entire disk.

MEMTEST.COM and DSKTEST.COM evaluate your system's performance. The functions of each are obvious.

Setup.COM lets you customize the Omikron software according to your personal preferences and as certain software applications require. You can store the options changed by Setup permanently on the system disk.

TRSCPM.COM provides a mechanism to transfer files from TRSDOS formatted single-density disks to CP/M formatted disks. Both systems use a soft-sector disk; however, both sector lengths and directory structure differ. This program moves data from the TRSDOS-format system to the CP/M system.

This feature also allows moving Basic programs from one system to the other as long as you save the TRSDOS program to the disk in ASCII format. The program transfers the files sector by sector, copying extraneous information in some cases (the bytes past the TRSDOS end-of-file location, for instance).

In addition to the many utilities included on the system disk, you can see from Table 1 that the standard CP/M system disk includes a powerful context

Built-In Commands

Command	Description
ERA	Remove the specified file(s) from currently logged-in or specified disk.
DIR	List the names of all files in the specified directory on the console device.
REN	Rename the specified file to the designated name.
Save	Save the specified number of pages (256-byte blocks) to the file designated. Pages are taken from the Transient Program Area beginning at 100 hexadecimal (hex).
Type	Type (display) the contents of the specified ASCII file to the console device.
User	Allow specification of different user numbers for maintenance of separate files in the same directory.

Transient Commands

Command	Description
ASM	Load the CP/M assembler and assemble the specified program. The Assembly source code is assumed to be in Intel source mnemonics and the assembler produces 8080 machine language in the Intel hex format.
DDT	Allow dynamic interactive testing of programs while operating within the CP/M environment (DDT includes a limited disassembler).
Dump	Dump the contents of the specified file to the system console in hex form (displays the file's contents, representing each byte with ASCII letters for the hex codes).
ED	Allow the creation and editing/correction of ASCII character files in the CP/M environment.
Load	Load the assembled program in the Intel hex format and convert it to an executable machine code file.
MOVCPM	Allow reconfiguration of the CP/M system for any memory size.
PIP	Allow movement of files from one form of storage to another. You can specify many powerful parameters to control file movement.
STAT	Provide status and general purpose access to pertinent system and disk parameters from the CP/M command level.
Submit	Allow the submission of CP/M commands in a batch manner. This is similar to the TRSDOS Do command. Parameter substitution is allowed within Submit files. The compiled Submit file is executed after Submit completes. You can chain Submit commands.
SYSGEN	Allow the generation of a system disk by properly initializing the CP/M operating system on the disk.
XSUB	Extend the power of Submit to allow input to user programs as well as to the Console Command Processor.

Table 1. CP/M Version 2.2 Commands.

editor (ED), an Intel-compatible 8080 assembler (including the ability to perform conditional assembly), and a dynamic system debugging monitor (DDT).

Microsoft Basic 80

CP/M does not come with a Basic interpreter. On many systems, you have to add this feature by purchasing an interpreter compatible with the operating system. Owners of TRS-80s have been spoiled by having a high-quality Basic interpreter available at the flick of a switch.

The Omikron Mapper package comes with the industry-standard Microsoft interpreter in two versions for 8080/8085/Z80 microprocessors and CP/M, MBasic.COM 5.2, and OBasic.COM 4.51. OBasic is for those users who have software compatible with this interpreter and who don't wish to change to MBasic.

MBasic 5.2 is the most extensive and powerful Basic interpreter available for microprocessors. It meets the requirements for the Basic ANSI standard and supports many features not normally found in other Basic interpreters, such as complex string manipulation routines.

MBasic is similar in almost all respects to the Basic interpreter implemented on the Model 4. In many respects, this is the same Basic currently on the Models I and III.

The most significant difference from Model I/III Basic is in variable naming conventions. MBasic allows variable names to be of any character string (letters, numbers, and decimal point) up to 40 characters, whereas Model I/III Basic recognizes variable names with a maximum of two characters; the remainder of the variable name is insignificant.

In MBasic, you can't use reserved words as variable names but a variable name can contain a reserved word within it. This generally leads to a program error of some type in Model I/III Basic.

This feature causes most of the incompatibility between MBasic and Model I/III Basic. In MBasic, you must surround each reserved word with spaces or delimit it in some other manner. The internal structure of the tokenized programs is different.

In order to transfer Basic code from the Model I/III to the CP/M system, you must first write or edit the program

so the interpreter can clearly identify the reserved words (contrary to the programming hints that obtain maximal speed from these Basic programs) and you must store the programs on the TRSDOS disk in ASCII format. This requires a significant programming conversion for those programs written without spaces in the lines.

"New" features of MBasic include the while/wend structure for program control, the ability to call a subroutine written in another language and pass arguments to it, chaining programs while preserving variables, erasing array variables under program control, renumbering program lines, and swapping variables in a single statement. These features are new to those who have used Model I/III Basic exclusively.

One significant feature implemented in MBasic is the Call subroutine. MBasic provides a linkage to external subroutines via a Call statement.

This subroutine linkage allows preparation of segments of code using an assembler or other language translator and calls it from MBasic with a sophisticated argument list. The calling linkage is compatible with the Microsoft compilers (Fortran, Cobol, and Basic), letting you compile complex routines for speed and use them directly from MBasic.

Conclusion

As anyone experienced with the CP/M system knows, its heart is the BIOS implementation of system-specific functions. Omikron has outdone itself with a superb BIOS module.

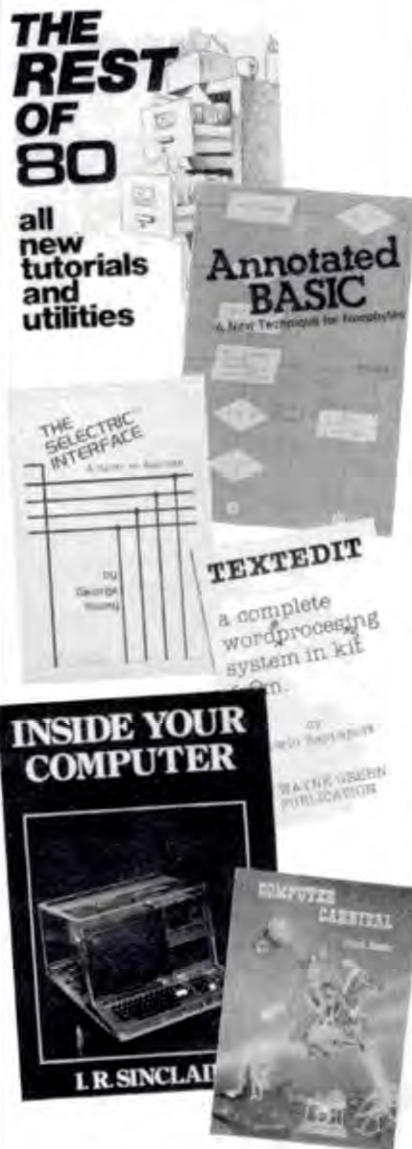
When I ran some benchmark tests on the MBasic interpreter, I was astounded to find that this interpreter outperforms its relative in the Model I TRS-80 mode. Operating the interpreter in a Model I with no speed-up, I obtained execution times indicating a significant increase in speed for equivalent routines (MBasic compared to NEWDOS80 Disk Basic).

When you consider that MBasic allows 40-character names and requires that reserved words have some type of delimiter around them, this is even more surprising.

As with any product, the Mapper software has some negative aspects. The distribution medium is the standard 5¼-inch disk. The CP/M software is written on this disk in 35-track format with 18 sectors (128 bytes) per track.

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suffer a reduction of 10 percent capacity over the TRSDOS single-density format. After creating a 40-track system disk, working user storage is 81K (82,944 bytes out of 92,160 bytes due to system overhead). Compare this to the 102,400 bytes available on a 40-track, single-density TRSDOS disk.

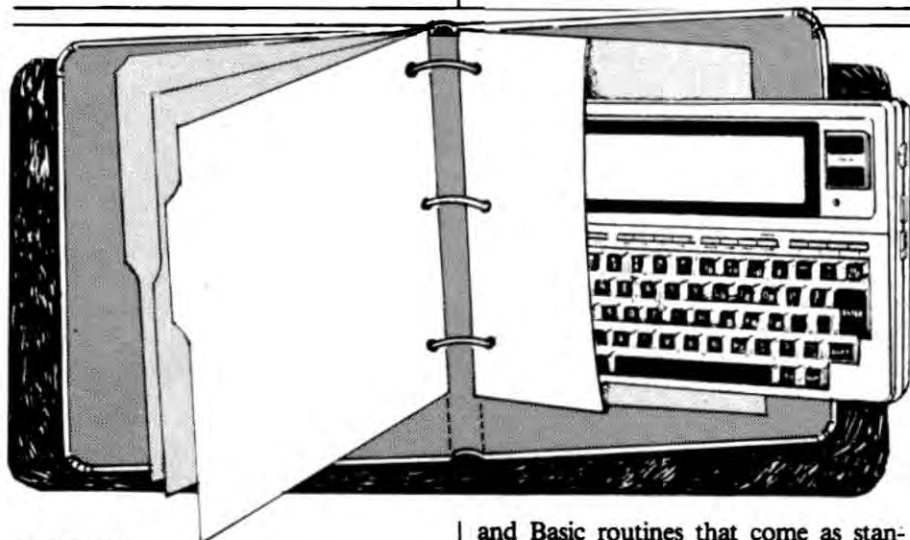
Because of the limited storage available with the 5¼-inch disk, Omikron has to delete some of the standard files resident on CP/M system disks in order to include their specialized programs. These deleted routines are available to you at a nominal fee of \$25 from Omikron and include items such as the Assembly source code to the BIOS and the Boot loader, MOVCPM.COM (relocates CP/M system BDOS and CCP for different memory configurations), and DEBLOCK.ASM (the source code for a CP/M disk deblocking algorithm).

Unlike Level II Basic, the manual sup-

plied with MBasic doesn't offer the beginner an easy understanding of the language. Since this is not the sole source of Basic for your computer, this should be no problem.

Omikron now has a new software/hardware package available that further increases the TRS-80's power. At additional cost, they will provide TURBODOS and a replacement PROM chip for their Mapper installations.

Consider the wealth of software you obtain in addition to the hardware modification. CP/M 2.2 generally retails for approximately \$150 and you must install the system (this usually means rewriting parts of the BIOS to add functions or change existing ones—no easy task for a beginner). MBasic usually retails for approximately \$249. I cannot imagine where else you can get a bargain like this. ■



★★★★★

Businesspak +
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\$89.95
SORT2 +
\$29.95
Model 100
24K required
32K recommended

by Carl Oppedahl

Businesspak+ is a nice collection of six programs for the Model 100. It augments the existing ROM-based word processing, telecommunications,

and Basic routines that come as standard equipment with the Model 100.

Businesspak+ contains Write+, a word processing program; EXPNS+, a simple spreadsheet program; Put+, a text entry program; Sort+, a routine that sorts records entered through Put+; Telex+, a package that lets you use Action Telex, a commercial telex service; and Graph+, a program that graphs data entered to EXPNS+ on the Radio Shack DMP-100 printer.

Each program runs in Basic and relies occasionally on a machine-language routine hidden in memory. In addition, each relies on a corresponding do-file containing various operating parameters. You can change the do-file, often called a SPEC file in the documenta-

Continued on p. 69

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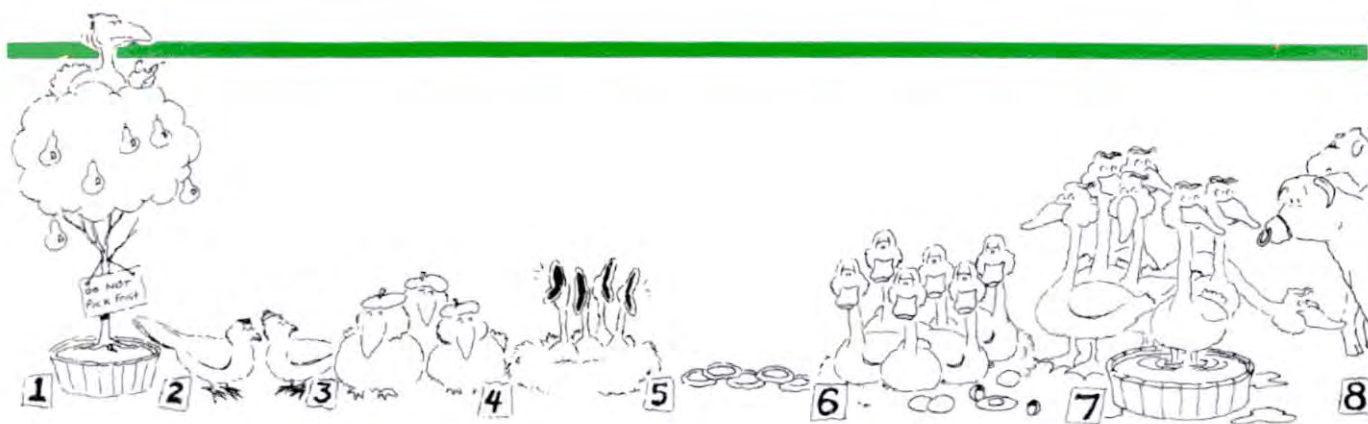
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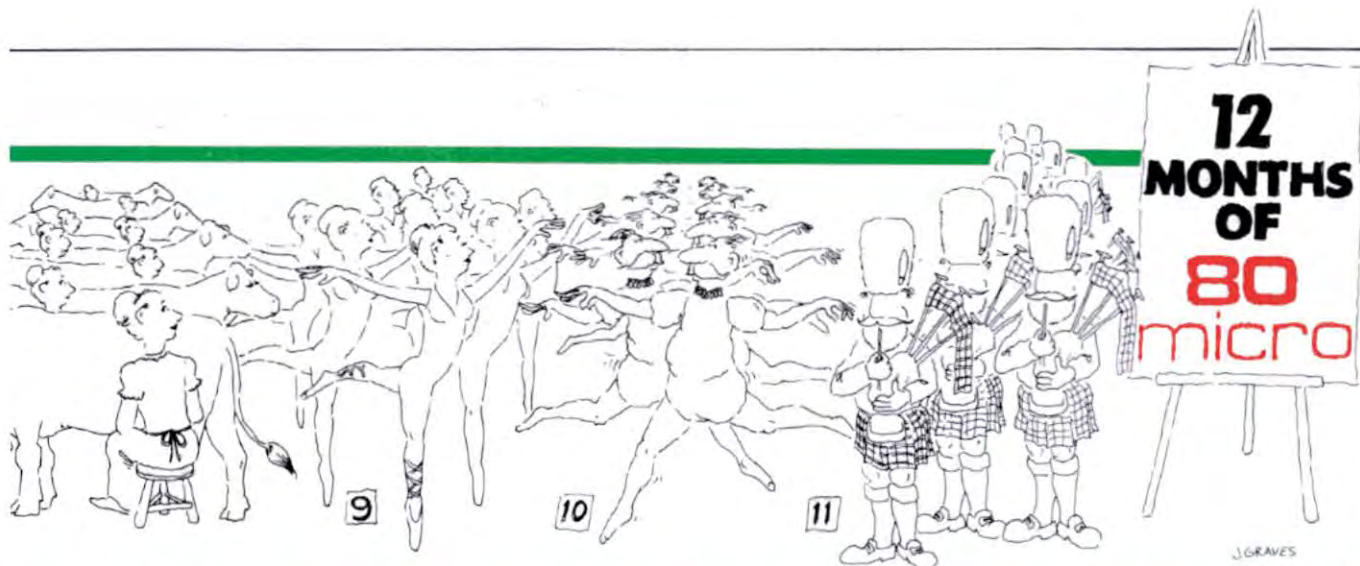
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Delta 10/15**



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tion, to modify the behavior of the Basic program.

Write+ is a delightful program that lets you print out files created through Text. You can arrange to skip perforations, pause between pages for printing on single sheets, and print multiple copies, double- or triple-spaced output, and page headers and footers with the time and date.

The two types of word processors in the world are those that display on the screen exactly what will appear on the printed page, and those that display raw text on the screen and format the text for printing after you complete all your editing. Write+ is the latter type.

For instance, text that is double-spaced on paper appears single-spaced on the screen. Given that the Model 100 screen is much smaller than most CRTs, that is the best choice.

The Model 100 input and output routines are largely device-independent. Any of several devices with appropriate file names can be the object of Open and Close statements. These include RAM, LCD, CAS, MDM, LPT, and COM.

Write+ takes advantage of this. You can take the output that would usually go to the printer and route it to RAM for later editing or to COM for printing on a serial printer. Similarly, though you usually use Write+ to print files put in RAM by means of Text, it can take its input from any other device, such as a file on cassette.

Write+ is easy to use. You can easily print out text files created long ago with Text, skipping perforations, within 20 minutes of opening the Businesspak+ package.

Write+ uses simulated form feeds. When the time comes to skip forward to the top of the next page, the program uses individual line feed commands with an ASCII value of 10. Many printers, however, are capable of responding to a form feed character with an ASCII value of 12.

This accomplishes motion to the top of the next page much more quickly and quietly than a series of line feeds. It would have been nice if W+SPEC let the user select simulated or actual form feeds.

I have, however, determined a way to modify Write+ so that form feeds accomplish the perforation skip and blank page skips. The new lines appear in Program Listing 1.

EXPNS+ is an aid to travelers who must keep an expense record. Though it's described as a spreadsheet program, it is quite limited in capability. The program sets up an array of numbers, drawing up totals for up to 18 rows and 12 columns.

It does not let the user define relationships between and among different locations in the array, but merely adds up each row and column. Thus EXPNS+ is far less versatile than programs like VisiCalc.

"EXPNS+ is an aid to travelers who must keep an expense record."

You can store the numerical values in the array in RAM, then transfer them to and from other devices, such as a cassette. You can use the RAM file as input for the Graph+ program or merge it into a word processing file using Text.

Put+ is a simple data entry program. Given a user-defined P+SPEC file, the program accepts user keyboard entries and assembles uniform-length ASCII records composed of fields of user-determined fixed lengths. The program defines the fields within records in a SPEC file that the user creates. When you run the Put+ program again later, the program adds new records to the end of the existing file.

During keyboard entry of data, you go from one field to the next by means of the down-arrow key, and store the record by pushing the enter key. I found that to be awkward, and often pressed the enter key at the end of a line when the software expects the down-arrow key.

Also, when filling in, for example, a three-character field with a three-digit entry, I often found that Put+ jumped ahead to the next record when it should have simply accepted text for the next field in the same record. PCSG has since corrected both of these awkward situations in Put+.

Given the SPEC file and assuming you have fewer than 256 records, the Sort+ program then sorts the records as discussed below. You can also easily search the records using SCHEDL and ADDRSS (or even Text).

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However, when you display the file on the screen or print it on the printer, it tends to look irregular. This occurs because the program runs adjacent fields together without spaces to separate them, and because both the screen display and print routines wraparound entire words at the end of the line rather than cut them off. According to PCSG, a new program called Data + (\$59.95) is available that allows variable-format displays and listings.

The Sort + program allows sorting of up to 255 uniform-length ASCII records according to any selected constant-length field in the records. It's easiest to use Sort + with records created through Put +, but you can use Sort + on other files too, as long as the records and fields within records are of uniform length. Simply create a Put + specification file to match the fields in the file you want sorted.

Also, when Sort + reads in the file it will sort, it puts any lines of nonstandard length at the beginning of the output file. This is handy for two reasons: You can leave explanatory material, such as a heading or verbal summary, at the beginning of the file and it isn't disrupted by the sorting process.

If you mistakenly include a line of inconsistent length in the file, it appears at the beginning as well. This brings the line to your attention so you can correct it.

The sort is a simple sort in ASCII order. The documentation claims that you can sort 255 records in 15 to 20 seconds. One file I sorted actually required just over two minutes. I attribute this to the fact that Sort + swaps entire records whenever a comparison so indicates.

This isn't really a drawback, but a consequence of the Model 100's limited memory. On a larger machine, it would be possible to sort more efficiently by extracting and sorting key fields, and by swapping the entire records only when the key fields are in order.

PCSG has also released another program, Sort2+, that does a few things Sort + cannot. For example, it sorts true numeric data so that 6 comes out above 10 in order.

Or you can set Sort2+ to sort with the uppercase flag bit suppressed: The result is that the program treats upper- and lowercase letters equally in the sorting process. Finally, it performs the sort directly on the RAM file, rather than by reading the file into the Basic program area. Sort2+ needs less free RAM than Sort +.

Telex + helps you send telexes, mailgrams, and the like from text files you've previously typed in and saved. To use Telex +, you must open an account with Action Telex, a company based in Dallas that accepts messages through a modem over phone lines and sends them out via the Western Union telex network.

This requires payment of a \$150 annual registration fee and a moderate us-

age charge. The advertisements I've seen for Businesspak + don't make this point very clear. The Businesspak + documentation describes a free trial arrangement whereby you can send three free telexes or mailgrams.

I tried this by calling the phone number in the manual and supplying the requested information. I was told that Action Telex would contact me with an identification code for the free trial. Three weeks and three more phone calls passed before I finally got a code.

When I tried it out, the program indicated that Action Telex had accepted my mailgram and two telexes for delivery, but none of them reached their destination. When the local office finally called with another code, I had better luck. The mailgram got through all right, but the telex was delayed eight hours.

Though the documentation said nothing on the matter, I found I had to precede the destination telex number with a zero. After that I had no trouble with Action Telex.

I also had some problems with the Telex + program itself. The Model 100 has a built-in modem with provisions for acoustic coupling and direct-connect autodial operation. However, one constant feature of the program is that it tries to dial the phone number for access to the Action Telex computer whenever you run it.

If you are using the acoustic coupler, this doesn't hurt anything, just wastes time. But if you are trying to dial the access number manually for MCI access or to get through a Touch-Tone-only switchboard, the dialing routine frustrates your efforts by hanging up the phone for a second before listening for the carrier tone.

It would be helpful if PCSG modified Telex + to allow the equivalent of the Term key in TELCOM, and thus bypassed the autodialing routine. One remedy is to use a duplex jack instead of the silver phone cord. Plug in both the phone and beige cable. Do not hang up the phone until the Model 100 detects the carrier.

Graph + lets you prepare graphs based on numerical and text information typed in using the EXPNS + program. The graphs can be pie, bar, and line charts.

Since Graph + takes its input only from EXPNS +, and since EXPNS +

Program	K to load	Free K to run
Write +	4.4	2
EXPNS +	7.0	5
Put +	2.8	1
Sort +	2.6	4+
Telex +	3.9	1
Graph +	6.0	7

Table 1. Program sizes.

For Version 1.3:

```
1400 IF FF%<>0 THEN PRINT#2,MID$(LFS,1,2*(BM%+LC%));HF%=2:GOSUB 1550
1405 PRINT#2,CHR$(12);:IF BL%-PP%>0 AND PG%<PE% THEN 1490
1410 IF CN%<NC% THEN CLOSE:BL%=160:PP%=0:GOSUB 1450:GOTO 130 ELSE
PRINT#2,CHR$(12);
```

For Version 2.1:

```
32 IFFF<>0THENPRINT#2,LEFT$(LFS,2*(BM+LC));HF=2:GOSUB43
33 PRINT#2,CHR$(12);:IFBL-PP>0ANDPG<PE THEN39
34 IFCN<NCTHENCLOSE:BL=160:PP=0:GOSUB37:GOTO6
ELSEIFFDTHENPRINT#2,CHR$(12);
```

Program Listing 1. Form feed modifications for Write +.

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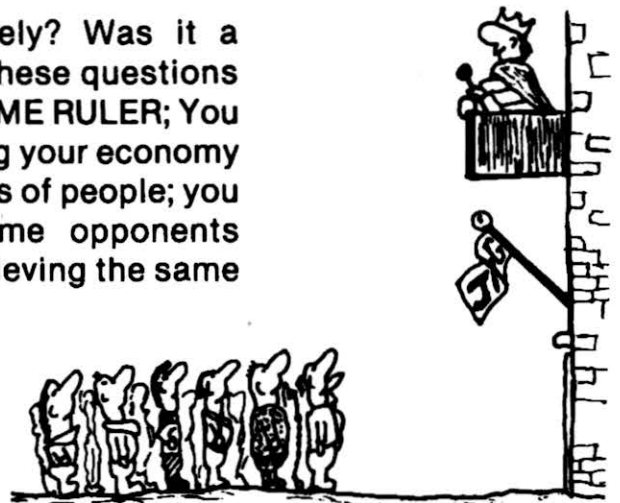
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handles only up to 18 columns, that's the largest number of points you can graph. Thus any line graph is, of necessity, quite bumpy.

The Businesspak+ software comes on cassette, all of which you can back up. I found the cassettes themselves to be of high quality and well recorded; I had no load errors after dozens of loads. You must load each program from cassette before use, which takes as long as four minutes.

Documentation and Support

The documentation, totaling some 108 pages, is written under the assumption that the user is already familiar with the connections to the Model 100, has mastered the built-in program Text, and has at least passing familiarity with the other built-in software.

The documentation has no general index, but you don't need one since index tabs for each program allow easy reference to explanatory material. In addition, Write+, perhaps the most complex program, has its own index in the most recently received documentation.

The PCSG telephone number appears prominently on the manuals and instructions. I called several times at various times of the day and night, and always reached cheerful people. Though I had difficulty getting signed up with Action Telex, the frustration was outweighed by the many other times that my questions were answered immediately and correctly.

Each time I called, PCSG asked for the serial number of my software package. I consider this a perfectly reasonable request as it helps protect against

software pirates, but the drawback was that I was immediately identified as a reviewer. Nonetheless, I sense that all purchasers can expect good customer support.

User-Friendliness

The programs are well error-trapped, although occasionally I tripped them up with unusual inputs. For example, each program depends on one or more SPEC files containing file formats, field names, and so on. If the SPEC file is not set up properly, the program using it can go astray. I had particular prob-

Businesspak+ provides a good package of routines for the Model 100 owner. They are easy to learn and use."

lems coming up with a P+SPEC file suitable for use with Put+.

One problem anyone faces who writes text-handling programs for the Model 100 is that RAM files can have arbitrarily long records. A Line Input or Input that goes to a string variable can cause an OS (out of string space) error that's hard to protect against.

To alleviate this problem, Microsoft provided the INPUT\$ function, which gets a specified number of characters from an input device regardless of line

terminators. Even that function generates errors; for example, if three characters are requested, and if only two characters are left in the device you'll get an end-of-file error.

The writers of Businesspak+ use a machine-code routine of about 166 bytes called from Basic. This routine goes to the input device and gets the next printable line of characters up to the next carriage return or space.

One drawback of the machine-code routine is that if no space occurs within the next 160 characters, the routine only returns a single character. I discovered this when I attempted to list a Basic program with all the spaces removed. Some of the long lines in the file printed out in a column, one character at a time. I had to go back to the Basic program and insert spaces to make listing through Write+ possible.

The programs are written in Basic rather than machine code. The advantage of Basic is that the user can easily modify the code, perhaps to customize it for a different printer or add a feature. The disadvantage is that machine code can be faster and more compact. For most of the programs, such as Write+ and Put+, the execution, printing, and keyboard delays are not even perceptible.

Even if you have the maximum RAM available to the Model 100, 32K, you don't have enough room to leave all the Businesspak+ programs in RAM all the time. The instruction book suggests that you purge the programs when you are done and reload them later from tape. Personally, I find Write+ so handy that I have left it in RAM continuously since first loading it.

The advertising and the manual I initially received are silent on the required RAM. Most of the routines fit in less than 4K, leaving a little work space for an 8K user (see Table 1). No serious user should consider less than 24K, and I recommend getting a full 32K.

Businesspak+ provides a good package of routines for the Model 100 owner. They are easy to learn and use. The graphing program works only on the Radio Shack DMP-100, and the telex program involves a further expenditure of \$150 per year. But the word processing, sorting, text entry, and simple spreadsheet programs are general in their scope and utility. I recommend them. ■



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Assembly Language Made Simple—Part I

by Hardin Brothers

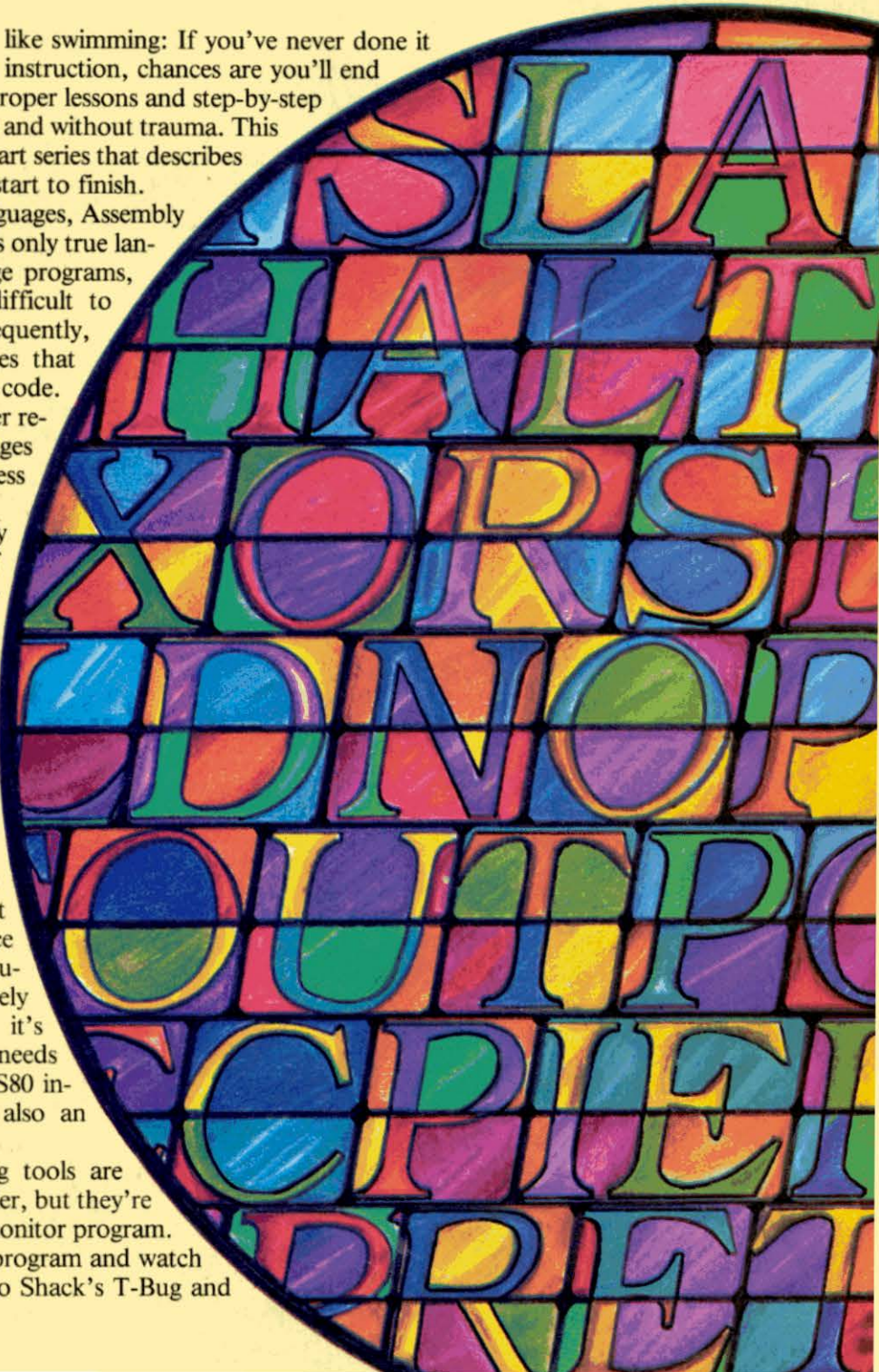
Assembly-language programming is like swimming: If you've never done it before and plunge in without any instruction, chances are you'll end up over your head. However, with the proper lessons and step-by-step guidelines, you'll learn the skill smoothly and without trauma. This article is the first in a consecutive three-part series that describes Assembly-language programming from start to finish.

Like Basic and all other computer languages, Assembly language is a variation on the computer's only true language, machine code. Machine-language programs, comprising only 1's and zeros, are difficult to write and prone to typing errors. Consequently, programmers developed other languages that use mnemonic code to replace machine code. Although easier to work with, the further removed from machine code these languages are, the slower they execute and the less powerful they are.

Assembly language provides a happy medium. It combines the advantages of simple code with the power of a language that closely resembles machine code. As a result, an Assembly-language program runs faster and provides more computational power than, say, a Basic program.

Before you begin to write in Assembly language, you need the proper tools. Most important is a program called an editor/assembler. If you don't own one, the Radio Shack Series 1 Editor/Assembler is a good choice to get you started. It's powerful for the price (\$30 to \$35), comes with excellent documentation, and while it doesn't completely satisfy an experienced programmer, it's powerful enough to satisfy all your needs until you become an expert. NEWDOS80 includes Apparat's EDTASM module, also an excellent first assembler.

Several other beginner programming tools are helpful in addition to the editor/assembler, but they're not mandatory. Most useful is a good monitor program. Monitors let you single-step through a program and watch the execution of each instruction. Radio Shack's T-Bug and



Here's your first lesson in Assembly-language programming. This article describes how the Z80 chip processes Assembly instructions.

Debug, as well as any DOS Debug, can start you off, but more powerful monitors are available.

Other useful tools are a disassembler program, Nanos Systems Corp.'s Z80 reference card, a printer for listings (invaluable for complex debugging), several reference books, and a disk system to simplify loading, saving, and assembling programs. These are all extras that make Assembly-language programming easier; at first, all you need is an editor/assembler.

The Z80

The heart of your Model I, II, III, or 4 is a Z80 microprocessor chip (or Z80A, the same thing but faster). Though this is one of the most advanced 8-bit microprocessors made, with 22 registers and a strong instruction set, it still has a very limited repertoire of capabilities.

The Z80 can get a value from memory, put a value into memory, move values around in between its internal registers, add and subtract two values, perform simple logical manipulations (AND, OR, and Exclusive-Or), report some information about the results of its operations, keep track of where to find its next instruction, and manipulate a simple data structure called a stack. It can't multiply or divide, directly print to the screen or printer, or do most of the things your computer does in Basic.

Your job as an Assembly-language programmer is to utilize the simple abilities of the Z80 chip to develop a complex program, usually complete with input from keyboard, tape, or disk and output to tape, disk, screen, or printer. To do so, learn to think in terms of the Z80's capabilities, which means you have to break each operation into specific, small steps. If you can train yourself to analyze and build programs in these small steps, you're well on your way to becoming an Assembly-language programmer.

Assembly and Machine Language

The only instructions the Z80 understands are sequences of 5-volt and zero-volt electrical impulses. Generally we refer to those impulses as 1's and zeros.

For example, the sequence of impulses represented as 11001011 00100111 makes the Z80 copy a specific single bit from one place inside itself to another. Because se-

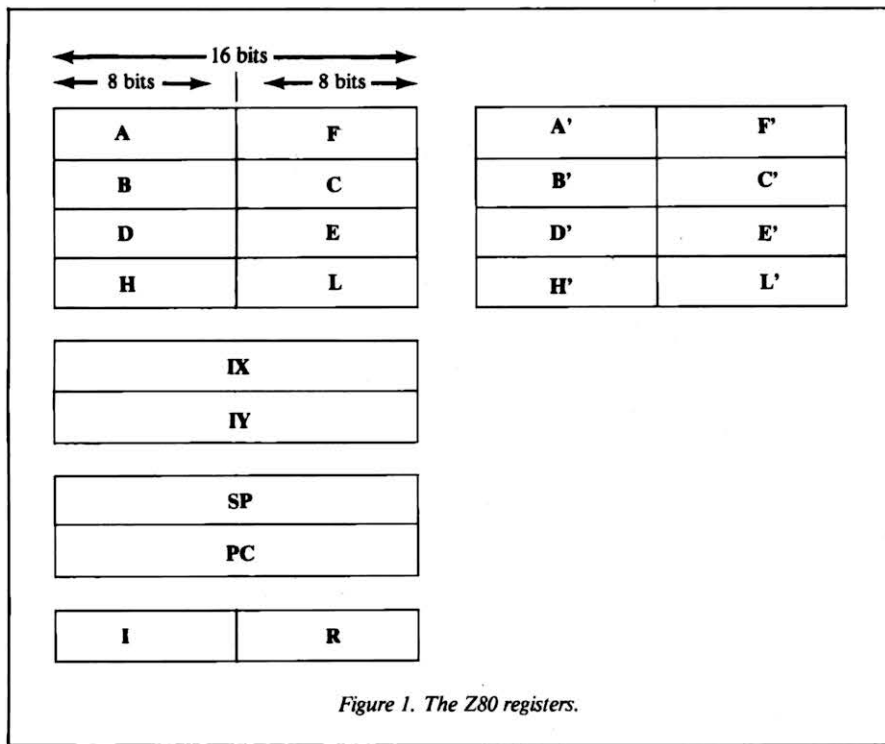
quences of 1's and zeros look like a binary number, programmers often think of them as such, and translate them into hexadecimal or, rarely, decimal numbers. The above instruction would thus appear as CBH 47H in hexadecimal notation, 203 071 in decimal. When you write programs by loading such values directly into memory, either with POKEs or by using a monitor program, you program in the Z80 native tongue, machine language.

However, the Z80 recognizes almost 700 such instructions. Except in unusual circumstances, it's a waste of time for a programmer to look up each instruction in a table and enter its special sequence directly into memory. That's why the first computer language ever developed was "Assembler." Using an assembler, you can write instructions using mnemonic (memory aids), 2- to 4-letter abbreviations of program instructions. You can write the binary instruction above as BIT 0,A which, while still far removed from English, is much easier to remember and understand.

The assembler changes the mnemonic into the appropriate bit sequence by looking it up in a table. The list of mnemonic instructions, which you write, is called a source code; the list of machine instructions, which the assembler writes from the source code, is the object code. The Z80 chip cannot act directly on source code instructions, so the translation into bit sequences is necessary before you can run your program.

Unlike Basic, assemblers are not interactive. You must write the source code, assemble it into machine language (which you save on either tape or disk), then load the object code back into the computer to run it. If a bug occurs in the program (and one almost always does), you must then reload the assembler program, reload your source code, correct the source code, save your source code back to tape or disk, assemble the program again on tape or disk, load the new object code back into memory, and run it again.

Virtually all assemblers come with an editor, a separate but related program that helps you write and correct source code. The editor is a simple, line-oriented text processor that includes the ability to number lines of source code and to find lines by reference to their numbers.



Whenever you use an editor/assembler package to write a program, you must go through a four-step process:

- Use the editor to write the source code.
- Save the source code to tape or disk.
- Assemble the source code into object code and save the object code to tape or disk.
- Leave the editor/assembler program, return to either Level II Basic or DOS, load in the object code form of the program, and run it.

The finished program probably loads as a SYSTEM program, if it's on tape, or as a /CMD program if it's on disk.

Memory and Registers

Your computer provides several different types of memory. Basic resides in ROM, the keyboard and screen each have specially dedicated random-access memory (RAM), and programs and data use between 16K and 48K (on the Models I and III) of general-purpose RAM. Each byte of memory has a unique address which the Z80 uses to find stored values and to place values in the correct locations.

Like program instructions, memory addresses are nothing but unique sequences of electronic impulses, but it is easier to think of them in terms of hexadecimal or decimal numbers. You can remember memory addresses more easily in hexadecimal once you become familiar with that numbering system.

In Models I and III, ROM occupies addresses from 0000 hexadecimal (hex)

to 37FF hex, the keyboard from 3800 hex to 3BFF hex, the video screen from 3C00 hex to 3FFF hex, and general memory from 4000 hex to 7FFF hex, BFFF hex, or FFFF hex depending on the amount of RAM in your system. All of the programs I include with this article run with any size RAM (except 4K) for a Model I, III, or 4 (in the Model III mode).

You may notice that memory holds both program instructions and data, and wonder how the Z80 distinguishes the two. It doesn't. As far as the Z80 is concerned, no difference exists between the two; you and your program decide which parts of memory hold instructions and which hold data. However, if you make a mistake and allow the Z80 to operate on data as if it were instructions, you face the infamous "silent death"—either a locked up computer

or a spontaneous reboot.

The Z80 contains 208 bits of memory organized into registers (see Fig. 1). Each register is either 8 or 16 bits wide—that is, each holds either 8 or 16 bits of information. As a programmer, you manipulate the values held in these registers, and copy information from the registers to RAM and vice versa.

The A register, which holds 8 bits, is the accumulator. It's a general pipeline for moving data into and out of the Z80 chip, and also aids in almost all of the arithmetic and logical operations the Z80 performs.

The individual bits of a second register, called the F or flag register, holds information about the results of various internal operations. The Z80 uses these flags to perform conditional branches (similar to the Basic If...Then command).

B, C, D, E, H, and L are all general-purpose 8-bit registers that hold temporary data and operands for arithmetic and logical operations. You can also use these registers in pairs: BC, DE, and HL. Each pair holds 16 bits and can hold data addresses in memory, or large values used in some arithmetic functions.

The HL register pair also has a special function. Whenever the Z80 performs 16-bit arithmetic operations, the HL register pair becomes an accumulator and holds the results of the calculations. Using any register pair as two 8-bit or one 16-bit register is entirely up to you, and you can change their function at any time.

Two 16-bit index registers exist, IX and IY. They almost always hold addresses of data tables in memory, and make accessing that much easier.

SP, the stack pointer, is a special-purpose register that holds the address of (points to) a data table called the stack. Stack operations let the Z80 return to the appropriate location after

The Key Box
Model I and III
16K RAM
Assembly Language
Editor/Assembler

```

00100 ;*****
00110 ;*
00120 *   The First Program  --  *
00130 ;*
00140 *   Print "HI" in the upper- *
00150 *   left corner of the screen *
00160 ;*
00170 ;*****
00180 ;
00190          ORG      7000H          ;Define beg. of prog.
00200 ;
00210 START  LD      A,48H          ;48H is ASCII value of H
00220          LD      (3C00H),A      ; and put it on screen
00230          LD      A,49H          ;49H is ASCII value of I
00240          LD      (3C01H),A      ; and put it on screen
00250 LOOP   JP      LOOP          ;Loop forever
00260 ;
00270          END      START
00280 ;

```

Program Listing 1. Assembly-Language Lesson 1.

Shape your TRS-80 to communicate with any computer you want.



Omniterm is the most flexible, powerful terminal program you can buy. Omniterm lets you adapt your TRS-80 to communicate with 99.9% of the world's computers. Your company's mainframe, for example. Or any other personal computer, time-sharing computer, or communications service.

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it completes a subroutine, simplify saving data from registers temporarily, and allow transfer of 16 bits of information from one register pair to another.

The program counter, register PC, always holds the address of the next program instruction. The Z80 uses the PC register to keep its place in the program while it carries out an instruction.

A', F', B', C', D', E', H', and L' (the prime set) are a second set of general-purpose registers. If you give the correct instructions to the Z80, it saves the regular general registers (A to L) and the prime set becomes active. A later exchange instruction switches the first set of registers back into active service. It's up to the program (and programmer) to keep track of which set is in use at any given time—the Z80 considers the inactive set the prime set.

Finally, there are two 8-bit registers, I and R, that programmers rarely use. The R register holds the address of the next bank of memory that needs refreshing (a kind of electronic tickling to stay awake). The Z80 handles the memory refresh chores automatically. The I register is useful for some interrupt processing, but the Models I and III don't include the hardware necessary to use it.

A First Program

The best way to understand Assembly-language programming is to start programming. Because every editor/ assembler package includes its own unique editor instructions, I will not give explicit instructions on using the editor portion of your editor/assembler. Load the program and run it, then use the documentation to experiment with the editor until you are comfortable with its commands. You probably use a command like I to start entering text on numbered lines, a Break to return to the function prompt, a P to list what you have written, and so on.

Your first Basic program was probably something like

```
10 PRINT "HI"
```

so I'll start you with a similar Assembly-language program (see Program Listing 1). Even though this is a simple, short program, there is much to learn from it. The first nine lines, 100-180, are all remarks and the assembler ignores them. In most assembler formats, a semicolon precedes all remarks.

It is wise to liberally include remark statements in your source code programs—the remarks don't take up memory space in your completed machine-language program and they help

you understand program logic several weeks later.

After the remark lines, everything in the program falls into four neat columns. The first column, or field, contains a five-digit line number as supplied by the editor. As I explained earlier, these numbers are used only by the editor and ignored by the assembler. They help you find the correct line to edit and the right place to insert new lines. Just as in Basic, it is normal in Assembly language to increment lines by 10 so you can insert lines later. Also, your editor probably includes a simple renumbering facility.

The second column contains labels,

each of which can contain one to six alphanumeric characters. Labels can represent either values (as I show in the next program) or the addresses. The labels in this program, Start and Loop, represent the addresses of the instructions that follow them.

The third column contains either the mnemonics for the machine-code instructions or pseudo-ops—direct instructions to the assembler program that don't get translated into machine instructions. Simple assemblers provide only a handful of pseudo-ops that are easy to understand and use.

The fourth column contains the operands for each instruction. Each mne-

Making Sense of Those Crazy Numbers

by Amee Eisenberg
80 Micro Technical Editor

The Decimal System

For those of us with 10 fingers, a decimal number system (based on units of 10) has always made intrinsic sense. You start at your thumb and keep counting until you run out of fingers. Then you make a mark to signify one group of 10 and start at your thumb again. Things are counted in groups of 10s plus any leftover 1's.

We write numbers using a place value system, placing units, or 1's, furthest to the right in a number. The next place holds the 10s, and the next the 10 times 10s, or 100s. Reading from right to left, the value of the place increases by a multiple of the base. Thus, 1, 10, and 100 signify one unit, 10 units, and 10 times 10, or 100, units respectively. You can represent this as follows:

```
Y Y Y (* 1)
      (* 10)
      (* 100)
```

The Binary System

Your computer is based on a binary numbering system; that is, it uses a two-unit counting system. It counts with electrical impulses that are either off or on, which we represent numerically as 0 and 1. It also uses a place value system to keep

track of larger numbers.

In a binary, or base 2, numbering system, the places hold multiples of 2. So the first place represents units, the next 2's, the next 4's. Thus, 1, 10, and 100 signify 1 unit, 2 units, and 2 times 2, or 4, units respectively. This is represented as:

```
Y Y Y (* 1)
      (* 2)
      (* 4)
```

Binary becomes ungainly for humans as the numbers get larger. For instance, the number 136 decimal is written 10001000 in binary. That is, there are no 1's, no 2's, no 4's, one 8, no 16s, no 32s, no 64s, and one 128. Adding the one 8 and the one 128 results in the decimal equivalent, 136, as below:

```
1 0 0 0 1 0 0 0 0 0 (0 * 1)
                    0 (0 * 2)
                    0 (0 * 4)
                    8 (1 * 8)
                    0 (0 * 16)
                    0 (0 * 32)
                    0 (0 * 64)
                    128 (1 * 128)
                    -----
                    136 decimal
```

Since humans count in decimal and computers in binary, a compromise counting system is necessary to make conversations between humans and computers a little simpler.

monic requires that zero, one, or two operands follow it. In most cases, the number of operands is obvious—you can't ask the Z80 to load (LD) a value unless it knows where the value is coming from and where it is going. So, two operands always follow the Load command.

Finally, Assembly code reserves the last column of each line for remarks. You can quickly learn to write cogent remarks that fit on the same screen line as the rest of the instructions and produce clean, easy-to-read source code.

Refer back to Listing 1. Lines 100-180 are remarks ignored by the assembler. Line 190 starts with the

pseudo-op ORG, which defines the starting address of the program so the assembler can calculate addresses of each of the instructions.

Notice that the program's address, 7000H, is a hexadecimal number followed by the letter H. The same address, in decimal, is 28672. Unless a suffix of H or B follows a number, the assembler assumes that number is in decimal format. However, the assembler accepts a suffix of D to indicate a decimal number. Get into the habit of adding a base suffix to the end of every number you use in a source code, regardless of its base; it makes debugging much easier.

Enter the base 16, or hexadecimal, numbering system.

The Hexadecimal System

Hexadecimal (usually abbreviated hex), is just like decimal if you have 16 fingers. To count in hex, you say 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F. A is equivalent to 10 decimal, B to 11 decimal, C to 12, D to 13, E to 14, and F to 15. Ten hex is equal to 16 decimal because, just like decimal and binary, hex uses a place value system to represent numbers. Ten hex means that there are no units and one 16:

Y Y (*1)
 (*16)

When you write a hexadecimal number, we append the uppercase letter H to it to avoid confusing it with binary or decimal. Additionally, we write the numbers A through F as 0AH, 0BH, 0CH, etc., the zero eliminating confusing the numeral with a letter.

To understand why hex is convenient for the computer, you need to think about how the computer stores information. The Z80 microprocessor uses 8-bit logic. A bit is an electronic signal that's either on or off (binary, remember?).

A group of 8 bits of information clustered together is called a byte. A single hex numeral can represent half-bytes, or nibbles, consisting of 4 bits because the greatest value a four-digit binary number represents is 16 decimal. Remember, 1000 in binary is 10 in hex and 16 in decimal. So two hexadecimal digits can represent any 8-bit value (a byte).

It's easy to convert a binary byte to a hexadecimal byte. Take the number 10001000 binary again. The first step is to break the byte into its component nibbles, 1000 and 1000. Then convert each nibble to hex:

1 0 0 0	0 (0*1)	1 0 0 0	0 (0*1)
	0 (0*2)		0 (0*2)
	0 (0*4)		0 (0*4)
	8 (1*8)		8 (1*8)
	—		—
	8H		8H=88H

Therefore, 10001000 binary is 88 hex. Check this by converting both binary and hex values back to decimal. Earlier I said that 10001000 binary is 136 decimal. 88H means 8 units plus 8 sixteens (or 128) which equals 136 decimal.

Try another binary-to-hex conversion, this time with 10011110. Break it into two nibbles: 1001 and 1110. Convert each nibble:

1 0 0 1	1 (1*1)	1 1 1 0	0 (0*1)
	0 (0*2)		2 (1*2)
	0 (0*4)		4 (1*4)
	8 (1*8)		8 (1*8)
	—		—
	9		E (14 decimal)
			= 9EH

So, 10011110 is 9E hex. If you check this by converting to decimal you find 10011110 equals (128 + 16 + 8 + 4 + 2) or 158, and 9EH equals (9 × 16 + 14), also 158.

Working with binary and hex becomes easier as you do more of it. And learning these other number bases is necessary if you want to speak in your computer's native tongue. ■

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```

00100 ;*****
00110 ;*
00120 ;*   The Second Program --   *
00130 ;*
00140 ;*   Fill the screen with 'HI' *
00150 ;*
00160 ;*****
00170 ;
00180 VIDEO EQU 3C00H ;3C00H = top of screen
00190 ;
00200 ORG 7000H
00210 ;
00220 START LD HL,VIDEO ;HL=> Top of screen
00230 LD BC,400H ;BC=length of screen
00240 LOOP1 LD A,'H' ;Get first character
00250 LD (HL),A ;Put it on screen
00260 INC HL ;HL=> next screen pos'n
00270 DEC BC ;BC=number of pos'ns left
00280 LD A,'I' ;Get next character
00290 LD (HL),A ;Put it on screen
00300 INC HL ;HL=> next pos'n
00310 DEC BC ;one less pos'n left
00320 LD A,B ;Get MSB of count
00330 OR C ;Merge with LSB of count
00340 JP NZ,LOOP1 ;Loop er of pos'ns left
00350 LOOP2 JP LOOP2 ;Then loop forever
00360 ;
00370 END START
00380 ;

```

Program Listing 2. Assembly-Language Lesson 2.

Line 210 is the first line of actual instruction. It has the label Start, which the assembler sets equal to the address of the instruction (7000 hex). This instruction tells the computer to load (LD) the A register with 48 hex, the ASCII value of the character H.

Line 220 instructs the Z80 to take the current value in the A register, and place it in memory at address 3C00 hex. Remember that the screen memory occupies addresses from 3C00 hex to 3FFF hex. Therefore, this instruction causes the Z80 to place the value 48 hex in the first location of screen memory. The computer's screen electronics then print an H in the upper left-hand corner of the screen.

Four things in line 220 require special attention. First, notice the parentheses placed around the screen address. They are necessary to indicate to the assembler that 3C00 hex is an address, not a value you want manipulated. The instruction is best read as "Load the contents of register A into the memory location represented by the value 3C00 hex."

Second, notice that getting the H to the screen requires two instructions. The first instruction reads the H from memory and the second stores it to a different place in memory. In general, the Z80 cannot simply move data from one memory location to another. It only moves data to or from the registers in the chip. (Some instructions avoid this restriction, however.)

Third, it is important to realize that this instruction doesn't change the contents of register A. It copies the contents to location 3C00 hex, but A is not empty. An LD instruction never changes the

value that it moves; it only transfers that value to a new place.

Fourth, notice the order of the two operands of each LD instruction. The first operand receives the value transferred from the second. If you read line 220 as "Load 3C00H from A" you can remember the correct order of operands.

Lines 230 and 240 are now clear. They load the A register with the ASCII value of I and place that value at the next screen location. When the computer executes the instruction in line 240, it prints HI in the top corner of the screen.

Line 250 introduces a new instruction, the Jump (JP) instruction. It tells the Z80 to take its next instruction from a new place in memory (like Basic's GOTO). Notice that the line gives the symbol LOOP, and the instruction says "Jump to LOOP." This instruction produces a tight, endless loop similar to the Basic instruction "50 GOTO 50." The computer seems to lock up and there's no way to regain control except by pushing the reset button. This instruction is necessary to stop the Z80 from wandering off and trying to execute whatever it finds scattered through memory. Every program must come to some specific end, either with a loop or a return to Basic or DOS.

The last line of Listing 1 uses the pseudo-op END for two purposes. First, the assembler needs to know the end point of the program. Every source code must have END in its last line. Second, if the address of the beginning of the program follows END, the assembler includes that information on disk or tape so the program runs automatically. Start is the label for the be-

ginning of this short program and, because it already equals 7000 hex, it tells the assembler that the program starts at that address.

Before you read further, try to enter and assemble the program in Listing 1. Use the Insert command to get automatic line numbering, and copy the program exactly (you may leave out the remarks if you wish), using the right-arrow key to tab between columns on the screen. Then return to the prompt.

When you're ready to assemble the program, first try a test assembly by assembling the program with no output. The command you give to the assembler is probably A ,NO, or A/NO which asks it to assemble without output. If you enter the program correctly, the assembler displays 00000 Errors. That is the assembler's method of saying that each line has correct syntax; obviously, the assembler doesn't know whether your program does what you want it to.

Save the source code to either tape or disk. (If you make a logic error in your program, you want to correct the source code, not write it all over.) Assemble the program to tape or disk. In both cases, give the program a name—on tape the names can be anything you wish; on disk, write the source code with a /SRC or /ASM extension and the program with a /CMD extension to make it run directly. Finally, use SYSTEM or DOS to load and run your program. "HI" should appear in the upper left corner of the screen. Your computer is in an endless loop, so press the Reset button to regain control.

If all goes well, reload the editor/assembler and the source code and try to modify it—perhaps have the program print your name on the screen. Experiment with different messages and different screen locations—it is the only way to learn Assembly language.

Modifying a Program

I know Listing 1 isn't an exciting program, but your first Basic program probably wasn't much fun either. Here I add a few bells and whistles, as well as some new concepts.

Program Listing 2 fills the entire screen with the letters HI. It also introduces several new programming techniques, the first of which is in line 180. The EQU pseudo-op sets the label Video equal to the value 3C00 hex; instead of having to remember a value each time you use it in a program, you can give it an easy-to-remember label.

Line 200 looks familiar. Line 220 tells the computer to load the value of Video into the HL register pair. In this pro-

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gram, HL points to, or holds, the address of the current video position in order to simplify the program.

Line 230 loads the BC register pair with the value 400 hex (which equals 1,024). This program uses BC as a byte counter; 400 hex equals the length of the screen, and when BC is zero, the screen is full. Using a byte counter is similar to using a For...Next loop in Basic.

Line 240 loads the A register with the ASCII value for H. By placing the H inside a set of single quotation marks, you tell the assembler to translate the letter into its ASCII equivalent—you don't have to look it up in a table. Line 250 loads the value in the A register into the memory location to which HL points. Notice that parentheses enclose the HL

*"The screen
should fill with
the word HI."*

just like the addresses in the last program, which tells the Z80 to treat the current HL value as a memory address.

Line 260 increments (increases by 1) HL so it points at the next memory location and line 270 decrements (decreases by 1) BC so it holds the number of screen positions remaining. Lines 280-310 repeat the whole process for the letter I.

Lines 320 and 330 test the value in BC to see if it is zero yet, which means the screen is full. First, the program copies the value in the B register into the A register. Then it ORs the value in C with the current value in A. If both B and C are zero, the result of the OR is zero, and the program sets the zero flag in the F register. Otherwise, the result is some other value and the F register flag indicates Not Zero.

Line 340 uses the results of the OR to decide whether or not to repeat loop 1. It tells the Z80 to jump only if the F register shows Not Zero. If the flag indicates a zero result of the OR in the previous instruction, the program ignores the Jump command. The jump continues until the BC register pair decrements to zero. Then line 350 performs an endless-loop jump.

Notice that the instructions from lines 240-340 do not depend on any particular values in HL or BC. Whatever its current value, HL points to the current address on the screen. The program in-

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```

00100 ;*****
00110 ;*
00120 ;*   The Third Program --   *
00130 ;*
00140 ;*   Fill the screen with a  *
00150 ;*   simple message         *
00160 ;*
00170 ;*****
00180 ;
00190 ;
00200 VIDEO EQU 3C00H ;Address of screen top
00210 ;
00220 ORG 7000H ;Beginning of program
00230 ;
00240 ;First, clear the screen
00250 ;
00260 CLEAR LD HL,VIDEO ;HL=> screen top
00270 LD BC,400H ;BC = Length of screen
00280 CL10 LD (HL),' ' ;ASCII Space to screen
00290 INC HL ;HL=> next screen pos'n
00300 DEC BC ;Decrease count
00310 LD A,B ;Get MSB of Count
00320 OR C ;Merge LSB of count
00330 JP NZ,CL10 ;Loop back until BC=0
00340 ;
00350 ;Now that screen is clear, display message
00360 ;
00370 PRINT LD HL,VIDEO ;HL=> screen top
00380 LD DE,MESSAG ;DE=> beg. of message
00390 PR10 LD A,(DE) ;Get next character
00400 LD (HL),A ;And put it on screen
00410 CALL INCMMSG ;Increment & check DE
00420 CALL INCVID ;Increment & check HL
00430 JP NZ,PR10 ;Loop until screen's full
00440 ;
00450 ;The screen is full, look for a keystroke then start over
00460 ;
00470 KEY LD A,(3BFFH) ;Check the keyboard
00480 OR A ;Set the flags
00490 JP Z,KEY ;Loop until key is down
00500 ;
00510 ;Key is pressed -- wait until it is released
00520 ;
00530 NOKEY LD A,(3BFFH) ;Check the keyboard
00540 OR A ;Set the flags
00550 JP NZ,NOKEY ;Wait until key is up
00560 JP CLEAR ;Then start again
00570 ;
00580 ;Now come the subroutines
00590 ;
00600 ;Increment the message pointer until it points to
00610 ; the end of the message and then reset it to the
00620 ; beginning.
00630 ;
00640 INCMMSG INC DE ;DE=> Next pos'n of msg.
00650 LD A,(DE) ;Get the character
00660 CP 0 ;Is it a 0 ?
00670 RET NZ ;Return if not
00680 LD DE,MESSAG ;Else DE=> beg. of msg.
00690 RET ;And then return
00700 ;
00710 ;Increment the video pointer until it is off the screen
00720 ;
00730 INCVID INC HL ;HL=> Next pos'n of vid.
00740 LD A,B ;Get MSB of pointer
00750 CP 40H ;If B=40H, off the screen
00760 RET ;Return for test
00770 ;
00780 ;Now type in the message
00790 ; (You may use any message you wish)
00800 ;
00810 MESSAG DEFB 'How is this for fast? '
00820 DEFB 0 ;Mark end of message
00830 ;
00840 ;That's all, so end the program
00850 ;
00860 END CLEAR ;Include starting address
00870 ;

```

Program Listing 3. Assembly-Language Lesson 3.

crements it after each character prints. BC's current value decrements after the program prints each character. The program continues until BC indicates a full screen. The entire routine depends on the Z80's ability to make a conditional jump in line 340, based on the current status of the zero flag.

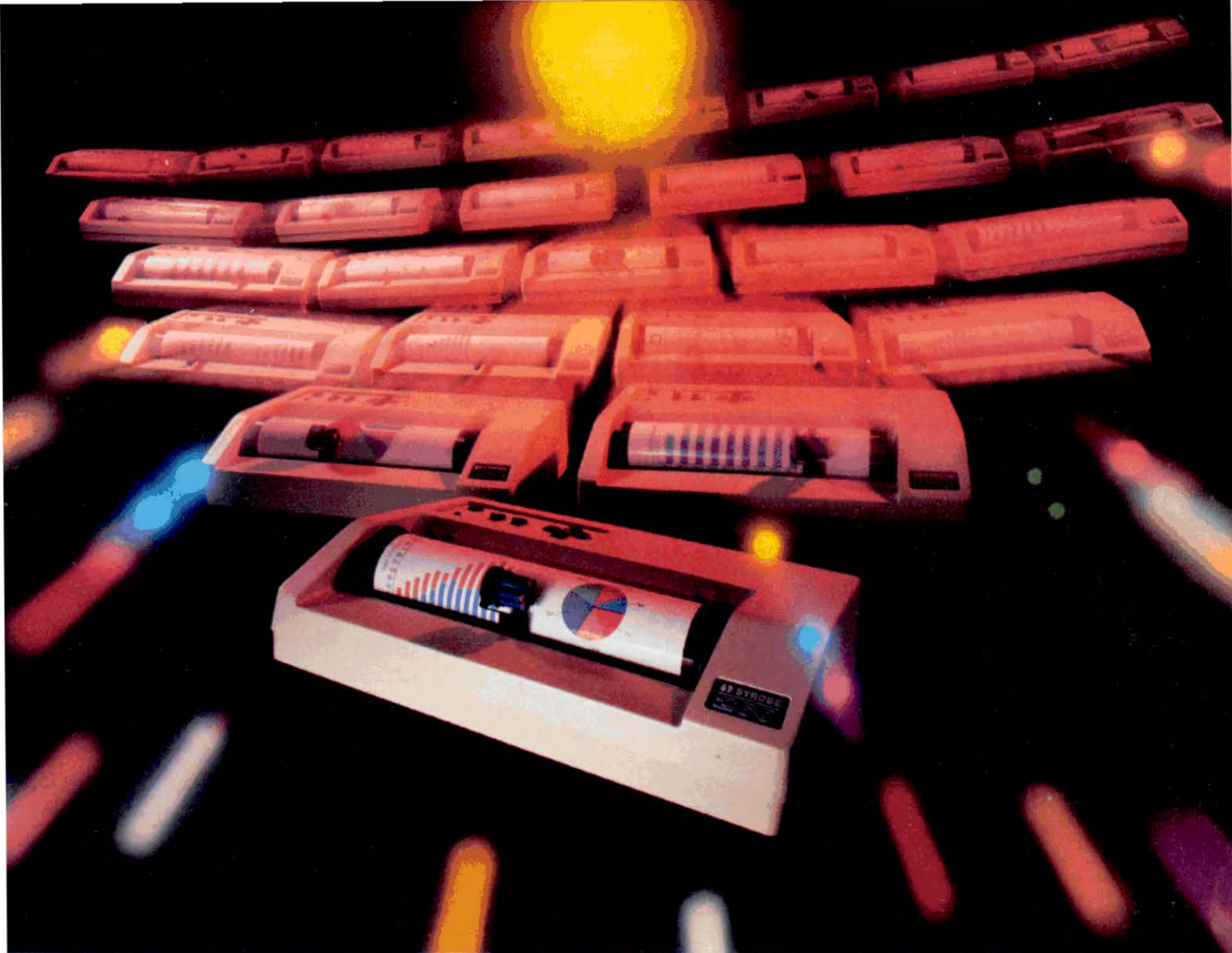
Enter, assemble, and run Program Listing 2. Again, you must use the reset button to exit from the program because of the endless loop in line 350. The screen should fill with the word HI. See if you can modify this program be-

ing careful that you don't let the program print off the end of the screen.

More Bells and Whistles

This next program lets you fill the screen with any message you wish. It also allows you to hit any key to clear the screen and print the message again.

Lines 190-270 in Program Listing 3 need no explanation. Notice that the instruction in line 280 loads a character (here, an ASCII space) directly into the memory location to which HL points. This instruction avoids first loading the



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character into the A register and then back into a new location in memory.

Lines 290-330 are similar to the last program. They increment HL, decrement BC, and test to see if BC equals zero. The entire block of code from lines 260-330 clears the screen by filling it with spaces.

The second block of the program, lines 370-430, prints a message repeatedly until it fills the screen. HL again points to the screen location. Now, however, DE points to the message in line 810. These lines load 1 byte of the

*“Keep experimenting
and you will
soon find that
Assembly language is
as easy as any
other computer language.”*

message into the A register in line 390, then put that character into screen memory in line 400.

Lines 410 and 420 introduce a new mnemonic, Call. This instruction is similar to Basic's GOSUB command in that it runs a subroutine. The Z80 saves the address of the next instruction before it runs a subroutine in order to know where to return when it completes the subroutine. Then it jumps to the subroutine and performs those instructions.

The label INCMMSG, which stands for “Increment Message Pointer,” defines the first subroutine. The subroutine starts at line 640. This line increments DE, which points to the message. Once incremented, line 650 loads the new character to which it points into A. The command CP zero in line 660 means “Compare the value in A with zero. If the two values are identical, set the flag to Z to indicate a true compare; otherwise set the flag to NZ.”

The RET command in line 670 means “Return from this subroutine.” Because NZ follows it, it is a conditional return—the computer executes the return only if the flag in the F register indicates Not Zero. Otherwise, in line 680, the program points DE to the beginning of the message again, and then an unconditional return in line 690 sends the Z80 back to the instruction in line 420. The entire subroutine INCMMSG depends on a zero byte at the end

Continued on p. 86

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Beginner's Guide to Assembly-Language Terminology

Simple Glossary

This short glossary should help you learn the most common Assembly-language terms. It's arranged in logical, rather than alphabetical, order.

bit (binary digit)—Though sometimes defined in terms of electronic signals, for present purposes a bit is the smallest amount of information on which the computer acts. It is a single 1 or zero digit and the building block for all computer notation.

byte—A sequence of 8 bits. A byte is generally thought of in terms of its total value. With 8 bits you can express any value between 0000000B and 11111111B. In normal decimal notation that's any value between 0 and 255; in hexadecimal it's any value from 00 hex to 0FF hex.

word—In computer jargon, a word comprises 2 consecutive bytes, or 16 bits, and the computer handles it as a single value. The value of a word can vary from 0 to 65535 (decimal), from 0000 hex to FFFF hex, from 00000000 00000000B to 11111111 11111111B in binary.

address—A one-word (2-byte) value that denotes any byte of memory. Every byte of memory has a unique address, allowing you to find it easily, and find and manipulate its value.

LSB and MSB (least significant byte and most significant byte)—Since every word and every address is composed of 2 bytes, it is useful to have a name for each. The most significant byte is the high-order byte—the one that normally comes first. The other is the least significant byte. For example, in the hexadecimal word 3C42 hex, 3C hex is the most significant byte and 42 hex is the least significant byte. Because of the way the internal Z80 circuitry works, it usually stores 2-byte values in memory backwards, with the LSB before the MSB.

ASCII code—Every possible video character, all video control characters, all graphics characters, and all special (Model III) characters have a unique 1-byte code that the video circuitry uses. The codes for letters and numbers are standard between various computers, but graphics and special characters are not. The ASCII code for the character 1 is 49 or 31 hex or 00110001B (rather than the seemingly obvious value of 1, a complicating fact of life for machine-language programmers).

register and register pair—Registers are special memory inside the Z80 chip. Each is either 1 or 2 bytes in length (8 or 16 bits). A register pair is two 8-bit registers that can work together as a single 16-bit register. There are 22 registers inside the Z80 that your programs can manipulate directly.

ROM (read-only memory)—ROM is unalterable, unchangeable memory inside the computer that holds the resident Level I or Level II Basic inside the Models I and III. This memory doesn't change even when you shut off the computer's power, so your computer never "forgets" its knowledge of Basic.

RAM (random-access memory)—Sometimes called read-and-write memory, or program memory, this memory is changeable. The computer uses it to store both programs and data. Unfortunately, it loses all of the information stored in it if the power to your computer is turned off. Unless you did some unusual home-brew modifications, your computer has 4K, 16K, 32K, or 48K bytes of RAM. (K stands for 1000, but in computer usage usually means 1024. 16K, therefore, means 16384 bytes of RAM.)

Status Flags

The F, or flag, register contains 4 commonly used status bits, each of which can direct conditional jumps, calls, and returns.

Z and NZ—The zero flag is the most common. This bit indicates whether the result of a previous operation was zero or some other value. For example, if the result of a subtract or compare operation is zero, the flag shows zero. In source code, the condition Z means zero and NZ means not zero. The zero

Continued on p. 86

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of the message to mark its conclusion.

Line 420 sends the Z80 out to another subroutine, INCVID (Increment the Video Pointer), and passes control to the instructions starting in line 730. First line 730 increments HL. Remember that the video memory is in address from 3C00 hex to 3FFF hex. If HL equals any value in that range, it points at the screen and everything is okay. But when HL equals 4000 hex, it points to the first memory address past the screen. Then H holds the value 40 hex and L holds the value 00 hex.

Line 740 loads the new value in the HL register into the A register for testing. Line 750 compares that value to 40 hex in order to set the F register flags. You might expect the next instruction to be a conditional jump or return, but it isn't. Instead, the subroutine ends with an unconditional return (RET) command. However, the return command doesn't affect the F register, and so the flags remain the same when the Z80 returns to the instruction in line 430, which does contain a conditional instruction. Very often in Assembly language, programs set the condition flags with one instruction but don't use them until several instructions later. Be sure that the instruc-

tions between don't change any of the flags.

Line 430 repeats the print block until the screen fills. Then the program continues with the KEY block starting with line 470. Here, the value in memory location 3BFF hex loads into the A register, which is part of the keyboard memory. This location holds a zero if you're not pressing any key; if it holds any other value, you're holding down at least one key.

Unfortunately, loading a value into the A register doesn't set the condition flags. Therefore, line 480 ORs register A with itself. The value in A doesn't change, but the flags are set to indicate whether its current value is zero. If it is, the conditional jump in line 490 sends the Z80 back to KEY to wait for you to press a key.

After you do so, the program enters the final block of the program, NOKEY. Another loop waits for you to release the key. Then, and only then, the program loops back to the Clear routine at the beginning, clears the screen, and starts all over.

Lines 810 and 820 demonstrate two new pseudo-ops. In line 810, DEFM means "Store the text between the

single quotation marks in memory here." It loads whatever you type in into memory and sets the label MESSAG equal to the address of the first character.

Finally, in line 820, DEFB means "store 1 byte of this value into memory." This instruction stores a byte

Continued from p. 85

flag generally checks the results of arithmetic and logical operations, and tests whether a single register decrement (DEC) results in zero.

C and NC—The carry flag indicates whether a carry or borrow occurred that gives an arithmetically inaccurate answer. For example, if a program adds two 8-bit numbers and produces a 9-bit result, the carry flag holds the 9th bit. Also, rotate and shift instructions use the carry flag extensively.

P and M—The normal arithmetic convention for working with signed numbers uses the highest-order bit to indicate the sign. Therefore 1 indicates a negative number and zero indicates a positive number. The sign flag shows whether the result of a signed arithmetic operation is plus (P) or minus (M). This flag is also of use with compare operations.

PE and PO—The last testable flag has two functions. As a parity flag, it indicates whether a byte has an even or odd number of bits equal to 1. PE then means even parity and PO means odd parity. The same set of flags can also indicate whether there is an overflow from an 8-bit or 16-bit addition or subtraction, in which case PO means no overflow and PE indicates that an overflow has occurred.

N and H—There are two final flags in the Z80, N and H, which you cannot test directly by a program. The computer uses them in a special type of arithmetic called "binary-coded decimal" and generally accesses them by the special DAA instruction.

Logical Operations

The Z80 performs three kinds of logical operations: OR, AND, and XOR. Each has specific uses in Assembly-language programs.

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of zero into memory to mark the end of the message. This is the zero byte that the subroutine INCMMSG tests for. Never assume that any memory location holds some specific value. If your program looks for a byte of zero at the end of a message, you must put that byte there.

ample, when the Z80 uses OR to combine two values, first it ORs their highest bits, then their next highest bits, and so on. Logical operations have no concern with the total values of the operands; bit patterns are the only concern.

AND—When the Z80 ANDs, the result bit is a 1 only if both of the operand bits are 1's.

```

10010011
AND 10100110
10000010

```

Use AND to mask out unwanted bits. For example, if you want to isolate just the 4 lowest bits of an 8-bit byte, you can AND that byte with 00001111. The result copies the 4 lowest bits of the original byte into the result and sets the 4 highest bits to zero.

OR—The result bit of 2 ORed bits is a 1 if either or both of the operand bits are 1's.

```

10010011
OR 10100110
10110111

```

OR merges two values together and forms bit records in which each bit in a byte has an individual meaning.

XOR (Exclusive OR)—The result bit of 2 XORed bits is a 1 if either, but not both, of the operand bits is a 1.

```

10010011
XOR 10100110
00110101

```

Programs use XOR less often than OR and AND. Its major use is in clearing the A register and flags with the command XOR A.

An interesting fact about the XOR operation is that it is cyclic. For example, if you XOR A and B, and then XOR the result by B again, the second result is the original A value. ■

Be sure to try a test assembly of Listing 3 before you save the source code and assemble the program. With a program of this length, you can easily make a typing mistake that you must correct before the program runs correctly.

Once you get this program running, it demonstrates the speed of machine language. When you press and release a key, you see a very brief blink on the screen. In that time, it prints a space in every screen location and prints the message again until the screen is full. Even though it must print 2,028 characters, it all happens in a flicker of the screen.

Learning More

No one can learn any computer language from one article. So far you can use only a few mnemonics and a few of the many types of program logic. You are on your way, but still have much to learn.

You can do many things to develop your Assembly-language programming skills. First, read Assembly-language programs in magazines carefully and try to follow the logic of each. Most magazine programs have a lot of remarks to help you understand what they do.

Second, read through the list of Z80 mnemonics (there is an excellent list with complete explanations in the Series 1 manual) and try to imagine how you can use each variation of each instruction. Also, you might read one of the books available on beginning Assembly-language programming. William Barden's *TRS-80 Assembly-Language Programming*, available from Radio Shack, is one of the easiest to read.

Third, if you have some short machine-language programs available in your library, try to disassemble one and understand what it does without the benefit of remarks. Don't try to disassemble something as long as Scripsit or VisiCalc; such complexity will completely overwhelm you.

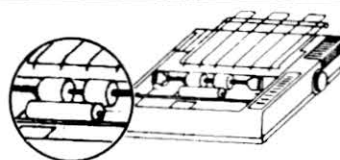
Most important, write your own Assembly-language programs. The more you write, the easier it becomes. Keep trying, keep writing, keep experimenting and you will soon find that Assembly language is as easy as any other computer language. ■

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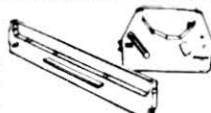
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Assembly-Language Disk I/O

by David G. Haan

With a knowledge of Assembly-language disk input/output, you can make your programs run more efficiently and solve most I/O problems.

Assembly-language disk input/output (I/O) is a complicated and advanced technique, but understanding it allows you more creativity in programming and more knowledge in troubleshooting and repairing disk I/O problems.

This article deals with the use of the Model III TRSDOS disk I/O and explains the subroutines used in reading and writing disk files. Included is a demonstration program, TESTFILE/TST, that chains these ROM routines and shows how they manipulate disk files.

Within the text, I explain how to use

each of the routines and what you can expect on entry and exit. I also point out some errors in Radio Shack's explanation of these routines. You should have a copy of the *Disk System Owner's Manual* for reference.

In order to see the results of each routine, I provide a non-destructive exit routine so you can examine the areas in memory that are affected. I list the routines alphabetically in the first section of EQU's.

I don't intend here to teach coding practice, but merely to demonstrate steps necessary to use each of the rou-

tines. At the end of this article, you should have sufficient knowledge to write Assembly-language disk I/O routines.

I will use the Program Listing (TESTFILE/TST) as a demonstration program throughout this article. If a file by the name of TESTFILE/TST exists on the disk you want to use, you should rename it.

Table 1 lists the major storage areas and buffers TESTFILE uses for system routines and their functions.

The program sets up registers before each call to a system routine. This is not always necessary since some of the registers used remain unchanged when returning from a previous routine. It is done, however, to indicate the information required prior to calling a system routine.

Following along with the Listing helps you see what registers the routines need, and what they need to contain prior to executing the routines. Table 2 shows the condition of the registers prior to and after each routine's execution.

Program Operation

The demonstration program starts by saving the HL register (see the Listing). The HL register contains the address of the first non-blank character following the last command you entered under

The Key Box

**Model III
32K RAM
Assembly Language
TRSDOS, Editor/Assembler,
Disk Drive**

Storage Areas	Bytes Used	Description
BUFFER	256	Operating system uses this as a data storage area during a disk read or write. It must be 256 bytes long since all reads and writes are done one sector at a time.
UREC	less than 256	A user buffer that locates all the data you want to write to or read from disk. The system moves data between UREC and Buffer if the logical record length is less than 256 bytes.
DCB	64	Data control block contains information used by the system to read or write data from or to the disk. For a layout of the DCB, see Table 3 or the <i>Disk System Owner's Manual</i> .
KBLNBF	16	Buffer used to hold data entered via keyboard. Used in conjunction with system routine KBLINE.
DIRBUF	24	This is where RAMDIR places a single directory entry. The format of this buffer is shown in Table 4 or under RAMDIR in the <i>Disk System Owner's Manual</i> .

Table 1. Storage areas and buffers.



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TRSDOS READY. Keep this fact in mind for later reference.

Then the program checks to see if this is your initial entry into this program. It does so by looking at a storage location called Entry that contains the address of the location at which you reenter the program (if you have reentered it).

If the reentry address is between 8000 hexadecimal (hex) and 8FFF hex, Entry uses it as the reentry address. The program places the contents of Entry there with a routine called Look. Look is the non-destructive exit routine the program calls each time you execute a system program and provides a place in memory where you can look to see the effects of the routine's execution.

When you run this program for the first time, it clears the storage areas from Buffer to LKBUF. This makes it easier to see what data the system routines put into memory. Also, the program puts dummy data into the area called UREC. The program then writes this data to disk. Following this, a message indicates the start of the program.

The program then prompts you for the name of a file to which you want to write data. This is where you type in the filespec you want used in the disk's data control block (DCB). The code that asks for the filespec starts at the label GETSPC. With the B register set to 15, and the HL register set to the keyboard input buffer (KBLNBF), the system routine KBLINE lets you enter up to 15 characters for a file name.

Once you do so and hit the enter key, the system's Syntax routine checks to see if your filespec has the correct syntax. If it does, the subroutine duplicates the filespec in the DCB. Syntax uses the HL register, which points to the filespec in the keyboard input buffer (KBLNBF), and the DE register, which points to the DCB.

On return, Syntax sets or clears the zero flag, depending on whether or not the filespec syntax was good. If it is, the subroutine sets the zero flag. If not, it resets the zero flag and the program prompts you for the filespec again.

To check this system, enter any file name preceded by a blank such as BADSPEC. Press the enter key. Since this enters a bad filespec (the first character is a blank), the program displays a message asking for a filespec again.

You might think that since the file name must begin with an alpha character and have eight or fewer characters, Syntax would check this. It doesn't. It does check to see that the filespec starts with a blank, but Syntax allows the file name to start with a number and simply

truncates it to eight characters.

Also, if you use an extension and password, Syntax truncates the extension to three characters, the password to eight characters, and doesn't return an error. If you need to check for the accuracy of your filespec, better do your own checking rather than rely on the Syntax routine.

Now enter TESTFILE as a file name and press the enter key. Since this file name has the correct syntax, the subroutine copies it to the DCB and the local routine Look displays a message asking you if you want to look at the results. If you answer with anything other than Y, the program continues execution, so answer with a Y. This brings you into Debug.

You can go directly to Debug from the demonstration program by using the system routine called COMDOS. COMDOS executes any command you can execute while in TRSDOS READY from a user program. The HL register must point to the address which has the command you wish to execute. The program then executes a jump to COMDOS.

The Look routine points the HL register to the label EXECUT in the message area of the listing, which contains the program name Debug followed by a carriage return. Once in Debug, you can use the command D to look at both KBLNBF and the DCB.

To view KBLNBF, enter its address

found in the section of equates at the beginning of the program under Storage Locations. In KBLNBF, note the file name TESTFILE followed by 0DH, a carriage return. Now look at the DCB. You can find this address listed in the section of equates also.

Notice that the file names in KBLNBF, which is now below the DCB, and the DCB are the same except for one thing. The file name TESTFILE in KBLNBF is followed by 0DH while the file name in the DCB is followed by 03H. The TRSDOS *Disk System Owner's Manual* says the file name in the DCB is followed by 0DH. As you can see, this isn't true if you use the Syntax routine.

To return to the demonstration program, press the Q key to exit Debug and type in the name under which you assembled the demonstration program. This returns you to where you left off. The program displays a message on the screen indicating the location at which you reentered the program. In fact, each time you reenter the program, a message indicates the reentry point.

You should reenter the demonstration program at the label Extend. You can now enter a three-character extension that the program adds to your file name in the DCB via the PUTTEXT routine. Of course, you could have added the extension to the file name when you originally entered the filespec, but the

Routine	Registers					
	AF	BC	DE	HL	IX	IY
BKSPC	Yes	No	No	No	No	No
CLOSE	Yes	No	No	No	No	No
CMDDOS	N/A	N/A	N/A	N/A	N/A	N/A
CMDTXT	N/A	N/A	N/A	N/A	N/A	N/A
COMDOS	N/A	N/A	N/A	N/A	N/A	N/A
DIVIDE	Yes	No	No	Yes	No	No
DSPDIR	Yes	Yes	No	Yes	No	No
ERRDSP	Yes*	No	No	No	No	No
FILPTR	Yes	Yes	No	No	No	No
INIT	Yes	No	No	No	No	No
JP2DOS	N/A	N/A	N/A	N/A	N/A	N/A
KILL	No	No	No	No	No	No
OPEN	Yes	No	No	No	No	No
POSEOF	Yes	No	No	No	No	No
POSN	Yes	No	No	No	No	No
PUTEXT	Yes	Yes	No	Yes	No	No
RAMDIR	No	No	No	No	Yes	No
READ	Yes	No	No	No	No	No
REWIND	Yes	No	No	No	No	No
SYNTAX	Yes	Yes	No	Yes	No	No
VERF	Yes	No	No	No	No	No
WRITE	Yes	No	No	No	No	No

Yes = registers have changed. No = registers have not changed. N/A = not applicable.
 Only the primary registers change; the demonstration program doesn't use the alternate set.
 * Only the flag register changes.

Table 2. Register conditions after routine execution.

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extension is being requested here to demonstrate the routine. Enter TST as the extension.

To work properly, PUTEEXT requires that the HL register point to the location of the extension and the DE register point to the DCB. The demo program then calls PUTEEXT. There are no exit conditions to check for, so the program calls Look so you can again check the results in KBLNBF and the DCB. In the DCB, the filename now appears as TESTFILE/TST followed by 03H. Now return to the demonstration program.

You should have reentered at the label OPNFIL. Here the program attempts to open the file using the filename TESTFILE/TST. If the file had already existed, it would simply have been opened, but since the file doesn't exist, the program displays the message File Not Found. You can look at the DCB and see that nothing happened.

Before going on, look at the local routine ERPROC which contains the system routine called ERRDSP. You can find this in the Listing under the banner Error Display Processor. ERRDSP is a system routine that displays an error code or expanded error message on the CRT. It then either returns to the user program, or to TRSDOS READY. Setting bit 6 masks the error code that is in the A register. The

routine spells out the full error message.

If bit 7 is set, control returns to the user program. How you process an error is up to you. You can abort the program, try again, skip processing, or whatever you feel is appropriate. Now return to the demonstration program.

You should reenter the program at label NEWFIL. This initializes a new file and you can again look at the DCB. The parameters that the HL, BC, and DE registers pass are the same whether you open or initialize a file.

In this case, the HL register contains the address of a 256-byte buffer called Buffer where the operating system does the actual writing to and reading from the disk. The DE register must point to the DCB, and the B register must contain the logical record length.

A physical record is 256 bytes long or one disk sector. You can subdivide the physical record into smaller segments called logical records. A logical record is a record of from 1 to 256 bytes long. In the EQUs, I define the logical record length (LRL) as 128 bytes long.

If you define a logical record as 64 bytes long, four logical records comprise one physical record ($4 \times 64 = 256$). However, if a logical record does not evenly divide into a 256-byte physical record (such as a logical record of 50 bytes), the system spans physical records to keep your logical records intact.

It's possible to have a logical record equal in size to the physical record (256 bytes), but this requires additional programming. I'll discuss how the data moves to and from disk and the special requirements for 256-byte logical records later.

For now, answer Y to the question on the screen and take a look at the DCB. Notice that the program file name in the DCB no longer appears. Instead, the DCB's layout is as shown in Table 3. Bytes 3 and 4 of the DCB point to the 256-byte buffer called Buffer. Remember, the low order byte appears first, the high order byte second.

Byte 5 represents the offset to the delimiter at the end of the current physical record. Byte 6 indicates the drive number on which the file resides. Byte 8 is the end-of-file offset of the last delimiter in the last physical record. Byte 9 shows the logical record length, and bytes 10 and 11 display the next physical record number with bytes 12 and 13 giving the ending physical record of the file.

Figures 1 and 2 show examples of how to interpret the contents of bytes 5, 8, 10, and 11 of the DCB. Figure 1 shows two physical records, or sectors, of 256 bytes each, comprising four 128-byte logical records.

Suppose you just read the first logical record (record zero) of physical record zero. Byte 5 of the DCB now contains 80 hex and bytes 10 and 11 of the DCB contain 0000 hex. The DCB now points to the first byte of the next logical record.

Logical record zero goes from bytes 0 hex to 7F hex, and logical record 1 goes from bytes 80 hex to 0FF hex. Byte 5 of the DCB actually contains the first byte following the end of the last logical record read or, for that matter, the last one written.

Figure 2 is similar to Fig. 1 (now in the second logical record of physical record zero). Here, byte 5 of the DCB contains 0 hex, and bytes 10 and 11 of the DCB contain 0001 hex. The DCB now points to the first byte of logical record 2, the first logical record of physical record 1.

Byte 8 of the DCB is similar to byte 5 of the DCB, but only applies to the last physical record in the file. It points to the first byte following the last logical record in the last physical record.

In Fig. 2, if the last logical record in the file is logical record 2, byte 8 of the DCB contains 80 hex. This is actually the first byte of the next logical record, if it existed. You should note that the value in byte 8 need not always point to

Byte	Contents
0-2	Reserved for system use.
3-4	Address of system I/O buffer. (BUFFER)
5	Offset into the current physical record of the end of the last logical record read or written.
6	Drive number on which the file exists.
7	Reserved for system use.
8	End Of File offset to the end of the last logical record.
9	Logical record length.
10-11	The next physical record where a read or write will take place.
12-13	The last physical record in the file.
14-63	Reserved for system use.

Table 3. Data control block layout.

Byte	Contents
0-14	File name/ext:d left justified and padded with spaces.
15	Protection level of file. 0 to 6.
16	End Of File offset to the end of the last logical record in the last physical record.
17	The logical record length.
18-19	The last physical record number in the file. LSB is in byte 18 and the MSB is in byte 19.
20-21	The number of granules allocated to the file. LSB is in byte 20 and the MSB is in byte 21.
22-23	Two plus marks indicating the end of the directory.

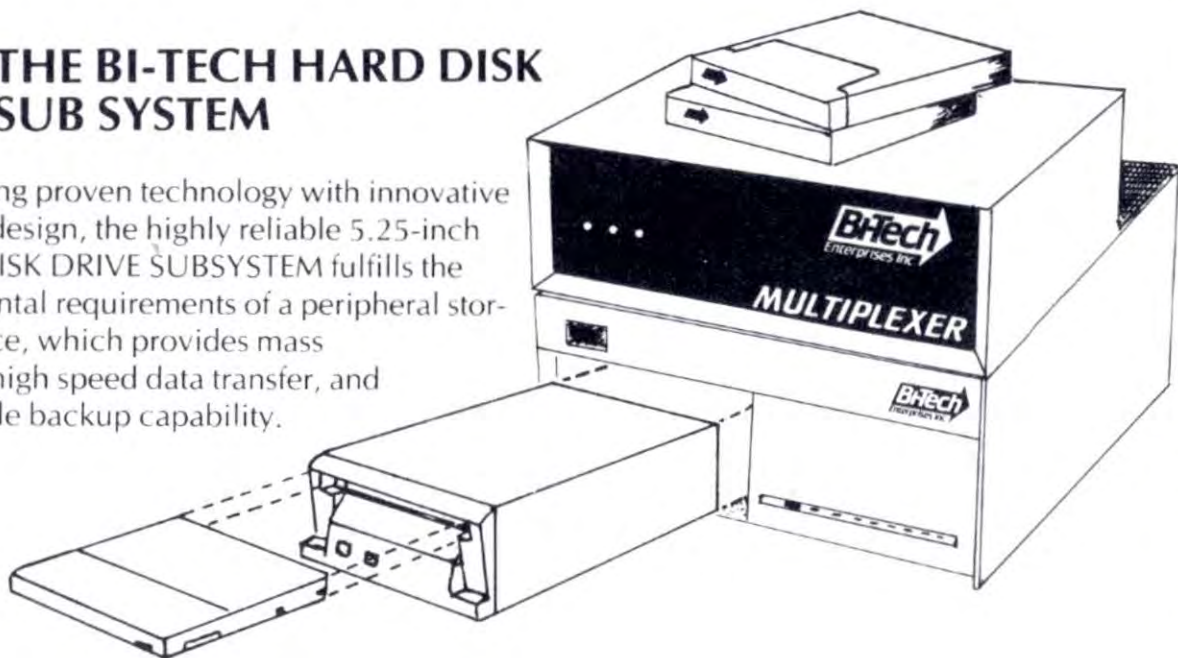
Table 4. Directory layout in RAM.

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the beginning of the next logical record. It can point anywhere within your last logical record. It is meant to point to the first byte following the actual end of data.

To make sure you put the correct end-of-file (EOF) offset in the DCB, you must calculate and put the actual EOF offset into byte 8 of the DCB. One way you can experiment with this is to use this program with different logical record lengths and modify the end-of-file offset in byte 8 of the DCB just before closing the file. To keep it simple, don't do it here. Now return to the demonstration program.

Write Operation

Once you return from looking at the DCB, execute the code at the WRTFIL label. The system needs two pieces of data to write a record to disk. The HL register must point to the buffer that contains the data you want to save, and the DE register must point to the DCB. The program sets the HL register to point to UREC, which contains some sample data, while the DE register points to the DCB.

When the program invokes the Write subroutine, it moves 128 bytes (the logical record length) from UREC to the area called Buffer. If the write is successful, it sets the zero flag. If an error occurs, the subroutine resets the zero flag and returns an error code in the A register for display via ERPROC.

As long as the logical record length is fewer than 256 bytes long, the system

moves data from the user buffer UREC to the I/O buffer called Buffer and vice versa.

If you set the logical record length to 256 by opening a file with the B register equal to zero, you must move the data between UREC and Buffer yourself. This means that for each Write command, you must move the 256 bytes of data you want written to Buffer before the program calls the Write routine. Also, after each read, you must move the 256 bytes from Buffer to wherever you want it to go as its final destination. When the logical record length is 256 bytes, Read and Write commands ignore the HL register.

Once you complete the first write of the logical record of 128 bytes, answer Y to the question on the screen and look at Buffer and the DCB. If you look at the DCB, you see that the next physical record number at bytes 10 and 11 is zero. Also, the offset to the delimiter at the end of the current physical record at byte 5 is 80 hex, indicating that the program successfully completed one write. Records start at number zero with two 80 hex logical records per physical record. Looking at Buffer, you can see the dummy data.

Return to the demonstration program to continue with the next write at label WRT002. The program now initiates a second disk write, but here the HL register points one logical record length (1 LRL) into UREC. This occurs so the system can pick up the next block of data.

Make sure the HL register points to the right area of memory for the data you want transferred. If the write is successful, the program transfers a sector of data, or 2 LRLs, from Buffer to the disk. Again, you can look at the DCB and buffer areas for verification.

Now the DCB shows that the next physical record number at bytes 10 and 11 is 1 and the ending physical record at bytes 12 and 13 is also 1. The offset to the end of the current record at byte 5 is zero, indicating that the program has written two logical records.

After returning to the demonstration program at label WRT003, the program completes a third write, after which you may look at the DCB. Notice that the last half of the buffer contains junk. The program clears out Buffer after it writes a sector and loads it with data of its own choosing from somewhere in the system.

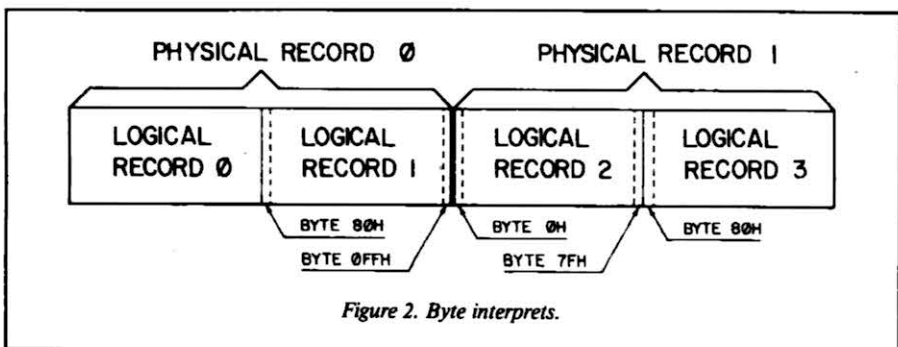
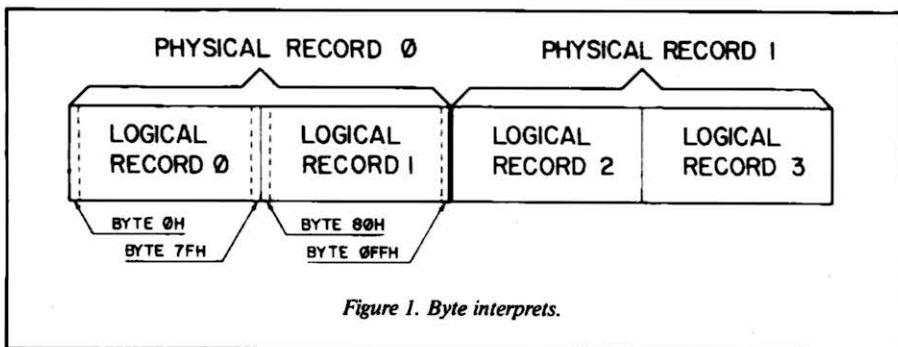
Now, return to the demonstration program at label WRT004 for a fourth disk write. Following this, at label WRT005, the program makes a fifth write. After each of these writes you may look at the DCB.

Since the fifth write is only half of a new third sector, the DCB shows that the next physical record is 2 (the third physical record), the ending physical record is 2, and the offset is 80 hex at byte 5, for a total of five 80 hex-byte logical records.

In the *Disk System Owner's Manual* the explanation of the next record number (NRN) as well as those of Read and Write operations, say that after each Read or Write the NRN increments by one. This is true only if the logical record length is 256 bytes long. If the logical record length is 128 bytes as in this case, the NRN increments only after two reads or writes.

You should now return to the program to close the file. You enter at label CLOSFL. To close a file, you need to pass only one parameter to the routine called Close. This is the address of the DCB in the DE register. When you close the file, the program makes a final write to the disk, keeps track of the end of the last logical record, and updates the DCB and the disk directory.

If you close the file successfully, the program sets the zero flag. If not, you need to process the error. Get into Debug and look at the DCB. As you can see, the file name, including the number of the disk drive where the file is located, again appears at the beginning of the DCB. If you call the directory, notice that the file has an LRL of 128 bytes, five logical records, three physi-



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cal records (one granule), and an EOF of 128 bytes.

If you want to quit and take a break, go ahead, but if you turn off your computer or run some other program, make sure you reenter the program at the correct point. To do this, use the M command under Debug and modify the location Entry so that it points to GTSPC1 in the demonstration program.

Remember, the low order byte of the address of GTSPC1 goes into the low order byte of Entry, and the high order byte of the address of GTSPC1 goes into the high order byte of Entry. Now you can exit Debug and continue with the rest of this article.

Read Operation

Now I'll show you how to read the disk file you generated. You will read

four records, the first, then the third, then back to the first, and finally the fifth logical record.

By typing in the name of the demonstration program, reenter the program. Do this, but with one additional entry, the name of the data file (TESTFILE/TST) following the name of the demonstration program.

For example, if the name of the demonstration program is DISKIO, type DISKIO TESTFILE/TST. You must include a single space between the program name DISKIO and the data file name. Every time you type in a command at TRSDOS READY, the HL register contains the address of the first non-blank character following the last command. The *Disk System Owner's Manual* describes this in detail under CMDTXT.

Once you type in the demonstration program name followed by the data file name, the program automatically saves the HL register in the location labeled PARAM. This brings you to the read section of the program at label

*"If you close
the file successfully,
the program
sets the zero flag."*

GTSPC1, with an accompanying message. Then the program loads the HL register with the address contained in the location PARAM. The Read routine checks this address to see if it includes a carriage return, indicating the end of a command, and the absence of parameters to pass. If no parameters exist, the program asks you to enter the filespec just as when you initially ran the program.

If you typed in the parameter TESTFILE/TST, the program uses this as the filespec to open the file. If you type an illegal parameter, an error occurs and you must enter a new filespec.

If everything goes right, the program opens the TESTFILE/TST file, ready to read. Before the program reads the file, it executes the FILPTR routine starting at label OPENOK. This routine requires that the DE register contain the DCB address. On return from FILPTR the B register contains the drive number on which the file resides, with the logical file number in the C register.

Program Listing. Demonstration program.

```

00010 ;
00020 ;*****
00030 ; FUNDAMENTAL ASSEMBLY LANGUAGE DISK I/O
00040 ; FOR THE TRS-80 MODEL III
00050 ;*****
00060 ;
00070 ORG 8000H
00080 BKSPC EQU 4445H ;BACKSPACE 1 LOGICAL REC
00090 CLOSE EQU 4428H ;CLOSE FILE ROUTINE
00100 CMDDOS EQU 429CH ;EXEC TRSDOS COMMAND
00110 CMDTXT EQU 4225H ;HAS LAST TRSDOS COMMAND
00120 COMDOS EQU 4299H ;EXEC TRSDOS COMMAND
00130 DIVIDE EQU 4451H ;DIVIDE ROUTINE
00140 DSPDIR EQU 4419H ;DISPLAY DIRECTORY
00150 ERRDSP EQU 4409H ;DISPLAY ERROR MESSAGE
00160 FILPTR EQU 428DH ;FINDS FILE # AND DRIVE #
00170 INIT EQU 4420H ;INITIALIZE DISK FILE
00180 JP2DOS EQU 402DH ;ENTRY TO TRSDOS
00190 KILL EQU 442CH ;KILLS FILE
00200 OPEN EQU 4424H ;OPEN FILE ROUTINE
00210 POSEOF EQU 4448H ;GO TO END OF FILE
00220 POSN EQU 4442H ;POSITION TO LOGICAL REC.
00230 PUTEXT EQU 444BH ;PUT EXTENSION IN DCB
00240 RAMDIR EQU 4290H ;RAM DIRECTORY ROUTINE
00250 READ EQU 4436H ;DISK READ ROUTINE
00260 REWIND EQU 443FH ;REWIND FILE ROUTINE
00270 SYNTAX EQU 441CH ;CHECK FILESPEC SYNTAX
00280 VERF EQU 443CH ;WRITE AND VERIFY
00290 WRITE EQU 4439H ;DISK WRITE ROUTINE
00300 ;
00310 ;*****
00320 ; MISCELLANEOUS ROUTINES AND DEFINITIONS
00330 ;*****
00340 ;
00350 KBLINE EQU 40H ;SCAN KEYBOARD FOR LINE
00360 KBWAIT EQU 49H ;WAIT FOR KEYBOARD INPUT
00370 LRL EQU 128 ;LOGICAL RECORD LENGTH
00380 LRL2 EQU 256 ;LOGICAL RECORD X2
00390 VDCLS EQU 1C9H ;CLEAR SCREEN ROUTINE
00400 VDLINE EQU 21BH ;DISPLAY LINE ROUTINE
00410 ;
00420 ;*****
00430 ; STORAGE LOCATIONS
00440 ;*****
00450 ;
00460 ADRBUF EQU $ ;ADDRESS OF 'BUFFER'
00470 BUFFER DEFS 256 ;DISK I/O BUFFER
00480 AUREC EQU $ ;ADDRESS OF 'UREC'
00490 UREC DEFS 640 ;USER BUFFER
00500 ADRDCB EQU $ ;ADDRESS OF 'DCB'
00510 DCB DEFS 64 ;DATA CONTROL BLOCK
00520 AKBBUF EQU $ ;ADDRESS OF 'KBLNBF'
00530 KBLNBF DEFS 16 ;KEYBOARD INPUT BUFFER
00540 ADRDIR EQU $ ;ADDRESS OF 'DIRBUF'
00550 DIRBUF DEFS 24 ;DIRECTORY BUFFER
00560 LENGTH EQU $-BUFFER
00570 DRVNUM DEFS 1 ;ASCII CODED DRIVE NUMBER
00580 LKBUF DEFS 2
00590 AENTRY EQU $ ;ADDRESS OF RE-ENTRY BUF
00600 ENTRY DEFS 2 ;RE-ENTRY ADDRESS BUFFER
00610 PARAM DEFS 2 ;PARAMETER ADDRESS BUFFER
00620 ;
00630 ;*****
00640 ; WRITE DISK FILE EXERCISE
00650 ;*****
00660 ;
00670 START LD (PARAM),HL ;SAVE PARAMETER POINTER
00680 CALL VDCLS ;CLEAR SCREEN
00690 LD HL,(ENTRY) ;GET RE-ENTRY ADDRESS
00700 LD A,H
00710 AND 0F0H
00720 CP 00H ;IS THIS FIRST TIME THRU?
00730 JR NZ,START1 ;YES
00740 JP (HL) ;NO. ENTER WHERE LEFT OFF
00750 START1 CALL CLRBUF ;CLEAR OUT BUFFERS
00760 CALL MOVDAT ;FILL USER BUFFER W/DATA
00770 LD HL,SIGNON ;SIGNON MESSAGE
00780 CALL VDLINE ;DISPLAY MESSAGE
00790 GETSPC LD HL,SPCMG ;FILESPEC MESSAGE
00800 CALL VDLINE ;DISPLAY MESSAGE
00810 LD HL,KBLNBF ;KEYBOARD INPUT BUFFER
00820 LD B,15 ;MAX # OF CHARS. ALLOWED
00830 CALL KBLINE ;GET FILESPEC
00840 LD HL,KBLNBF ;FILESPEC ADDRESS

```

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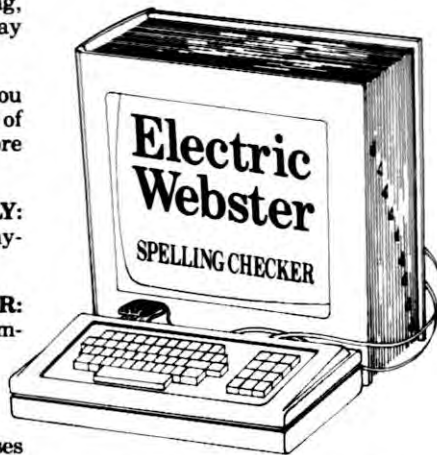
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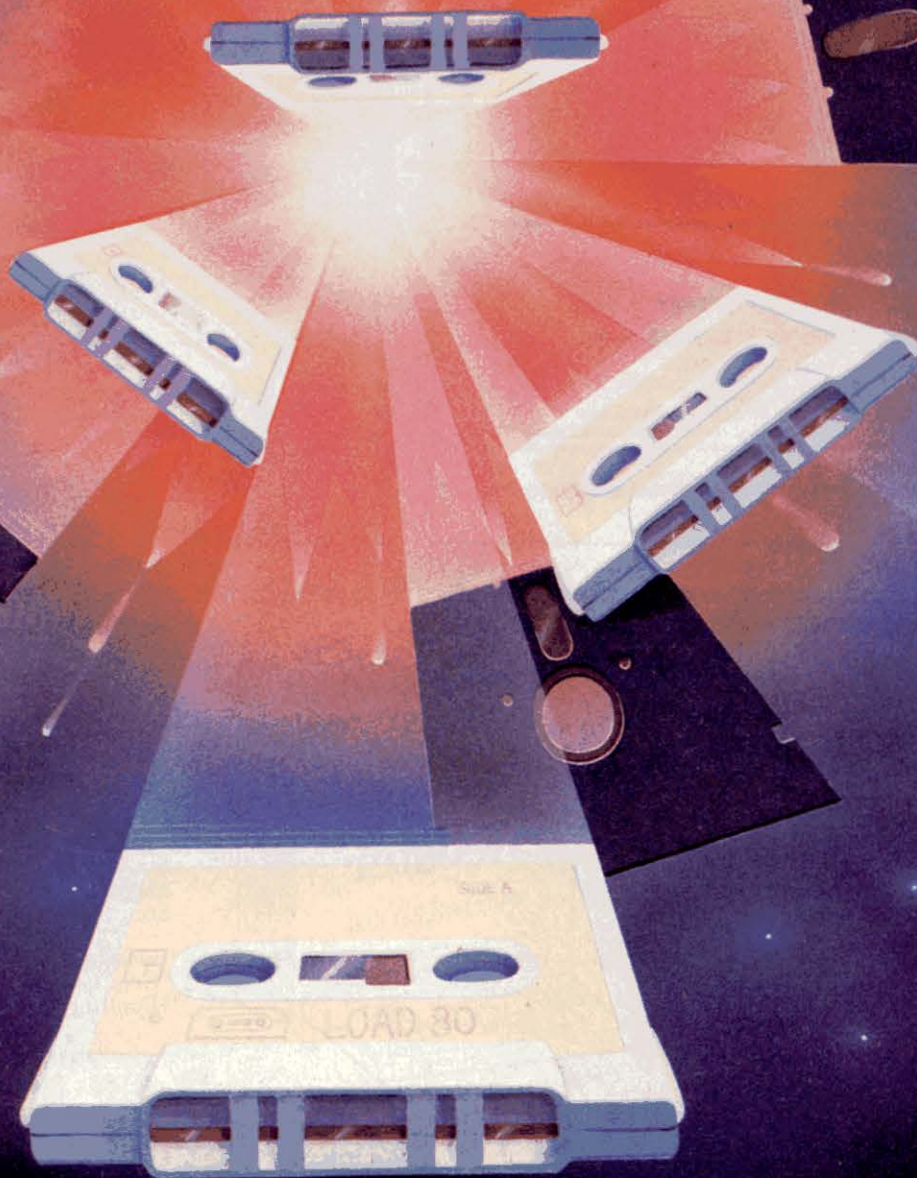
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If FILPTR finds the appropriate information, it sets the zero flag. Otherwise, it resets the flag and the program skips down to the label READ01.

On successful completion of FILPTR, the routine RAMDIR uses the BC register, returned by FILPTR, to get the directory information of TESTFILE/TST and places it in memory.

RAMDIR requires that the BC register contain the drive number in the B register, the file number in the C register, and the address of a 24-byte buffer in the HL register. The 24-byte buffer in this case is DIRBUF. The *Disk System Owner's Manual* states that the buffer must be 22 bytes long for data, plus 1 byte for the plus symbol, which indicates the end of the directory. In fact, there are two plus marks at the end of the directory, thereby requiring 24 bytes in the buffer. If RAMDIR is successful, it sets the zero flag.

Following the execution of RAMDIR, the program converts the drive number and file number of TESTFILE/TST contained in the BC register to ASCII and places them in two separate messages. In addition, it saves the ASCII coded drive number in a location labeled DRVNUM for later use

```

B Y T E M I C R O
O N A B S K E E P
A U T O T R O N E
R U N D A T A O N
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```

00850 LD DE,DCB ;DATA CONTROL BLOCK
00860 CALL SYNTAX ;TEST FOR CORRECT SYNTAX
00870 JR NZ,GETSPC ;BAD SYNTAX
00880 CALL LOOK ;EXAMINE FILESPEC ?
00890 EXTEND CALL MSG001 ;DISPLAY ENTRY MESSAGES
00900 LD HL,KBLNBF ;KEYBOARD INPUT BUFFER
00910 LD B,3 ;ALLOWS 3 CHAR. ENTRY
00920 CALL KBLINE ;GET EXTENSION
00930 LD HL,KBLNBF ;EXTENSION ADDRESS
00940 LD DE,DCB ;DATA CONTROL BLOCK
00950 CALL PUTTEXT ;ADD EXTENSION TO FILSPC
00960 CALL LOOK ;EXAMINE FILESPEC ?
00970 OPNFIL CALL MSG002 ;DISPLAY ENTRY MESSAGES
00980 LD HL,BUFFER ;ADDR SECTOR I/O BUFFER
00990 LD DE,DCB ;DATA CONTROL BLOCK
01000 LD B,LRL ;LOGICAL RECORD LENGTH
01010 CALL OPEN ;OPEN FILE
01020 JR Z,INITOK ;FILE OPENING SUCCESSFUL
01030 CALL ERPROC ;DISPLAY ERROR MESSAGE
01040 CALL LOOK ;EXAMINE DCB ?
01050 NEWFIL CALL MSG003 ;DISPLAY ENTRY MESSAGES
01060 LD HL,BUFFER ;ADDR SECTOR I/O BUFFER
01070 LD DE,DCB ;DATA CONTROL BLOCK
01080 LD B,LRL ;LOGICAL RECORD LENGTH
01090 CALL INIT ;INITIALIZE A NEW FILE
01100 JR Z,INITOK ;NEW FILE INITIALIZED
01110 CALL ERPROC ;DISPLAY ERROR MESSAGE
01120 INITOK CALL LOOK ;EXAMINE DCB ?
01130 WRTFIL CALL MSG004 ;DISPLAY ENTRY MESSAGES
01140 LD HL,UREC ;USER BLOCK
01150 LD DE,DCB ;DATA CONTROL BLOCK
01160 CALL VRF ;WRITE DATA TO DISK
01170 JR Z,WRTOK1 ;SUCCESSFUL WRITE
01180 CALL ERPROC ;DISPLAY ERROR MESSAGE
01190 WRTOK1 CALL LOOK ;EXAMINE BUFFERS ?
01200 WRT002 CALL MSG005 ;DISPLAY ENTRY MESSAGES
01210 LD HL,UREC+LRL ;NEXT LRL OF DATA
01220 LD DE,DCB ;DATA CONTROL BLOCK
01230 CALL WRITE ;WRITE DATA TO DISK
01240 JR Z,WRTOK2 ;SUCCESSFUL WRITE
01250 CALL ERPROC ;DISPLAY ERROR
01260 WRTOK2 CALL LOOK ;EXAMINE BUFFERS ?
01270 WRT003 CALL MSG006 ;DISPLAY ENTRY MESSAGES
01280 LD HL,UREC+LRL2 ;NEXT LRL OF DATA
01290 LD DE,DCB ;DATA CONTROL BLOCK
01300 CALL WRITE ;WRITE DATA TO DISK
01310 JR Z,WRTOK3 ;SUCCESSFUL WRITE
01320 CALL ERPROC ;DISPLAY ERROR
01330 WRTOK3 CALL LOOK ;EXAMINE BUFFERS ?
01340 WRT004 CALL MSG007 ;DISPLAY ENTRY MESSAGES
01350 LD HL,UREC+LRL+LRL2
01360 LD DE,DCB ;DATA CONTROL BLOCK
01370 CALL WRITE ;WRITE DATA TO DISK
01380 JR Z,WRTOK4 ;SUCCESSFUL WRITE
01390 CALL ERPROC ;DISPLAY ERROR
01400 WRTOK4 CALL LOOK ;EXAMINE BUFFERS ?
01410 WRT005 CALL MSG008 ;DISPLAY ENTRY MESSAGES
01420 LD HL,UREC+LRL2+LRL2
01430 LD DE,DCB ;DATA CONTROL BLOCK
01440 CALL WRITE ;WRITE DATA TO DISK
01450 JR Z,WRTOK5 ;SUCCESSFUL WRITE
01460 CALL ERPROC ;DISPLAY ERROR
01470 WRTOK5 CALL LOOK ;EXAMINE BUFFERS ?
01480 CLOSFL CALL MSG009 ;DISPLAY ENTRY MESSAGES
01490 LD DE,DCB ;DATA CONTROL BLOCK
01500 CALL CLOSE ;CLOSE FILE
01510 JR Z,CLOSOK ;FILE CLOSED SUCCESSFULLY
01520 CALL ERPROC ;DISPLAY ERROR MESSAGE
01530 CLOSOK LD HL,GTSPC1 ;GET RE-ENTRY ADDRESS
01540 LD (ENTRY),HL ;SET NEW RE-ENTRY ADDRESS
01550 JP JF2DOS ;JUMP TO TRSDOS READY
01560 ;
01570 ;
01580 ; READ DISK FILE EXERCISE
01590 ;
01600 ;
01610 GTSPC1 CALL CLRBUF ;CLEAR OUT BUFFERS
01620 CALL MSG010 ;DISPLAY ENTRY MESSAGES
01630 LD HL,(PARAM) ;GET PARAMETER ADDRESS
01640 LD A,(HL) ;FIRST CHARACTER OF PARAM
01650 CP 0DH ;CARRIAGE RETURN ?
01660 JR NZ,RDOPEN ;OPEN FILE USING PARAM.
01670 GTSPC2 LD HL,SPMSG ;GET FILESPEC MESSAGE
01680 CALL VDLINE ;DISPLAY MESSAGE
01690 LD HL,KBLNBF ;KEYBOARD INPUT BUFFER
01700 LD B,15 ;MAX # CHARS FROM KEYBRD
01710 CALL KBLINE ;INPUT KEYBOARD DATA
01720 LD HL,KBLNBF ;FILESPEC
01730 RDOPEN LD DE,DCB ;DATA CONTROL BLOCK
01740 CALL SYNTAX ;CHECK FOR CORRECT SYNTAX
01750 JR NZ,GTSPC2 ;BAD SYNTAX
01760 LD HL,BUFFER ;SECTOR I/O BUFFER
01770 LD DE,DCB ;DATA CONTROL BLOCK
01780 LD B,LRL ;LOGICAL RECORD LENGTH
01790 CALL OPEN ;OPEN FILE
01800 JR Z,OPENOK ;OPENED SUCCESSFULLY
01810 CALL ERPROC ;DISPLAY ERROR MESSAGE
01820 OPENOK JR GTSPC2 ;GET NEW FILESPEC
01830 LD DE,DCB ;DATA CONTROL BLOCK
01840 CALL FILPTR ;GET DRV/FILE # IN BC REG
01850 JR NZ,READ01 ;SKIP IF ERROR
01860 LD HL,DIRBUF ;DIRECTORY BUFFER
01870 CALL RAMDIR ;GET DIRECTORY INFO
01880 JR NZ,READ01 ;SKIP IF ERROR
01890 LD A,B ;PUT DRIVE # IN A REG
01900 ADD A,30H ;MAKE ASCII
01910 LD (DRVNUM),A ;SAVE FOR ROUTINE DSPDIR
    
```

Listing continued

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```

01920 LD (DRVBUF),A ;PUT IN MESSAGE
01930 LD L,C ;SET UP HL REGISTER TO
01940 LD H,0 ; MAKE FILE NUMBER AN
01950 LD A,10 ; ASCII STRING.
01960 CALL DIVIDE
01970 ADD A,30H ;MAKE REMAINDER ASCII
01980 LD (FILNUM+1),A ;SAVE IN MESSAGE
01990 LD A,L ;GET REST OF FILE NUMBER
02000 ADD A,30H ;MAKE IT ASCII
02010 LD (FILNUM),A ;PUT IN MESSAGE
02020 LD HL,DRVMSG ;DRIVE NUMBER MESSAGE
02030 CALL VDLIN ;DISPLAY MESSAGE
02040 LD HL,FILMSG ;FILE NUMBER MESSAGE
02050 CALL VDLIN ;DISPLAY REST OF MESSAGE
02060 CALL LOOK ;EXAMINE DIRECTORY ?
02070 READ01 CALL MSG011 ;DISPLAY ENTRY MESSAGES
02080 LD HL,UREC ;USER DATA BUFFER
02090 LD DE,DCB ;DATA CONTROL BLOCK
02100 CALL READ ;READ A LOGICAL RECORD
02110 JR Z,READOK ;RECORD READ OK
02120 CALL ERPROC ;DISPLAY ERROR MESSAGE
02130 CALL LOOK ;EXAMINE BUFFERS ?
02140 POSENT CALL MSG012 ;DISPLAY ENTRY MESSAGES
02150 LD DE,DCB ;DATA CONTROL BLOCK
02160 LD BC,2 ;LRL TO GO TO
02170 CALL POSN ;GO TO 3RD LOGICAL RECORD
02180 JR Z,POSNOK ;POSITIONED OK
02190 CALL ERPROC ;DISPLAY ERROR MESSAGE
02200 CALL LOOK ;EXAMINE DCB ?
02210 READ02 CALL MSG013 ;DISPLAY ENTRY MESSAGES
02220 LD HL,UREC+LRL ;OFFSET INTO BUFFER 1 LRL
02230 LD DE,DCB ;DATA CONTROL BLOCK
02240 CALL READ ;READ NEXT LOGICAL RECORD
02250 JR Z,RDOK ;NEXT RECORD READ OK
02260 CALL ERPROC ;DISPLAY ERROR MESSAGE
02270 RDOK CALL LOOK ;EXAMINE BUFFERS ?
02280 REWENT CALL MSG014 ;DISPLAY ENTRY MESSAGES
02290 LD DE,DCB ;DATA CONTROL BLOCK
02300 CALL REWIND ;GO TO BEGINNING OF FILE
02310 JR Z,REWOK ;REWIND COMPLETE
02320 CALL ERPROC ;PROCESS ERROR MESSAGE
02330 REWOK CALL LOOK ;EXAMINE BUFFERS ?
02340 READ03 CALL MSG015 ;DISPLAY ENTRY MESSAGES
02350 LD HL,UREC+LRL2 ;NEXT LOGICAL RECORD
02360 LD DE,DCB ;DATA CONTROL BLOCK
02370 CALL READ ;READ FIRST LOGICAL REC
02380 JR Z,RDOK1 ;FIRST LOG REC READ OK
02390 CALL ERPROC ;PROCESS ERROR MESSAGE
02400 RDOK1 CALL LOOK ;EXAMINE BUFFERS ?
02410 EOF02 CALL MSG016 ;DISPLAY ENTRY MESSAGES
02420 LD DE,DCB ;DATA CONTROL BLOCK
02430 CALL EOF02 ;GO TO END OF FILE
02440 JR Z,EOFOK ;POSITIONED TO EOF OK
02450 CALL ERPROC ;PROCESS ERROR MESSAGE
02460 EOFOK CALL LOOK ;EXAMINE BUFFERS ?
02470 BKENT CALL MSG017 ;DISPLAY ENTRY MESSAGES
02480 LD DE,DCB ;DATA CONTROL BLOCK
02490 CALL BKSPC ;BACK UP 1 LOGICAL RECORD
02500 JR Z,BKSPOK ;BACKSPACE 1 LRL OK
02510 CALL ERPROC ;PROCESS ERROR MESSAGE
02520 BKSPOK CALL LOOK ;EXAMINE BUFFERS ?
02530 READ04 CALL MSG018 ;DISPLAY ENTRY MESSAGES
02540 LD HL,UREC+LRL2+LRL ;USER BUFFER
02550 LD DE,DCB ;DATA CONTROL BLOCK
02560 CALL READ ;READ LOGICAL RECORD
02570 JR Z,RDOK2 ;READ SUCCESSFUL
02580 CALL ERPROC ;PROCESS ERROR MESSAGE
02590 RDOK2 CALL LOOK ;EXAMINE BUFFERS ?
02600 CLSENT CALL MSG019 ;DISPLAY ENTRY MESSAGES
02610 LD DE,DCB ;DATA CONTROL BLOCK
02620 CALL CLOSE ;CLOSE FILE
02630 JR Z,KILFIL ;CLOSE OF FILE OK
02640 CALL ERPROC ;PROCESS ERROR MESSAGE
02650 KILFIL LD HL,KILMSG ;KILLING FILE MESSAGE
02660 CALL VDLIN ;DISPLAY MESSAGE
02670 LD DE,DCB ;DATA CONTROL BLOCK
02680 CALL KILL ;KILL FILE
02690 JR Z,KILLOK ;KILL SUCCESSFUL
02700 CALL ERPROC ;PROCESS ERROR
02710 KILLOK LD A,(DRVNUM) ;GET DRIVE NUMBER
02720 LD (4271H),A ;PUT IN SYSTEM AREA
02730 CALL DSPDIR ;DISPLAY DIRECTORY
02740 LD HL,ENDMSG ;END OF DEMO MESSAGE
02750 CALL VDLIN ;DISPLAY MESSAGE
02760 CALL KWAIT ;WAIT FOR KEYBOARD ENTRY
02770 JP JP2DOS ;GO TO TRSDOS READY
02780 ;
02790 ;*****
02800 ; ERROR DISPLAY PROCESSOR
02810 ;*****
02820 ;
02830 ERPROC OR SC0H ;DISPLAY MODE FOR ERRDSP
02840 CALL ERRDSP ;DISPLAY ERROR MESSAGE
02850 RET
02860 ;
02870 ;*****
02880 ; EXAMINE DATA PROCESSOR
02890 ;*****
02900 ;
02910 LOOK POP HL ;GET RETURN ADDRESS
02920 PUSH HL ;RESTORE IT
02930 LD (ENTRY),HL ;SAVE RETURN ADDRESS
02940 LD HL,LKMSG ;LOOK? MESSAGE
02950 CALL VDLIN ;DISPLAY MESSAGE
02960 LD HL,LKBUF ;ANSWER BUFFER
02970 LD B,1 ;ALLOW 1 CHAR TO RTN

```

Listing continued

by the system routine DSPDIR.

The program displays the messages and calls Look so you can see the directory in RAM. You can use the directory to find out how many records are in the file, the file's logical record length, and other information needed to read the file. See Table 4 for the directory's layout.

Since you already know the number of logical records and the logical record length, returning to the demonstration program after looking at the directory leads right into reading the file starting at label READ01.

When you open a file, the data in the DCB points to the first logical record in the file. A message indicates that you are reading the first logical record. With the HL register pointing to UREC and the DE register pointing to the DCB, the program makes a call to Read. If the read is successful, it sets the zero flag and puts the first logical record into UREC. This gives you an opportunity to look at the buffer UREC.

After looking at UREC, return to the

*"You can use the directory
to find out
how many records
are in the file."*

demonstration program. You should reenter at the label POSENT where the routine POSN executes so you can read the third logical record. POSN requires that the BC register point to the logical record to which you want to read or write. Since the logical records start with record zero, record 2 is the third logical record, therefore BC equals 2.

The DE register must point to the DCB. If the positioning is successful, the subroutine sets the zero flag and a Look call lets you view the DCB. You should note here that the next physical record number at bytes 10 and 11 in the DCB is now 1, and byte 5 (the offset to delimiter at end of current physical record) is zero. This confirms your position at the end of the second logical record and points to the third logical record.

Now return to the demonstration program reentering at the label READ02. Here the program reads the third logical record. The program loads the HL register with UREC plus LRL, allowing the next read from the disk to place the data in the next 128 bytes of

the user buffer UREC. The program next loads the DE register with the DCB address and executes a Read command. On successful completion, a call to Look lets you examine UREC and the DCB.

Now return to the demonstration program at label REWENT where it executes a Rewind routine. This routine requires that the program load only the DE register with the address of the DCB. Once the program executes Rewind, the DCB points to the beginning of the file, record zero. Again, a successful execution sets the zero flag and you can look at the DCB via Look.

Returning to the demonstration program should place you at the label READ03. Here the program reads the first logical record. The HL register points one more logical record length into UREC, and the DE register contains the DCB address. The call to Read reads the first logical record into UREC. Following a successful read, you can look at UREC to verify that it now contains the first, third, and first logical records of TESTFILE/TST.

You can do one of two things in order to read the last logical record. You can use the POSN routine to go to logical record 5, or you can go to the end of the file and backspace one logical record. Here I do the latter.

Return to the demonstration program at label EOFENT. The DE register contains the address of the DCB and the program calls POSEOF. If successful, it sets the zero flag and the DCB points to the beginning of the next logical record beyond the last logical record.

For a write operation, you can extend the file here. But since you're reading and you want to look at the last logical record, you must backspace one record. If you looked at the DCB after the program executes POSEOF, return to the demonstration program at label BKENT.

With the DE register pointing to the DCB address, a call to BKSPC repositions the pointer in the DCB to the last logical record. To allow examination of the DCB, the program calls the Look routine. Considering bytes 10 and 11, the next physical record is 2 and the offset to delimiter at end of current record at byte 5 is zero. This verifies that the DCB is pointing to the fifth logical record.

Continuing with the demonstration program at label READ04, it loads the HL register with the address of the next logical record position into UREC and places the address of the DCB in the DE

Listing continued

```

02980 CALL KBLINE ;GET CHARACTER
02990 JR C,LOOK1 ;BREAK KEY PRESSED
03000 LD A,(HL) ;GET ANSWER
03010 CP 'Y' ;WAS IT YES ?
03020 RET NZ ;NO
03030 LD HL,EXECUT ;ADDRESS OF COMMAND
03040 JP COMDOS ;ENTER DEBUG
03050 ;
03060 ;*****
03070 ; ENTRY POINT MESSAGE DISPLAY ROUTINES
03080 ;*****
03090 ;
MSG001 LD HL,ENTMSG ;ENTRY POINT MESSAGE
CALL VDLIN ;DISPLAY MESSAGE
LD HL,ENT001 ;ENTRY POINT NAME #1
CALL VDLIN ;DISPLAY IT
LD HL,EXTMSG ;PROMPT FOR EXTENSION
CALL VDLIN ;DISPLAY MESSAGE
RET
MSG002 LD HL,ENTMSG ;ENTRY POINT MESSAGE
CALL VDLIN ;DISPLAY MESSAGE
LD HL,ENT002 ;ENTRY POINT NAME #2
CALL VDLIN ;DISPLAY IT
LD HL,OPNMSG ;OPEN FILE MESSAGE
CALL VDLIN ;DISPLAY MESSAGE
RET
MSG003 LD HL,ENTMSG ;ENTRY POINT MESSAGE
CALL VDLIN ;DISPLAY MESSAGE
LD HL,ENT003 ;ENTRY POINT NAME #3
CALL VDLIN ;DISPLAY IT
LD HL,INITMS ;INITIALIZING FILE MSG
CALL VDLIN ;DISPLAY MESSAGE
RET
MSG004 LD HL,ENTMSG ;ENTRY POINT MESSAGE
CALL VDLIN ;DISPLAY MESSAGE
LD HL,ENT004 ;ENTRY POINT NAME #4
CALL VDLIN ;DISPLAY IT
LD HL,LRL1ST ;'FIRST' LOGICAL REC MSG
CALL VDLIN ;DISPLAY IT
LD HL,WRT001 ;WRITING LOGICAL REC MSG
CALL VDLIN ;DISPLAY MESSAGE
RET
MSG005 LD HL,ENTMSG ;ENTRY POINT MESSAGE
CALL VDLIN ;DISPLAY MESSAGE
LD HL,ENT005 ;ENTRY POINT NAME #5
CALL VDLIN ;DISPLAY IT
LD HL,LRL2ND ;'SECOND' LOGICAL REC MSG
CALL VDLIN ;DISPLAY MESSAGE
LD HL,WRT001 ;WRITING LOGICAL REC MSG
CALL VDLIN ;DISPLAY MESSAGE
RET
MSG006 LD HL,ENTMSG ;ENTRY POINT MESSAGE
CALL VDLIN ;DISPLAY MESSAGE
LD HL,ENT006 ;ENTRY POINT NAME #6
CALL VDLIN ;DISPLAY IT
LD HL,LRL3RD ;'THIRD' LOGICAL REC MSG
CALL VDLIN ;DISPLAY MESSAGE
LD HL,WRT001 ;WRITING LOGICAL REC MSG
CALL VDLIN ;DISPLAY MESSAGE
RET
MSG007 LD HL,ENTMSG ;ENTRY POINT MESSAGE
CALL VDLIN ;DISPLAY MESSAGE
LD HL,ENT007 ;ENTRY POINT NAME #7
CALL VDLIN ;DISPLAY IT
LD HL,LRL4TH ;'FOURTH' LOGICAL REC MSG
CALL VDLIN ;DISPLAY MESSAGE
LD HL,WRT001 ;WRITING LOGICAL REC MSG
CALL VDLIN ;DISPLAY MESSAGE
RET
MSG008 LD HL,ENTMSG ;ENTRY POINT MESSAGE
CALL VDLIN ;DISPLAY MESSAGE
LD HL,ENT008 ;ENTRY POINT NAME #8
CALL VDLIN ;DISPLAY IT
LD HL,LRL5TH ;'FIFTH' LOGICAL REC MSG
CALL VDLIN ;DISPLAY MESSAGE
LD HL,WRT001 ;WRITING LOGICAL REC MSG
CALL VDLIN ;DISPLAY MESSAGE
RET
MSG009 LD HL,ENTMSG ;ENTRY POINT MESSAGE
CALL VDLIN ;DISPLAY MESSAGE
LD HL,ENT009 ;ENTRY POINT NAME #9
CALL VDLIN ;DISPLAY IT
LD HL,CLOSMS ;CLOSING FILE MESSAGE
CALL VDLIN ;DISPLAY MESSAGE
RET
MSG010 LD HL,ENTMSG ;ENTRY POINT MESSAGE
CALL VDLIN ;DISPLAY MESSAGE
LD HL,ENT010 ;ENTRY POINT NAME #10
CALL VDLIN ;DISPLAY IT
LD HL,RDMSG ;READING FILE MESSAGE
CALL VDLIN ;DISPLAY MESSAGE
RET
MSG011 LD HL,ENTMSG ;ENTRY POINT MESSAGE
CALL VDLIN ;DISPLAY MESSAGE
LD HL,ENT011 ;ENTRY POINT NAME #11
CALL VDLIN ;DISPLAY IT
LD HL,LRL1ST ;'FIRST' LOGICAL REC MSG
CALL VDLIN ;DISPLAY MESSAGE
LD HL,RDLRL ;READING LOGICAL REC MSG
CALL VDLIN ;DISPLAY MESSAGE
RET
MSG012 LD HL,ENTMSG ;ENTRY POINT MESSAGE
CALL VDLIN ;DISPLAY MESSAGE
LD HL,ENT012 ;ENTRY POINT NAME #12
CALL VDLIN ;DISPLAY IT
LD HL,POSMSG ;POSITIONING MESSAGE

```

Listing continued

```

04040 CALL VDLINE ;DISPLAY MESSAGE
04050 RET
04060 MSG#13 LD HL,ENTMSG ;ENTRY POINT MESSAGE
04070 CALL VDLINE ;DISPLAY MESSAGE
04080 LD HL,ENT#13 ;ENTRY POINT NAME #13
04090 CALL VDLINE ;DISPLAY IT
04100 LD HL,LRL3RD ;'THIRD' LOGICAL REC MSG
04110 CALL VDLINE ;DISPLAY MESSAGE
04120 LD HL,RDLRL ;READING LOGICAL REC MSG
04130 CALL VDLINE ;DISPLAY MESSAGE
04140 RET
04150 MSG#14 LD HL,ENTMSG ;ENTRY POINT MESSAGE
04160 CALL VDLINE ;DISPLAY MESSAGE
04170 LD HL,ENT#14 ;ENTRY POINT NAME #14
04180 CALL VDLINE ;DISPLAY IT
04190 LD HL,REWMMSG ;REWINDING FILE MESSAGE
04200 CALL VDLINE ;DISPLAY MESSAGE
04210 RET
04220 MSG#15 LD HL,ENTMSG ;ENTRY POINT MESSAGE
04230 CALL VDLINE ;DISPLAY MESSAGE
04240 LD HL,ENT#15 ;ENTRY POINT NAME #15
04250 CALL VDLINE ;DISPLAY IT
04260 LD HL,LRLIST ;'FIRST' LOGICAL REC MSG
04270 CALL VDLINE ;DISPLAY MESSAGE
04280 LD HL,RDLRL ;READING LOGICAL REC MSG
04290 CALL VDLINE ;DISPLAY MESSAGE
04300 RET
04310 MSG#16 LD HL,ENTMSG ;ENTRY POINT MESSAGE
04320 CALL VDLINE ;DISPLAY MESSAGE
04330 LD HL,ENT#16 ;ENTRY POINT NAME #16
04340 CALL VDLINE ;DISPLAY IT
04350 LD HL,EOPMSG ;POSITIONING TO EOP MSG
04360 CALL VDLINE ;DISPLAY MESSAGE
04370 RET
04380 MSG#17 LD HL,ENTMSG ;ENTRY POINT MESSAGE
04390 CALL VDLINE ;DISPLAY MESSAGE
04400 LD HL,ENT#17 ;ENTRY POINT NAME #17
04410 CALL VDLINE ;DISPLAY IT
04420 LD HL,BKSPMS ;BACKSPACING MESSAGE
04430 CALL VDLINE ;DISPLAY MESSAGE
04440 RET
04450 MSG#18 LD HL,ENTMSG ;ENTRY POINT MESSAGE
04460 CALL VDLINE ;DISPLAY MESSAGE
04470 LD HL,ENT#18 ;ENTRY POINT NAME #18
04480 CALL VDLINE ;DISPLAY IT
04490 LD HL,LRL5TH ;'FIFTH' LOGICAL REC MSG
04500 CALL VDLINE ;DISPLAY MESSAGE
04510 LD HL,RDLRL ;READING LOGICAL REC MSG
04520 CALL VDLINE ;DISPLAY MESSAGE
04530 RET
04540 MSG#19 LD HL,ENTMSG ;ENTRY POINT MESSAGE
04550 CALL VDLINE ;DISPLAY MESSAGE
04560 LD HL,ENT#19 ;ENTRY POINT NAME #19
04570 CALL VDLINE ;DISPLAY IT
04580 LD HL,CLOSMS ;CLOSING FILE MESSAGE
04590 CALL VDLINE ;DISPLAY MESSAGE
04600 RET
04610 ;
04620 ;*****
04630 ; CLEAR BUFFER AREAS
04640 ;*****
04650 ;
04660 CLRBUF LD BC,LENGTH ;LENGTH OF STORAGE AREA
04670 LD HL,BUFFER ;START OF STORAGE AREA
04680 CLRLP XOR A ;CLEAR A REGISTER
04690 LD (HL),A ;CLEAR STORAGE AREA
04700 DEC BC ;DECREMENT BYTE COUNTER
04710 LD A,B ;IS CLEARING FUNC. DONE ?
04720 OR C
04730 INC HL ;GO TO NEXT LOCATION
04740 JR NZ,CLRLP ;NO, FINISH CLEARING BUFS
04750 RET
04760 ;
04770 ;*****
04780 ; PROVIDE DUMMY DATA FOR WRITE
04790 ;*****
04800 ;
04810 MOVDAT LD DE,UREC ;ADDRESS OF USER BUFFER
04820 LD A,8 ;LOOP COUNTER
04830 MOVLP1 LD HL,LRL#01 ;DATA TO BE MOVED
04840 LD BC,16 ;NUMBER OF BYTES TO MOVE
04850 LDIR ;MOVE THEM
04860 DEC A ;REDUCE LOOP COUNTER
04870 JR NZ,MOVLP1 ;FINISH DATA MOVE
04880 LD A,8 ;LOOP COUNTER
04890 MOVLP2 LD HL,LRL#02 ;DATA TO BE MOVED
04900 LD BC,16 ;NUMBER OF BYTES TO MOVE
04910 LDIR ;MOVE THEM
04920 DEC A ;REDUCE LOOP COUNTER
04930 JR NZ,MOVLP2 ;FINISH DATA MOVE
04940 LD A,8 ;LOOP COUNTER
04950 MOVLP3 LD HL,LRL#03 ;DATA TO BE MOVED
04960 LD BC,16 ;NUMBER OF BYTES TO MOVE
04970 LDIR ;MOVE THEM
04980 DEC A ;REDUCE LOOP COUNTER
04990 JR NZ,MOVLP3 ;FINISH DATA MOVE
05000 LD A,8 ;LOOP COUNTER
05010 MOVLP4 LD HL,LRL#04 ;DATA TO BE MOVED
05020 LD BC,16 ;NUMBER OF BYTES TO MOVE
05030 LDIR ;MOVE THEM
05040 DEC A ;REDUCE LOOP COUNTER
05050 JR NZ,MOVLP4 ;FINISH DATA MOVE
05060 LD A,8 ;LOOP COUNTER
05070 MOVLP5 LD HL,LRL#05 ;DATA TO BE MOVED
05080 LD BC,16 ;NUMBER OF BYTES TO MOVE
05090 LDIR ;MOVE THEM

```

Listing continued

register. The call to Read puts the fifth logical record into the user buffer UREC. A call to Look lets you view the new data in UREC.

With the reading of all the records complete, you can now reenter the program at label CLSENT, where a number of things happen in succession. You first want to close the file. Do so in the same manner in which you built the file, with the DE register pointing to the DCB and by executing a call to Close.

Since you no longer have any use for this file, you can also kill it. The only parameter you need to kill the file is to point the DE register to the DCB and make a call to the Kill routine. A successful kill operation returns the zero flag set.

To verify this, look at the disk directory to see that the directory no longer lists the file name. The subroutine KILL now sets the first 16 bytes of the DCB to zero.

The DSPDIR routine displays the disk directory. It needs only the drive number of the disk from which you want a directory, coded as an ASCII number in location 4271 hex. If you remember, you put the drive number in the location DRVNUM. Picking it up here and moving it to 4271 hex, followed by a call to DSPDIR, verifies that you killed TESTFILE/TST. The directory listing is abbreviated, showing only file names.

Now return to the demonstration program. Here, two messages indicate that you've closed and killed the file. Immediately following this, the program clears the screen and displays the directory.

Enter any character following the directory display to terminate the demonstration program with a jump to the TRSDOS entry point JP2DOS.

Two routines not covered in this program are VERF and CMDDOS. VERF is the same as Write except that after each write to disk, VERF reads the data to verify a proper write.

CMDDOS is similar to COMDOS except CMDDOS returns to the user's program after completing the routine. Of course, if you execute one of your programs from another program using this command, you must execute a final return to ensure that you make it possible to return. All the routines just covered are limited to accessing user generated files only. No system files are accessible. ■

Write to David G. Haan at 4361 S. Estes St., Littleton, CO 80123.

Listing continued

```

05100      DEC      A      ;REDUCE LOOP COUNTER
05110      JR      NZ,MOVLPS ;FINISH DATA MOVE
05120      RET
05130      ;
05140      ;*****
05150      ;      MESSAGES
05160      ;*****
05170      ;
05180      SIGNON  DEFM    'ASSEMBLY LANGUAGE DISK I/O '
05190      DEFM    'FOR THE TRS-80 MODEL III.'
05200      DEFM    @DH
05210      SPCMSG  DEFM    'ENTER FILENAME.'
05220      DEFM    @DH
05230      LKMSG  DEFM    'DO YOU WISH TO LOOK AT ANY DATA?'
05240      DEFM    @DH
05250      LRL001 DEFM    'LRL NUMBER ONE. '
05260      LRL002 DEFM    'LRL NUMBER TWO. '
05270      LRL003 DEFM    'LRL NUMBER THREE '
05280      LRL004 DEFM    'LRL NUMBER FOUR '
05290      LRL005 DEFM    'LRL NUMBER FIVE '
05300      EXTMSG  DEFM    'ENTER 3 CHARACTER EXTENSION (E.G. TST).'
05310      DEFM    @DH
05320      OPNMSG  DEFM    'ATTEMPTING TO OPEN FILE.'
05330      DEFM    @DH
05340      INITMS  DEFM    'INITIALIZING NEW FILE.'
05350      DEFM    @DH
05360      LRL1ST  DEFM    'FIRST '
05370      DEFM    @3H
05380      LRL2ND  DEFM    'SECOND '
05390      DEFM    @3H
05400      LRL3RD  DEFM    'THIRD '
05410      DEFM    @3H
05420      LRL4TH  DEFM    'FOURTH '
05430      DEFM    @3H
05440      LRL5TH  DEFM    'FIFTH '
05450      DEFM    @3H
05460      WRT001  DEFM    'LOGICAL RECORD BEING WRITTEN.'
05470      DEFM    @DH
05480      CLOSMS  DEFM    'CLOSING FILE.'
05490      DEFM    @DH
05500      RDMSG  DEFM    'THIS SECTION WILL INVOLVE '
05510      DEFM    'READING RANDOM LOGICAL RECORDS.'
05520      DEFM    @DH
05530      RDLRL  DEFM    'LOGICAL RECORD BEING READ.'
05540      DEFM    @DH
05550      POSMSG  DEFM    'POSITIONING TO THIRD LOGICAL RECORD.'
05560      DEFM    @DH
05570      BKSPMS  DEFM    'BACKSPACING ONE LOGICAL RECORD.'
05580      DEFM    @DH
05590      DRVMSG  DEFM    'FILE EXISTS ON DRIVE '
05600      DEFM    @
05610      DEFM    @DH
05620      FILMSG  DEFM    'FILE NUMBER IS '
05630      FILNUM  DEFM    @
05640      DEFM    @DH
05650      REWMSG  DEFM    'REWINDING FILE.'
05660      DEFM    @DH
05670      EOPMSG  DEFM    'POSITIONING TO END OF FILE.'
05680      DEFM    @DH
05690      KILMSG  DEFM    'KILLING FILE.'
05700      DEFM    @DH
05710      ENDMMSG DEFM    'END OF DEMONSTRATION PROGRAM...'
05720      DEFM    'PRESS ANY KEY TO CONTINUE.'
05730      DEFM    @DH
05740      ENTMSG  DEFM    'REENTRY POINT IS AT PROGRAM LABEL '
05750      DEFM    @3H
05760      ENT001  DEFM    'EXTEND.'
05770      DEFM    @D0AH
05780      ENT002  DEFM    'OPNFIL.'
05790      DEFM    @D0AH
05800      ENT003  DEFM    'NEWFIL.'
05810      DEFM    @D0AH
05820      ENT004  DEFM    'WRTFIL.'
05830      DEFM    @D0AH
05840      ENT005  DEFM    'WRT002.'
05850      DEFM    @D0AH
05860      ENT006  DEFM    'WRT003.'
05870      DEFM    @D0AH
05880      ENT007  DEFM    'WRT004.'
05890      DEFM    @D0AH
05900      ENT008  DEFM    'WRT005.'
05910      DEFM    @D0AH
05920      ENT009  DEFM    'CLOSFL.'
05930      DEFM    @D0AH
05940      ENT010  DEFM    'GTSPCL.'
05950      DEFM    @D0AH
05960      ENT011  DEFM    'READ01.'
05970      DEFM    @D0AH
05980      ENT012  DEFM    'POSENT.'
05990      DEFM    @D0AH
06000      ENT013  DEFM    'READ02.'
06010      DEFM    @D0AH
06020      ENT014  DEFM    'REWENT.'
06030      DEFM    @D0AH
06040      ENT015  DEFM    'READ03.'
06050      DEFM    @D0AH
06060      ENT016  DEFM    'EOPENT.'
06070      DEFM    @D0AH
06080      ENT017  DEFM    'BKENT.'
06090      DEFM    @D0AH
06100      ENT018  DEFM    'READ04.'
06110      DEFM    @D0AH
06120      ENT019  DEFM    'CLSENT.'
06130      DEFM    @D0AH
06140      EXECUT  DEFM    'DEBUG'
06150      DEFM    @DH
06160      END      START

```

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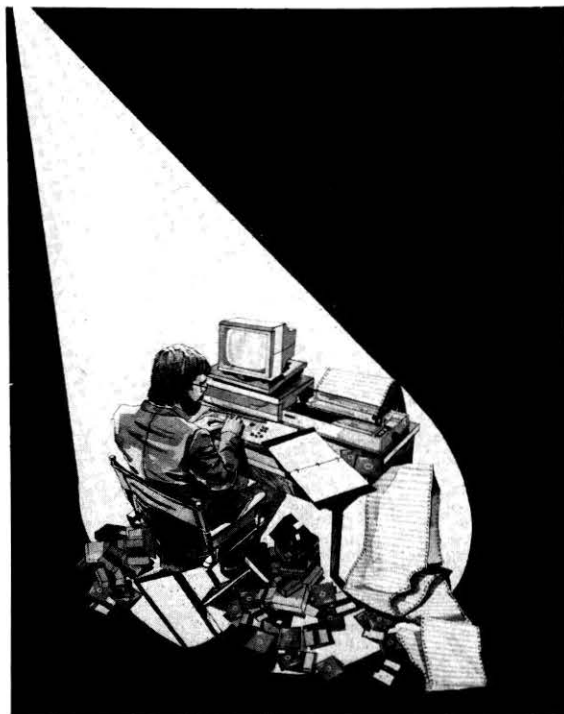
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The PRODUCER can be the time-saver you need to increase your productivity and make your job easier. The PRODUCER provides many of the advanced features found on products that cost many thousands of dollars more. You'll be proud to show your clients the professional quality programs created by The PRODUCER.



Listen to what one of our users wrote recently:

The PRODUCER has proven to be the greatest. I used to spend 70% of my time writing programs to create, maintain, sort, and list data. No More. Days and weeks of programming are now reduced to minutes and hours. The PRODUCER has increased the productivity of my custom software firm by 400%. This product is in a class reserved for the best.

A. Copelle, Northbrook, Illinois.

HOW DO I LEARN TO USE THE PRODUCER

In each TRS-80 version, we have provided a systematic guided tour of The PRODUCER program generator process. For the Model I and III, an audio cassette tape tutorial is part of your package. One of your fellow PRODUCER owners talks to you as you go through the step-by-step lessons. The tapes not only teach you the operating process, they enable you to actually create a program of your own design while you learn.

We have provided over 200 pages of thorough documentation in The PRODUCER Reference Manual, but we encourage you not to read the manual until after you have completed the tutorial. We've had many rave reviews from our users, like this one from S.R. Foster of Pensacola, Florida:

The tutorial was an excellent starter. It enabled me to get on with it without days and days of reading. Very helpful.

WHAT DO YOU GET WITH THE PRODUCER?

You will be impressed with the professionalism of the PRODUCER package:

DISKETTE(s) containing PRODUCER Program Development System.

REFERENCE MANUAL of over 200 pages of extensive, easy to read, well organized material. Attractive hardback 3-ring binder. Color keyed index tabs separate the chapters. Comprehensive alphabetical Index refers to specific chapter subsections.

QUICK REFERENCE CARD
REGISTRATION CARD

TUTORIAL SESSION including audio cassettes and detailed follow-along outline, written and produced by fellow PRODUCER user.

FREE HOME INVENTORY MANAGEMENT PROGRAM (\$59.95 value as a sample) allowing you to use a finished program immediately.

ONE YEAR SUBSCRIPTION to the PRODUCER newsletter

TOLL FREE NUMBER for technical assistance, available only to registered PRODUCER owners.



Pictured are the components of the Model III version of The PRODUCER. Other versions may vary slightly.



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HOW THE PRODUCER WORKS

We think you will be impressed with the ease of operation and the amazing versatility of features you get with the PRODUCER. Here is a step by step overview of the program writing process. The screen shown is an unretouched photo of the Master Menu from which each of these steps is selected.

Planning Your Program

The PRODUCER provides a helpful planning form you can print on your own printer. It helps you organize your thoughts to create a tailor made program to meet your needs.

Creating The Screen

Visible on your monitor will be the screen where information will be entered, edited and displayed. There are six simple steps to follow in creating your screen.

1. Draw Your Screen

Using the arrow keys construct the screen in any configuration you desire. With single strokes, enter large graphic letters and borders. Edit at will until you are satisfied.

2. Define Message Areas

Select an area of your screen where The PRODUCER messages to you will appear.

3. Define Input Fields

The PRODUCER will ask you questions about the areas where you will enter the data. You specify the length of each area or field, as well as acceptable characters in each field.

4. Define Display Fields

Locate the display fields anywhere you want on your screen. These show the results of the calculations you want made on your data.

5. Define Custom Prompts

You select an area where help messages to yourself can be displayed.

6. Save Your Results

Assign a working name for your program and save it to disk.



Editing Basic Data

1. Edit any part of The PRODUCER program you have created -- screen field names, lengths, prompt areas, etc.
2. Type in any help message you want as a custom prompt to help you operate the program.
3. Easily create calculations for your program using actual field names. You can use the contents of any numeric field and all math operations including logical operators.

Making Basic Code

Press a key, sit back and watch The PRODUCER do all the work of creating BASIC code for your program. You can see the program lines appear on your screen. Complete error-checking is done for you.

Building Reports

Virtually any report is available to you thru our NEW free form report generator. It works with any size paper. You are allowed up to 100 calculations within the report. You can specify exact position of any text information to any position on your paper (even preprinted forms, checks, etc.). An amazingly versatile tool.

Building The Program

Put the finishing touches on your program by selecting cursor type, size, flashing speed, auto messages, custom logos, etc. After your selections have been made, press a key and your entire finished program is created in less than 5 minutes. That's all there is to this remarkably simple program generation process.

Continued

TECHNICAL INFORMATION

The PRODUCER provides many advanced features which allow you to do "magic" with the programs you create.

The SCREEN GENERATOR

- *Use the full screen (all lines and column positions)
- *Create a professional well organized screen with graphics
- *Save up to 9 separate screens in memory at one time and get instant access to each
- *Move the cursor to any location on the screen
- *Replicate bars/lines/graphics to define certain screen areas
- *Access an instantly available Help Menu of all Screen Editor commands
- *Insert and delete any character with a single keystroke
- *Clear or erase selected areas of any screen
- *Insert and delete whole lines on the screen
- *Center any text on the screen
- *Move any rectangular block of text anywhere on the screen (block move)
- *Create titles with a single keystroke large graphic letter alphabet
- *Move portions of screens between different screens (cut and paste)
- *Save any number of screens to disk at any time
- *Recall any screen from disk any time
- *Create BASIC lines to re-create any screen

FILE and RECORD HANDLING

- *Rapidly access records with BTREE File structure
- *Search for a record with only the first few letters of the name or key (partial key) (Example: locate PRODUCER by typing PR)
- *Recall and edit duplicate and multiple keys (Example: Several last names may be the same on a file and you can find and edit them individually)
- *Fully edit any part of a previously entered record
- *Recover unused space automatically upon deletion of a record
- *Enter data very fast with the special batch mode
- *Recall immediately any record after it's been entered, eliminating time consuming sorting and indexing
- *Rapidly access any record anytime (2-4 seconds average)
- *Globally search and replace data in certain fields in selected record range
- *Automatically rebuild any file to meet new specifications. No need to re-enter data when a file needs to be restructured.
- *Balance any BTREE file automatically to reorganize and speed up file access time
- *Recover from power failure and easily rebuild files that have been damaged. Avoid laborious re-entry of long data files

SCREEN ORIENTED INPUT and EDITING of DATA

- *Insert and delete characters at any position in any field. No "back to start" retyping of data
- *Move forward or back to previously entered fields to edit using the arrow keys. Totally non-destructive cursor. Does not require re-entering of each data field
- *Move within any field using the arrow keys
- *Move instantly to any field with Control G command
- *Exit from input/edit mode at any point allowing immediate escape from data entry mode. Allows partial information to be entered for each record without the annoying, time consuming need to press ENTER for each blank field not used at the time of entry
- *Duplicate field information from a previous record with one keystroke. No need to re-enter duplicate information, addresses, etc. on consecutive records
- *View a custom prompt, your own custom reminder or help message for each field with 1 keystroke
- *Verify each character typed automatically
- *Enter data as fast as you want, even if you are a speed typist
- *View visible display of automatic field length restrictions
- *View prompts for each field showing number of characters allowed

PRINTED REPORTS

- *Create up to 9 separate reports at a time in a finished program
- *Generate any number of reports you want (no limit)
- *Select reports by name from a report menu in the program
- *Select from six different automatic report formats including custom mailing labels
- *Instantly print reports by key with no time consuming sort necessary
- *Sort and print any other (non key) field with the fast machine language sort
- *Sort only records that meet your search criteria
- *Sort on more than one field if desired
- *Use any restrictions or search criteria to determine which records will be included in a report
- *Use any number of multiple search criteria (including logical) (Example: You can search for all the males who are single, and drive a car that are over 24 years old but less than 35 years old)
- *Send any special command to your printer before or after any report
- *Specify any line length needed and any page length desired
- *Select single line or multiple lines per record, even one page per record
- *Total any fields during the report (running totals)

FREEFORM REPORT GENERATOR

Optional at only \$49.95

- *Specify column and row of every heading and field
- *Allow up to 100 of interfield calculations, even string calculations
- *Include any text anywhere on the screen
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- *Format any numeric fields anyway you wish
- *Print reports on pre-printed forms, checks, etc.
- *Create form letters with merged field data, with no word processing necessary
- *Put any field anywhere on the page. No limitations

ADVANCED CALCULATIONS

- *Globally recalculate any field in any or all records. (Example: If file is a list of gold assets and the spot price changes, each separate asset may be recalculated with a new value for the spot price)
- *Use all math operations including exponentiation and trigonometry
- *Use logical calculations such as And, Or, Not, etc.
- *Use any level of parenthesis in calculation formulas
- *Save results in any field and display results in any field
- *Store temporary results in several extra memory slots
- *Pass calculation results between records
- *Determine the exact order of calculations
- *Display or save results at your option in the finished record

OTHER ADVANCED FEATURES

- *Edit any part of any program without starting over or redefining the entire program
- *Create screen and input modules only (for professional programmers)
- *Create Calculate-only programs with the easy desk-top super calculator program
- *Design custom logos for your program
- *Control cursor type, size, flash speed, etc.
- *Design custom prompts or help info for any field

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- *FREE 1 year SUBSCRIPTION to PRODUCER Newsletter
- *TOLL FREE assistance number for all registered users
- *REFERENCE MANUAL of over 200 pages
- *FREE audio TUTORIAL

The
PRODUCER

WHAT ARE PRODUCER USERS SAYING?

We continue to receive testimonials from satisfied users almost every day. Here's a sampling of the feedback we are receiving:

VALUE

VERY impressive! No matter how much I use the PRODUCER, there is no doubt I got my money's worth. It is clear the program, packaging and tutorial are developed with lots of thought....Very user friendly! Congratulations!

R. N. Forbes, Los Altos Hills, California

The PRODUCER package I received was excellent. The finest software package I have ever purchased. Far beyond my expectations.

S. R. Foster, Pensacola, Florida

I think the PRODUCER will save me so much time that it will give me the time to do the more important tasks that my business calls for and the money I'll save from not having to buy canned programs that are overpriced. Now with the PRODUCER I can write a program overnight to do almost anything I want it to do and with written reports to boot. Talk about saving time and money. I feel the PRODUCER will pay for itself with my first three programs.

S. Tornatore, Canastota, New York

The PRODUCER is a very impressive software package. It is well worth the money. While other micro owners are printing mailing labels, I am now selling them programs to use. I now have more time to spend enjoying my computer.

V. E. Ryberg, Bloomington, Illinois

I'm in love with the PRODUCER. It's one of my favorite programs.

R. Selsback, Burlingame, California

It was very complete and professionally done. The packaging and program seem to have been thought out before assembly and sale. The 'value' of the deal, everything included was the best I've seen to date.

G. Slusher, Martin, Kentucky

Very professional packaging. It gave the feeling of getting your money's worth before even running the program...Very easy to use and leaves very few questions unanswered...As you can see, I like the PRODUCER and was impressed with how trouble free it is.

A. C. Vincent, Napa, California

Excellent. Above and beyond other software.

R. Haggood, Henrietta, Texas

VERSATILITY

The PRODUCER is the best all purpose program generator I have used. (We have tried almost all of them.) The generated code is bug free, well commented and efficient.

R. A. Copella, Northbrook, Illinois

I bought the PRODUCER to save time. I feel capable of being able to write almost all programs I need. The PRODUCER generated programs will save a lot of time writing basic code and debugging. Using the PRODUCER I can write a good database type program using math calculation in about three hours. I don't have to tell you how long it would take writing the same program from scratch.

S. Tornatore, Canastota, New York

A special thanks to Roger and all of you. You've made my computing life easier and better. My 10 year old can't wait to get his hands on the PRODUCER.

J. D. Konkler, Columbus, Ohio

DOCUMENTATION

The Reference Manual is a work of art. Not only is it attractive and easy to use, it is so well organized, documented and logically written that the manual is a rarity in the software market place.

S. R. Foster, Pensacola, Florida

One of the best I've seen. We write about 20 volumes of material per year. Take it from a 'pro', it's good!

J. Crespi, Sherman Oaks, California

The PRODUCER Reference Manual is professionally written to provide ready access to easily understood answers to questions which arise during use of the PRODUCER.

R. A. Copella, Northbrook, Illinois

The Reference Manual is supreme and superior to anything I have worked with.

R. A. Neuman, Okemos, Michigan

Very well laid out and organized. One of the best I've seen.

J. D. Konkler, Columbus, Ohio

QUALITY

Thank you for an excellent program. I agree that The PRODUCER will change the entire concept of program creation in the future. But for now, you stand as the best data-base-management-system I can buy.

E. Sung, Vancouver, B.C.

Your system really is Software of the Future. Your staff has insight others of us only dream of. Congratulations on a product of extraordinary design.

S. R. Foster, Pensacola, Florida

This is an excellent program. At this point I am totally pleased. This is by far my number one software and I will use it anywhere and everywhere I possibly can both personal and business. Once again congratulations to all of the people involved.

R. A. Neuman, Okemos, Michigan

Comparison shopping indicates the PRODUCER's superiority to all others. And I already own most of the others.

R. A. Copella, Northbrook, Illinois

Glad to see you take an interest in what some of us hackers are up against. I think the PRODUCER will make the software hackers upgrade their products to this high level quality of the PRODUCER. I'm sure you realize that there is a lot of garbage on the market.

D. J. Smith, Lombard, Illinois

I was impressed by the professional appearance of your program. Other software I have received were on copy paper and stapled into a booklet with very vague instructions.

W. J. Mahaffey, Absecon, N. J.

USE

The program is almost idiot proof.

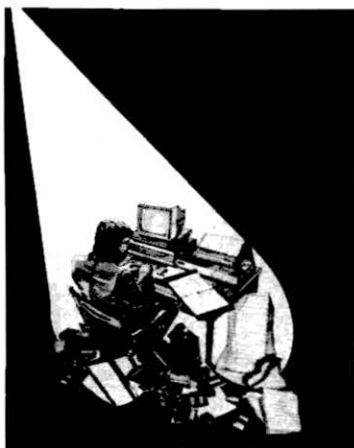
J. Crespi, Sherman Oaks, California

It is a very friendly friend and we will be working together for some time to come.

R. A. Neuman, Okemos, Michigan

Very easy to use and leaves very few questions unanswered.

A. C. Vincent, Napa, California



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Finding the Search Solution

by Joseph E. Trojak

These two Assembly-language programs use signature screening techniques that help you easily maintain and search large text files.

If you have large text files that require efficient indexing and searching methods, Mindex and Search can help. Potential applications for these programs include indexing personal literature collections, client or patient records, mailing lists, card catalogs, and so on.

Most information retrieval programs for microcomputers use sequential searching techniques that are exceedingly slow, or use indexing systems that require laborious coding of key words. Mindex and Search use a method that quickly searches large files of text and avoids the problem of coding key words: signature screening.

The first part of this article reviews file searching techniques and explains the signature screening method. The second part describes how to apply the signature screening method to 8-bit microcomputers, and lists the Assembly-language source code for Mindex and Search.

Both programs run on the Models II,

12, 16, and III with 48K RAM and one or more disk drives.

First, a few basic definitions. A key is that part of a record that identifies the record during a search. Primary keys uniquely specify a record. For example, when each record in a file contains the name, address, age, and social security number of a client, the social security number is a primary key for each record. It lets you call up a single, unique record.

Neither the name, address, nor age is sufficient to uniquely specify a record, so each is termed a secondary key or attribute. To avoid confusion I'll use the term search key to refer to the item you're searching for, and the term record key to denote the part of the record you're searching.

File Searching Techniques

Sequential Search

This is the simplest search technique. You start at the beginning of a file and compare every record key in the file with the search key until you find a match or the end of the file.

An example of this searching technique is that employed by a slow-witted detective who has a telephone number and needs to find the name and address of the person who leases the telephone line. The detective gets a telephone book, starts at page one, and compares every telephone number with the one he is searching for until he finds the exact number.

If the detective is lucky, the name begins with A; if he is very unlucky, it begins with Z. Most detectives would just dial the number and ask questions.

Binary Attribute Search

In this search technique, each record has a number of attributes (secondary keys), each of which has only two possible values: yes or no (true or false). Given a set of attributes, you can find all the records with these attributes by

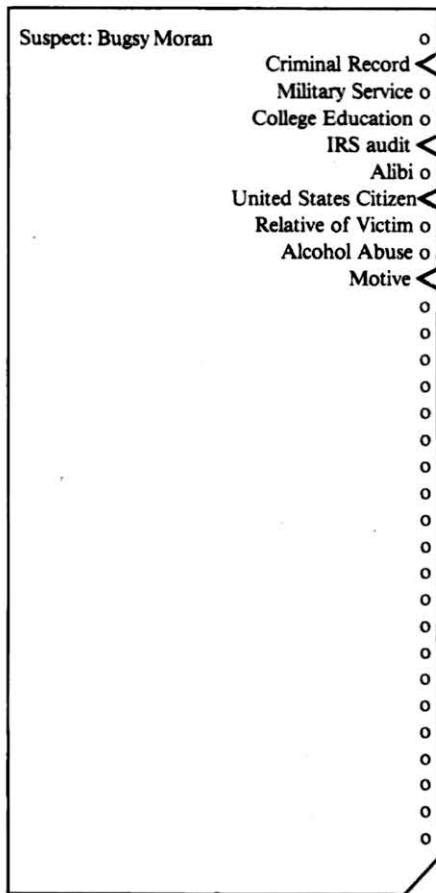


Figure 1. Edge-notched card for suspect Bugsy Moran.

The Key Box

Models II and III
64K RAM
Assembly Language
Radio Shack Assembly Language
Development System (ALDS) or
EDTASM

comparing corresponding true and false values.

Our detective has a list of 200 suspects in a case on which he is working, and has the following information on each suspect: criminal record, military service, college education, IRS audit, alibi at time of crime, United States citizen, relative of victim, history of alcohol abuse, and motive for the crime. He wants to find all suspects who have a criminal record, no alibi, and a motive.

He goes to his local stationery store, purchases edge-notched cards, and codes them as shown in Fig. 1. Each attribute has a hole at the edge of the card. If an attribute is true, a notch is cut out of the card next to the attribute; otherwise the hole is left intact.

In Fig. 1, you can see that Bugsy Moran has a criminal record, no alibi, and a motive. Our detective makes his search in the following way: He arranges all 200 cards in a deck and puts a needle through the holes for the alibi attribute, then lifts the deck by raising the needle. All records of suspects with alibis fall out of the deck and he can exclude them.

Automobile Model	Notch Code
Buick	99 21
Cadillac	54 83
Chevrolet	41 78
Chrysler	07 31
DeSoto	67 81
Dodge	46 15
Edsel	66 10
Ford	73 09
Hudson	32 77
Lincoln	28 41
Mercury	12 88
Nash	34 89
Oldsmobile	59 42
Packard	44 75
Pontiac	74 28
Plymouth	57 71
Rambler	93 14
Rolls Royce	61 85
Studebaker	01 94
Volkswagen	57 39

Automobile Color	Notch Code
Black	40 74
Blue	02 77
Brown	04 14
Chartreuse	15 80
Gray	69 52
Green	23 94
Maroon	29 44
Red	39 15
White	70 96
Yellow	59 20

Table 1. Superimposed notch codes for automobile model and color.

The detective takes the cards that didn't fall out and puts needles into the holes for the criminal history and motive attributes. When he lifts the needles, all records of suspects with a criminal past, no alibi, and a motive for the crime fall out. This amounts to 10 cards; he has narrowed his search to 10 out of 200 suspects.

You can consider the holes and notches in the edge-notched card as a string of bits. For any attribute, the bit is either zero (the hole is intact) or 1 (the card has a notch). The attribute bit string of each record is called the record's signature and is an index of the

record's attributes.

Binary Attribute Search of Superimposed Codes

This technique is similar to the simple binary attribute search except that the signature has more attributes than bits. The principle is to map a set of m binary attributes from a record into a set of n codes, then superimpose the codes for each attribute onto an n-bit signature.

Our detective is so enamored with his success in pruning his suspect list, he decides to use edge-notched cards for another purpose. In his state, automobile license numbers comprise three two-

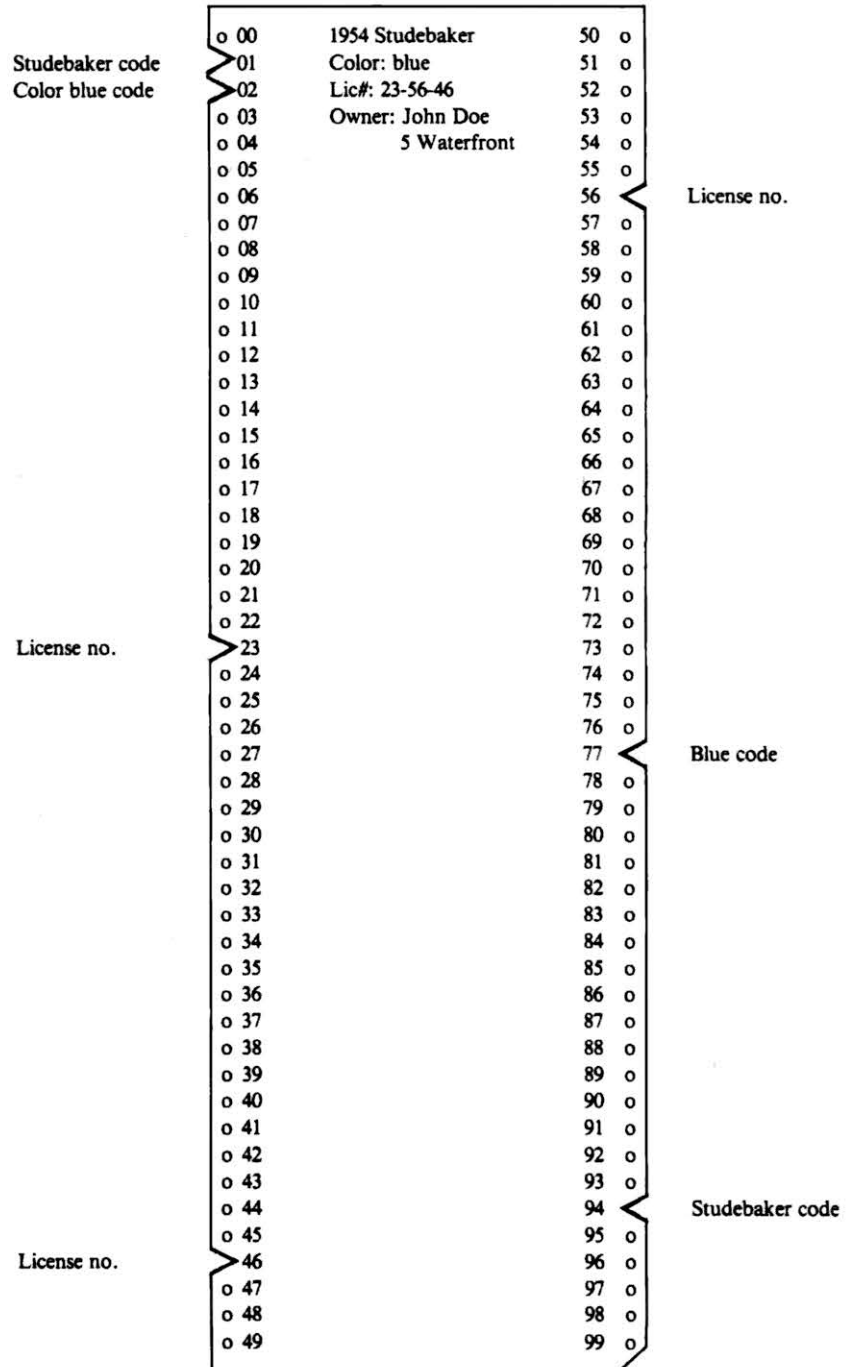


Figure 2. Edge-notched card for a blue Studebaker with license number 23-56-46.

digit numbers (72-54-81). There are one million possible license numbers.

Often, a witness to a crime remembers only one or two of the pairs of digits, so our detective devises a method that lets him quickly determine the owner of a vehicle when he knows only part of a license number.

He buys cards with 100 holes and uses the following coding technique: He numbers the holes in the card zero to 99. For each pair of digits in the license number, he makes a notch corresponding to the number in the appropriate card hole (Fig. 2). Additionally, he codes 20 models and 10 car colors as

shown in Table 1.

The detective obtains a registration list from the Department of Motor Vehicles (DMV) and starts to code all the information about 200,000 automobiles in his city onto cards. One year later, just as he finishes his task, he gets a call from a client whose TRS-80 was stolen.

The client saw the get-away car (a blue Studebaker) drive off, but could read only the first and last pairs of digits from the license plate. The DMV computer is broken so the police can't search the motor vehicle registry data base until tomorrow, but the client needs his computer today.

The detective takes his cards, puts them in a neat deck, then places very long needles through the holes corresponding to the digit pairs 46 and 23, the color blue, and the automobile model Studebaker. Three cards fall out of a deck of 200,000 cards. The detective sequentially searches the three cards and finds that only two are Studebakers. He has narrowed his search from 200,000 to two.

Both Studebakers are blue: one with license number 46-79-23 and the other 23-46-42. The model and color codes are the same and the detective specified only two of the three possible two-digit numbers from the license (23 and 46), so the signatures of both automobile records fit the search.

But why did the third car, a green Dodge, also fall out? The code for the color green is 23 94 and the code for the model Dodge is 46 15. The green Dodge that fits the search key had license number 77-01-02. The notches in the card (23, 94, 46, 15, 01, 02, 77) corresponded to every needle placed in the deck (Fig. 3), so the card fell out along with the two Studebaker cards.

The detective used a primitive coding scheme. Elaborate methods have been developed for both edge-notch cards and bit-string computer searches. Signature screening, which you'll use to search text files, is a variation on the method the detective employed.

Tree Search

In tree searching techniques, records are arranged in some order (numerical, alphabetical, and so on). Either the records within the data file are ordered, or a separate index file contains ordered information (keys) that points to the appropriate records in a file.

You start searching anywhere in the file. If your search key doesn't match a record key, you move your search closer to the beginning or end of the file depending on whether the search key is greater or less than the key of the record just searched.

As an example of this searching technique, consider the slow-witted detective. This time he has a suspect's name (John Smith) and wants to know where the suspect lives. Since names in the telephone book are ordered (sorted alphabetically), the detective uses the following search algorithm.

He opens the telephone book to the middle and finds names beginning with the letter K. He knows that the letter S is between K and Z, so he divides the remaining pages in half and finds names beginning with R. One more division

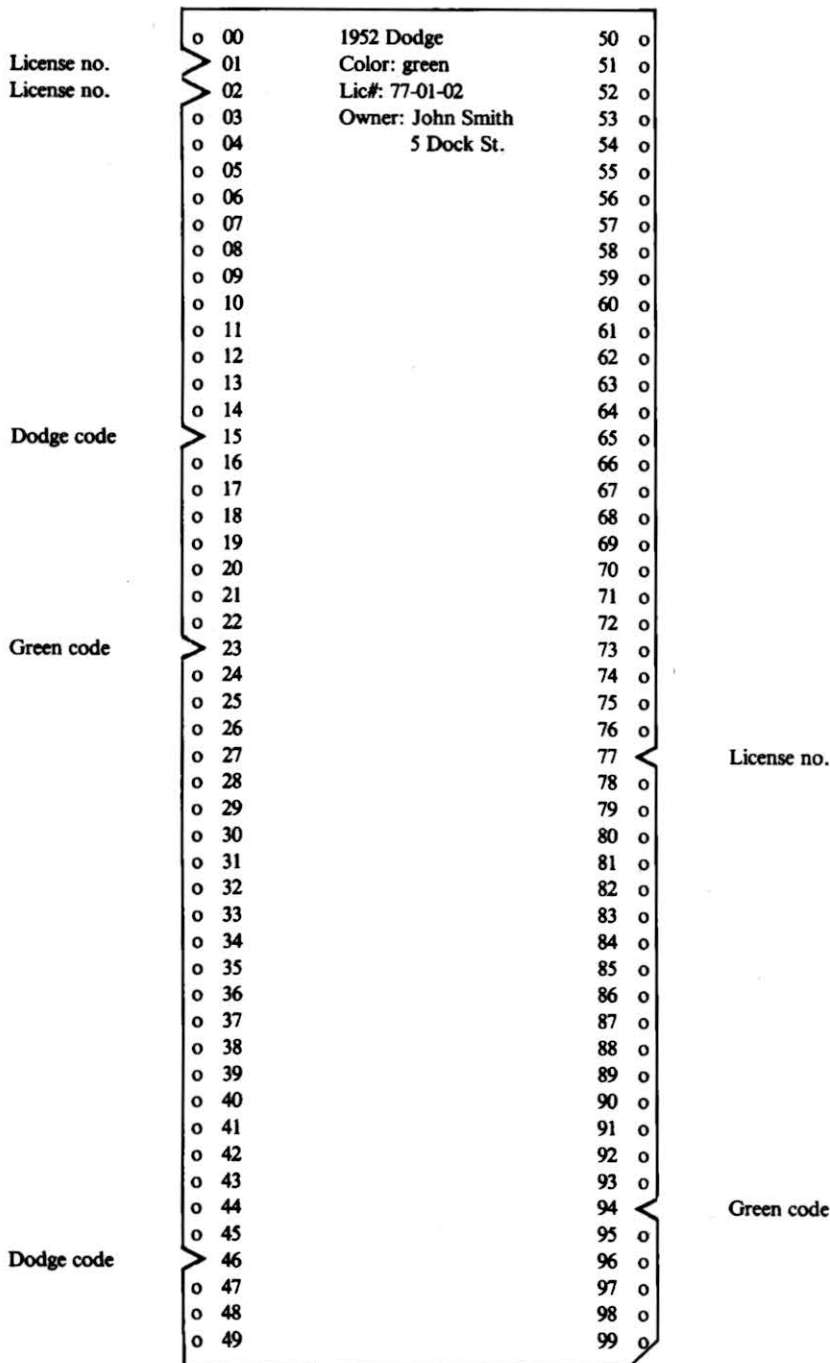


Figure 3. Edge-notched card for a green Dodge with license number 77-01-02.

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and search, and he finds names beginning with T.

He continues his search in the opposite direction, and after five more divide-and-search sequences he locates 25 John Smiths. The detective could have made his search more efficient if he had used information he already possessed: his knowledge that names beginning with S are closer to the back of the telephone book than to the front.

The many different tree searching techniques include binary searches, indexed sequential access methods, and so on. All require that the information you're searching for have some order so that comparisons between a search key and a record key determine in which direction the search branches (toward the beginning or end of a file).

Hash Search

In hash searching techniques, you can store the source file records in any order. The hash searching program performs a sequence of mathematical operations (hash functions) on the search key, and produces a value that points to the appropriate record.

The detective has decided that he must use high technology to keep up with the competition. He buys a Model 12 and a 12-megabyte hard disk drive, has a data-entry clerk type all the infor-

mation from the telephone directory into one large file, then hires a high school student to write a data retrieval program that quickly searches the file by name, number, or address.

The student realizes that sequential search techniques are too slow and that Microsoft Basic doesn't support ISAM files. She writes a program to convert every name into a code that indicates where the program stores the record in the file.

The hash function is simple: The ASCII values of the characters comprising an individual's name are multiplied together, then divided by 200,001. The remainder of the division is the record number at which the program stores the name, address, and telephone number. Formally,

$$h(k) = (\prod a_i) \text{ mod } 200,001$$

where h is the hash function, k is the key

Because the program listings in this article are so long, we had to print them at a size smaller than usual. We apologize for any inconvenience this causes.

To buy these programs on disk, see the ordering instructions on p. 204.—Eds.

(in this case the person's name), n is the number of letters in the person's name, and a_i is the ASCII value of the i th character in the person's name. π is the product $a_1 \cdot a_2 \cdot \dots \cdot a_n$ and mod is the modulus of the quantity in parentheses (the remainder after the number in parentheses is divided by 200,001).

The student finishes her task and goes away for summer vacation. The detective needs to find the address of James Joyce. He sits down at his computer and types in the search key, "James Joyce". Instantly a name, telephone number, and address appear on the video display. Unfortunately, the name is Joyce James, not James Joyce. Our detective has experienced a collision—two distinct record keys hashed to the same number.

The detective is disappointed and afraid that he'll have to use the telephone book. Then he notices a message at the bottom of the screen: "Press N for next record". He presses N. The computer pauses for a brief moment and displays the name James Joyce. The student incorporated a collision-handling routine into her program.

Signature Screening

Tree and hash searching methods are appropriate for records that contain specific fields (name, address, tele-

```

Ln #      Source Line
00001 ;MINDEX2/SRC...1.2
00002 ;Mar 05, 1983
-----
00003 ;
00004 ;MINDEX INDEXING PROGRAM FOR MODEL II
00005 ;MASTER SECTION: links main program with Model II I/O routines
00006 ;COPYRIGHT 1983, SOFTSHELL CORPORATION ALL RIGHTS RESERVED
00007 ;
00008 ;
00009 ;
00010 ;
00011 ;
00012 ;
00013 ;
00014 ;
00015 ;
00016 ;
00017 ;
00018 ;
00019 ;
00020 ;
-----
00010 PROG11 PSECT      ;begin relocatable program section
00011 START JP BEGIN ;BEGIN = start of M3
00012 LINK 'M3/REL' ;main program
00013 ;note: the program is called M3 because it
00014 ;was originally developed on Model III
00015 ;In its current form it will work with
00016 ;Model II or III given the proper I/O
00017 ;module
00018 LINK 'GR/REL' ;general programs
00019 LINK 'MOD11/REL' ;Model II I/O routines
00020 END START

```

Program Listing 1. Assembly-language listing of Mindex2/SRC.

```

Ln #      Source Line
00001 ;SEARCH2/SRC...1.2
00002 ;Mar 05, 1983
-----
00003 ;
00004 ;SEARCH PROGRAM FOR MODEL II
00005 ;MASTER SECTION: links S3, GR, S3OPEN, S3DSP, S3OPT and MOD11
00006 ;COPYRIGHT 1983, SOFTSHELL CORPORATION ALL RIGHTS RESERVED
00007 ;
00008 ;
00009 ;
00010 ;
00011 ;
00012 ;
00013 ;
00014 ;
00015 ;
00016 ;
00017 ;
00018 ;
00019 ;
00020 ;
00021 ;
00022 ;
00023 ;
00024 ;
00025 ;
-----
00010 PROG11 PSECT      ;begin relocatable program section
00011 ;
00012 ;
00013 ;
00014 ;
00015 ;
00016 ;
00017 ;
00018 ;
00019 ;
00020 ;
00021 ;
00022 ;
00023 ;
00024 ;
00025 ;
-----
00010 EXTERN BEGIN ;BEGIN = start of S3
00011 ;
00012 START JP BEGIN
00013 LINK 'S3/REL' ;SEARCH program proper
00014 ;note: the program is called
00015 ;S3 because it was originally
00016 ;developed on the Model III
00017 ;In its current form it will
00018 ;work with Model II or III
00019 ;given the proper I/O module
00020 LINK 'GR/REL' ;general routines
00021 LINK 'S3OPEN/REL' ;SEARCH open files routine
00022 LINK 'S3DSP/REL' ;SEARCH display
00023 LINK 'S3OPT/REL' ;SEARCH options
00024 LINK 'MOD11/REL' ;Model II I/O routines
00025 END START

```

Program Listing 2. Assembly-language listing of Search2/SRC:1.

Program Listing 3. Assembly-language listing of MOD11/SRC.

```

Ln #      Source Line
00001 ;MOD11/SRC VERSION 1.2
00002 ;Jun 21, 1983
-----
00003 ;
00004 ;MOD11 PSECT ;Model II I/O routines
00005 ;
00006 ;
00007 ;
00008 ;
00009 ;
00010 ;
00011 ;
00012 ;
00013 ;
00014 ;
00015 ;
00016 ;
00017 ;
00018 ;
00019 ;
00020 ;
00021 ;
00022 ;
00023 ;
00024 ;
00025 ;
-----
00010 PROG11 PSECT      ;begin relocatable program section
00011 ;
00012 ;
00013 ;
00014 ;
00015 ;
00016 ;
00017 ;
00018 ;
00019 ;
00020 ;
00021 ;
00022 ;
00023 ;
00024 ;
00025 ;
-----
00010 EXTERN BEGIN ;BEGIN = start of S3
00011 ;
00012 START JP BEGIN
00013 LINK 'S3/REL' ;SEARCH program proper
00014 ;note: the program is called
00015 ;S3 because it was originally
00016 ;developed on the Model III
00017 ;In its current form it will
00018 ;work with Model II or III
00019 ;given the proper I/O module
00020 LINK 'GR/REL' ;general routines
00021 LINK 'S3OPEN/REL' ;SEARCH open files routine
00022 LINK 'S3DSP/REL' ;SEARCH display
00023 LINK 'S3OPT/REL' ;SEARCH options
00024 LINK 'MOD11/REL' ;Model II I/O routines
00025 END START

```

Listing 3 continued

String	He ran down the lane						
Triplets	ran	dow	own	the	lan	ane	
Hash value	181	185	101	191	83	108	
String	Jill walks up the lane						
Triplets	jil	ill	wal	alk	lks	the	lan
Hash value	212	142	177	94	188	191	83
String	The goat ran up the lane						
Triplets	The	goa	oat	ran	the	lan	ane
Hash value	191	212	138	181	191	83	108

Table 2. Three strings, their corresponding triplets, and hash values.

phone number, and so on). Text, however, does not lend itself readily to such indexing, and many text searching programs still employ sequential search techniques.

In 1971, M.C. Harrison proposed a method to speed up searching large text files ("Implementation of the Substring Test by Hashing." Comm. Assoc. Computing Machinery. 14:777-779, 1971). The idea is simple: Before searching a string of text for a particular key, perform a quick screening test to determine whether the key is not present or possibly present.

If the test determines that the key isn't present in a string, you don't need to search that string. If the test is positive (the string might be present), a sequential search determines if the key is actually present in the string. I refer to this method as signature screening.

The following method is an extension of that which Harrison proposed. It's designed for use on 8-bit machines that read 256-byte disk sectors. Each record consists of a string of ASCII characters.

The search program considers every three sequential characters (triplet) of a string as attributes of the string. The program ignores triplets containing one or more spaces. For example, the string "Jack ran up the hill" has the following attributes: "Jac", "ack", "ran", "the", "hil", and "ill".

Considering only letters of the alphabet, you can have 26^3 or 17,576 possible attributes for any triplet of letters A through Z. The 17,576 possible attributes (triplets) are mapped onto a 251-bit string. A hashing function reduces the 17,576 attributes to 251 values (zero to 250).

The hash function, h , for any triplet is:

$$h(c_1, c_2, c_3) = (100a(c_1) + 10a(c_2) + a(c_3)) \text{ mod } 251$$

where c_1 , c_2 , and c_3 represent the first,

second, and third characters of the triplet respectively, and a represents the ASCII value of any character. Any uppercase letter is assigned the same value as the corresponding lowercase letter. The mod is the modulus of the quantity in parentheses (the remainder) after the number in parentheses is divided by 251. If any triplet has one or more blank characters in it, it has no hash value.

The word "hill" has two triplets. You want to find the hash value of the first triplet, "hil". The ASCII values of "h", "i", and "l" are 104, 105, and 108, respectively.

First multiply 104 by 100, 105 by 10, and 108 by 1. Then add the three numbers (11,558) and finally divide 11,558 by 251. The remainder, 12, is the value of the hash function for the triplet hil.

The hash function has several features that are important when indexing text. The order in which letters are arranged in a triplet determines the hash value. Triplets such as "tab" and "bat" do not hash to the same value.

Spaces, which often consume a considerable portion of text, aren't included so the program indexes only words of three or more characters. This avoids indexing many meaningless triplets. In the string "boy and girl", the program hashes and indexes only the triplets "boy", "and", "gir", and "irl". The triplets "oy ", "y a", "nd ", "d g", and " gi" aren't included. Last, the computation of the hash value is simple and quick.

The signature of a string consists of 251 bits initialized to zero. If a triplet of the string hashes to a value i , the search program sets the i th bit (b_i) of the signature to 1 (equivalent to cutting a notch in the i th hole of a notched-edge card). Signatures of file records are called record signatures while those of search keys are called key signatures.

It's easy to find a single key in a large

text file. First, the search program loads the record signatures of the text file into memory (or as much as will fit at one time). Second, the program determines the signature of the key. Then it sequentially compares each record signature to the key signature.

If for every b_i equal to 1 in the key signature, a corresponding b_i is equal to 1 in the record signature, the screening test is positive, and the program brings the record into memory and searches for the key. If for any i , b_i equals 1 in the key signature and b_i doesn't equal 1 in the record signature, the key isn't present and you don't need to search the record.

This is the same as putting needles through holes in edge-notched cards. Cards that don't fall out when you lift the needles lack at least one of the attributes you're searching for and you can bypass them.

As a concrete example, take a text file with only three strings: "He ran down the lane", "Jill walks up the lane", and "The goat ran up the lane". See Table 2 for all triplets and the corresponding hash values for the three strings.

Suppose you want to search the file for all strings that contain the name "Jill". The key signature for the name "Jill" (Fig. 4) has bits 212 and 142 set to 1; all the other bits are zero.

Comparing the signature of the string "He ran down the lane" bit for bit with the key signature, you see that b_{212} of the key signature equals 1 while b_{212} of the record signature equals zero. The screening test is negative and you don't need to search the actual string.

Comparing the signature of the string "Jill walks up the lane" with that of the key signature, you see that every bit equal to 1 in the key signature is also equal to 1 in the record signature. Read the record from the disk, search it sequentially, and you find the name "Jill" present.

Comparing the signature of the string "The goat ran up the lane" with that of the key signature, you again find that every bit equal to 1 in the key signature also equals 1 in the record signature. You read the corresponding record from the file, search it sequentially, and determine that the key isn't present (a collision has occurred). If you had more records in the file, you could continue the search in the same manner.

Searching for a string that contains two or more keys is simple. The program logically ORs the key signatures

Assembly Language Shortcuts—Part II

by Bob Bowker

This month's shortcuts emphasize efficient use of the stack and include a reassuring perspective on the mysteries of algorithms.

In my last article on Assembly language programming (*80 Micro*, June 1983, p. 173), I discussed some techniques on reducing memory requirements. This month, I'll consider the stack, a last in/first out storage area used by the Z80 to save both addresses and values as it jumps around in a program. The stack is available to the user, too; you can store addresses and values on the stack with the Push command, and reclaim them with Pop.

When you call a subroutine, the computer automatically stores the return address on the stack, so that when it encounters a return instruction, the last address on the stack tells the program where to return to.

If your subroutine has left an extra address on the stack, when it encounters the return, the program returns to the extra address, not to the proper place. Similarly, if too many addresses are popped off the stack, the address to which the program returns will be wrong.

What's Wrong is Right

Sometimes you can misuse the stack to advantage. Suppose that you have a program with 20 possible situations,

```

CONDITION 1      CONDITION 2                                CONDITION 20
LD BC,0123H      LD BC,0254H                                LD BC,2017H
LD (BUF),BC      LD (BUF),BC  =====>>> LD (BUF),BC
CALL ROUTINE     CALL ROUTINE                               CALL ROUTINE
RET              RET                                         RET

ROUTINE LD  HL,(BUF)
.
.
.
RET
    
```

Program Listing 1. Stack value pass.

```

CONDITION 1      CONDITION 2                                CONDITION 20
POP HL           POP HL                                    POP HL
CALL ROUTINE     CALL ROUTINE  =====>>> CALL ROUTINE
DEFB 32H         DEFB 54H                                  DEFB 17H
DEFB 01H         DEFB 02H                                  DEFB 20H

ROUTINE EX  (SP),HL
.
.
.
RET
    
```

Program Listing 2. Byte-efficient Stack value pass.

The Key Box

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each of which must pass a unique value to a common Write routine. One possibility is Program Listing 1. There is a way to use the stack to pass the value, and, in this example, save many bytes. See Program Listing 2. In each of the 20 cases here, the POP HL instruction puts the main return address into the HL register pair, and the call routine puts the address of the first DEFB onto the stack, even though we have no intention of returning here. At routine, the 1-byte instruction EX (SP),HL puts the main return address on the stack, and the HL register pair points to byte 1 of the value to be passed. When the program encounters the return instruction at the end of routine, it goes back to the original code that called the condition and not to one of the DEFB lines.

How to Call Yourself

Shortcuts are often needed when the number of bytes available for the task is limited; if you have to fit a program in a 1K EPROM, that byte 1,025 has got to go.

I am also motivated by laziness: I don't like to type in the same code twice if I can help it. Duplicating several lines of code is a waste of both typing time and assembler space, so I came up with the subroutine in Program Listing 3 to convert a hex digit into 2 ASCII bytes to be displayed. This routine uses one return instruction to handle both passes through its code. Line 160 calls the subroutine; when the program encounters the return in line 240, it branches back to line 170 to the address on the stack and continues on until it hits line 240 again. This time, the return forces a branch back to the main calling code since that address is now on the stack.

There's no practical limit to the number of layers you can create using the one return instruction. This next example uses up to three passes through the same section of code, at various times, according to two switches. You could use it to allow for differences in how long you must wait for a disk drive motor to get up to speed. The first flag can indicate whether your speed-up modification is on, and the second flag can indicate that a full second is required for that drive to get to 300 revolutions per minute (rpm), as opposed to the half second required by newer drives. The original version is in Program Listing 4. The routine checks two flags and calls wait once for each flag that's on; then it calls a single wait regardless of the flags. Compare it to the version in Program Listing 5. The program uses a single subroutine and its re-

```

00100 57      CONV  LD D,A      ;Store for now
00100 E6F0    AND 0F0H    ;Dump bot 4 bits
00120 0F      RRCA      ;Do the rotate trick
00130 0F      RRCA
00140 0F      RRCA
00150 0F      RRCA
00160 CDxxxx  CALL SUB    ;Call the subroutine
00170 57      LDA,D      ;Recall the number
00180 E60F    AND 0FH    ;Dump top 4 bits
00190 C630    SUB      ADD A,30H  ;Make it ASCII
00200 FE3A    CP 3AH    ;Allow for HEX
                                digits
00210 3802    JR C,ONE   ;A thru F
00220 C607    ADD A,07H
00230 CDxxxx  ONE    CALL 003BH ;Output the byte
00240 C9      RET

```

Program Listing 3. ASCII converter.

```

00100 01FFFF  DELAY LD BC,0FFFFH ;Delay length
00110 3Axxxx  LD A,(FLAG) ;Get flag
00120 F5      PUSH AF    ;Save the flag
00130 CB47    BIT 0,A    ;Check bit 0
00140 C46000  CALL NZ,60H ;Wait if it's on
00150 F1      POP AF    ;Restore orig (FLAG)
00160 F5      PUSH AF    ;... and store again
00170 01FFFF  LD BC,0FFFFH ;Delay length
00180 BB4F    BIT 1,A    ;Check bit 1
00190 C46000  CALL NZ,60H ;Wait if it's on
00200 F1      POP AF    ;Restore orig (FLAG)
00210 01FFFF  LD BC,0FFFFH ;Delay length
00220 CD6000  CALL 60H   ;Standard wait
00230 C9      RET      ;Job's done

```

Program Listing 4. Three-pass routine.

```

00100 010000  DELAY LD BC,0000H ;Delay count
00110 3Axxxx  LD A,(FLAG) ;Get flags
00120 CB47    BIT 0,A    ;Check bit 0
00130 C4xxxx  CALL NZ,SUB1 ;Delay if on
00140 CB4F    BIT 1,A    ;Check bit 1
00150 C4xxxx  CALL NZ,SUB1 ;Delay if on
00160 F5      SUB1    PUSH AF    ;Save flags
00170 CD6000  CALL 0060H ;...and delay
00180 F1      POP AF    ;Restore flags
00190 C9      RET

```

Program Listing 5. Single subroutine option.

turn several times. Each time the return is encountered, the program branches to the last address on the stack. If bit 0 of (FLAG) is on, the return forces a return to line 140, and to line 160 if bit 1 is on. If neither is on, the return branches back to the code that called the delay.

The program initially sets BC register pair to 0000 hexadecimal (hex) instead of 0FFFF hex since the wait routine 0060 hex returns it to 0000 hex every time it's called; thus BC is set up for the

next pass. That one extra count in the delay is only 14.65 microseconds, which in most cases won't hurt. The bonus in using the second routine is that 8 bytes are saved—over 25 percent!

End of the Line

The word algorithm is not only ugly, it's scary. That concept has probably kept more people away from Assembly-language programming than T-Bug ever did. An algorithm is nothing more than a way to do something.

```

00100 3Axxxx LINE LD A,(4020H) :Get CSRPOS LSB
00110 CB67 BIT 4,A ;Bit 4 on?
00120 C0 RET NZ ;Go back if yes
00130 CB6F BIT 5,A ;Bit 5 on?
00140 C0 RET NZ ;Go back if yes
00160 CDxxxx CALL NULINE ;It's a new line
00170 C9 RET ;Now go back

```

Program Listing 6. Algorithm check.

For example, once I needed a way to tell if the cursor was positioned at the start of a line on the screen. At one point I considered making a table of the 16 start-of-line addresses and doing 16 compares every time.

Then I found a blank page of Radio Shack's \$1.95 Video Display Worksheet paper left over from Level I days, and wrote the 16 addresses in a column down the left side. I converted the addresses to binary and wrote them down, too. In every case both bit 4 and bit 5 were off; that turned out to be an absolute test. If either bit 4 or bit 5 of the least significant byte (LSB) of the address of the cursor were on, the cursor was not at the start of a line on the screen. I had an algorithm (see Program Listing 6). This routine checks bits 4

“Don't be frightened off by jargon like algorithm; if what you're looking for, or what you've found, is a shortcut, call it that.”

and 5; if either is on, the cursor is not at the start of a line, so it returns. If both are off, the program calls the subroutine Nuline to do whatever, followed by the main return.

Don't be frightened off by jargon like algorithm; if what you're looking for,

or what you've found, is a shortcut, call it that.

To Vector or Not to Vector

Lowercase modifications on the Model I are pretty common now, but not all users have them. This poses a problem if you're going to sell, or otherwise distribute, a program to others; you have to make allowances for the unmodified computers. Also, if your program uses the printer in any way, you should allow for those who don't have one. There are few things more frustrating than to accidentally hit the P key, and sit helplessly as the computer locks up in a ROM loop looking for a printer that isn't there.

Vector is more jargon; it means jump, so let's call it a jump. That's also an easy way out of the problem: Place a jump or two at the start of your program, that can be changed by any user to allow for printers and lowercase.

For example, I wrote a program that calls a conversion subroutine just before printing every character on the screen; if the character were lowercase, it would be converted to uppercase. Before displaying the character in A on the screen, I would call LC2UC.

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My program also jumped through a subroutine on its way to the line printer; to print the character in A, I would call print.

```
00100 C3xxxx LC2UC JP CONV ;Go convert
      LC to UC
00110 C3xxxx PRINT JP LPR ;Go print out
```

These were the first two lines of the program, which loaded at 5200 hex. I included instructions to zap a return into line 100 (a C9 at 5200 hex) if the user had a lowercase mod; then, every time LC2UC was called, the program found a return before it could convert anything. Similarly, the program could zap a return into line 110 (a C9 at 5202 hex) if the user had no printer; this effectively disables the print command in the program.

Was That a I or a III?

When it first came out, the Model III was advertised as able to run all Model I software. As it turns out, that just isn't so; the culprits are the new ROMs in the III, which are different from the I's.

For most people, this is not important. However, if you want to sell a program that works on both, you have a decision to make: Should you sell sepa-

rate versions, or try to write one version that works on both models? If you choose to do the latter, you've still got problems. You must either make sure the program uses only those routines which are common to both models, or you must somehow have your program modify itself based on the host model.

The last choice is not difficult. You can tell whether the computer running

*"Should you sell
separate versions,
or try to write
one version that works
on both models?"*

your program is a III or a I by looking at the byte at 0054 hex in the ROM; if it's a 01 hex, you're on a Model I, and if it's an EB hex you're on a III. There are probably other addresses you can use, although this is the only reliable one I know.

Start your program after the jumps with a check of 0054 hex, and deal with the result accordingly. For instance, if you find that your computer is a III, you may want to disable your own LC vector right away by putting a return there, and store a 00 hex at 4019 hex to default the III to lowercase. If any of the DOS calls you intend to use are different in Model III versions of the operating system, you can alter them now. For example, assume that a DOS call in Model I is at 4290 hex, and in the Model III is at 442B hex.

```
01320 CD9042 HERE CALL 4290H ;Model I
      CALL
```

If your check finds that you're on a III, include the following lines before starting the main program:

```
65000 212B44 LD HL,442BH ;Model III address
65010 22xxxx LD (HERE+1),HL
```

When line 1320 is encountered, the proper Model III address will be called. ■

Robert Bowker is a free-lance television director. He can be reached at 11360 Sunset Blvd., Los Angeles, CA 90049.

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by Terry Kepner

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CP/M, Control Program for Microprocessors, was the first comprehensive in-memory disk operating system for 8080 and Z80 based microcomputers. And now it's available to those who own Model IIIs.

The three Model III CP/M conversion boards included in this review are the Mapper III from Omikron, the VID-80 from Holmes Engineering, and

the Shuffleboard III from Memory Merchant.

All three boards offer useful modifications, but their features do differ. Shuffleboard is the only one that lets you perform single-drive file copies, while Mapper III alone lets you transfer files and programs from TRSDOS disks to CP/M disks.

The Holmes board stands apart in that it modifies your Model III's ROM to use an 80-character by 24-line display in standard TRSDOS environments as well as the CP/M environment.

While all three boards provide CP/M capability, you should consider their features and choose the board best suited for you.

Each modification is similar in concept: You remove the Z80 CPU and put it on the CP/M board, then plug the CP/M board into the Z80 socket. The computer now operates as either a standard Model III or a Z80 CP/M computer.

Mapper III

Omikron sells several modification boards for the Models I and III, including four versions of the CP/M board (a 48K and a 64K RAM version for each computer), 8-inch drive support for the Models I and III, and a 24-line by 80-character video display modification for the Model III.

I'll describe the Model III 64K CP/M board, without the 8-inch drive board or the 80 by 24 display modification. The Mapper III is quite small, measuring 4 inches by 6 inches (see Photo 1). Centered on the right side of the board are the socket for your computer's Z80 chip and the pins for plugging the board into your computer.

The six pages of typeset installation instructions are clear, with many pictures to clarify the procedure. The guide is a professionally prepared pamphlet, the best hardware installation guide I've ever seen.

The installation instructions are easy to follow. You unplug the computer, then locate and remove the case screws. Lift off the cover, locate and remove the Radio Frequency Interference (RFI) shield screws, then remove the RFI shield.

Remove the Z80 chip (be very careful—bent pins aren't a total disaster, but make the installation difficult), plug it into the CP/M board (observe correct orientation of the chip in the socket), and plug the board into the computer Z80 socket. Finally, reassemble the computer. The entire installation takes about half an hour of continuous work.

Now I must fault the documentation. After reading the installation guide, I looked for instructions on turning on the system and testing the board's performance, but there aren't any.

The owner's manual (15 photocopied pages of mixed typesetting and printing) details the CP/M system, describing video, keyboard, RS-232, and printer drivers, plus other important information about the Omikron version of CP/M. But it doesn't contain instructions on turning on the system in TRSDOS, CP/M, or Level II Basic.

I've since discovered that Omikron is still writing the user's manual. By the time you read this review, the guide will be finished and included with the other manuals.

When I turned my system on, strange characters filled the screen; I got no drive response and other peculiar reactions. I took my computer apart, removed the CP/M board, then replaced it and reassembled the computer. This time everything worked the way it should and the drive light came on.

The video screen displays the Omikron sign-on message, with two operation choices listed, C and T. Pressing the C key causes the Model III to boot up the CP/M disk in drive zero. Pressing T boots a TRSDOS disk. If you

want Level III Basic, press T and the break key. TRSDOS operation remains unchanged.

Omikron designed the video driver to emulate the Soroc IQ120 terminal, so any CP/M programs compatible with

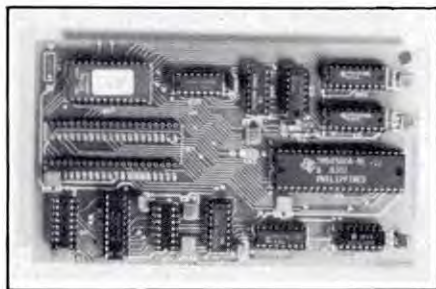


Photo 1. Mapper III.

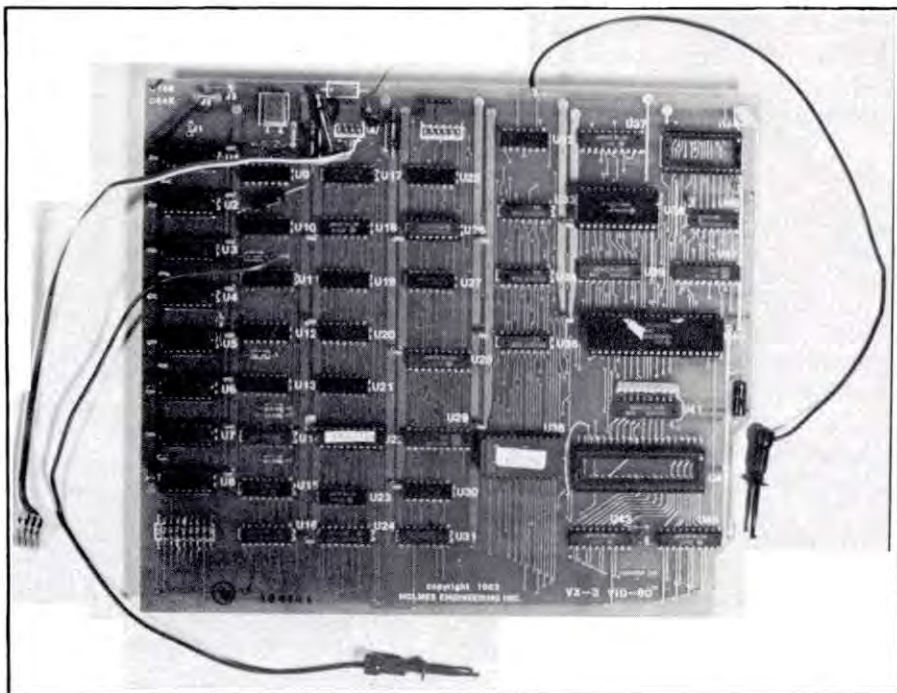


Photo 2. VID-80.

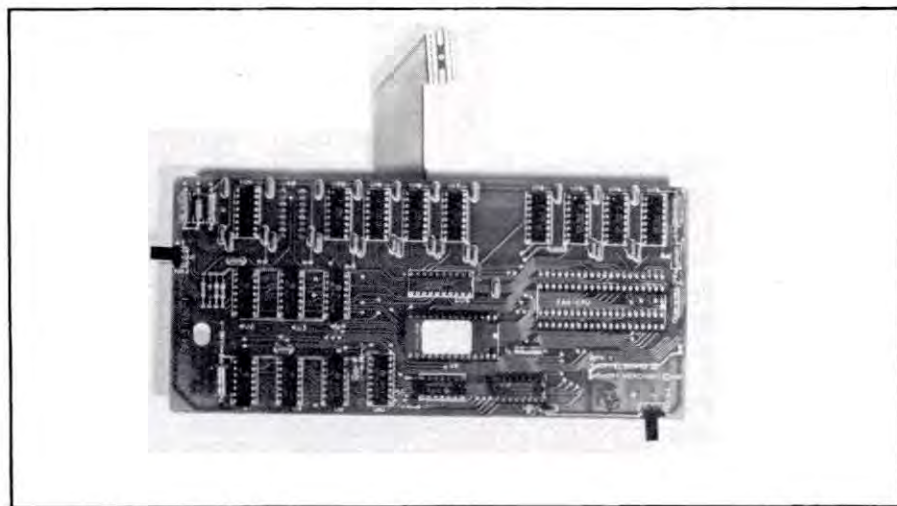


Photo 3. Shuffleboard III.

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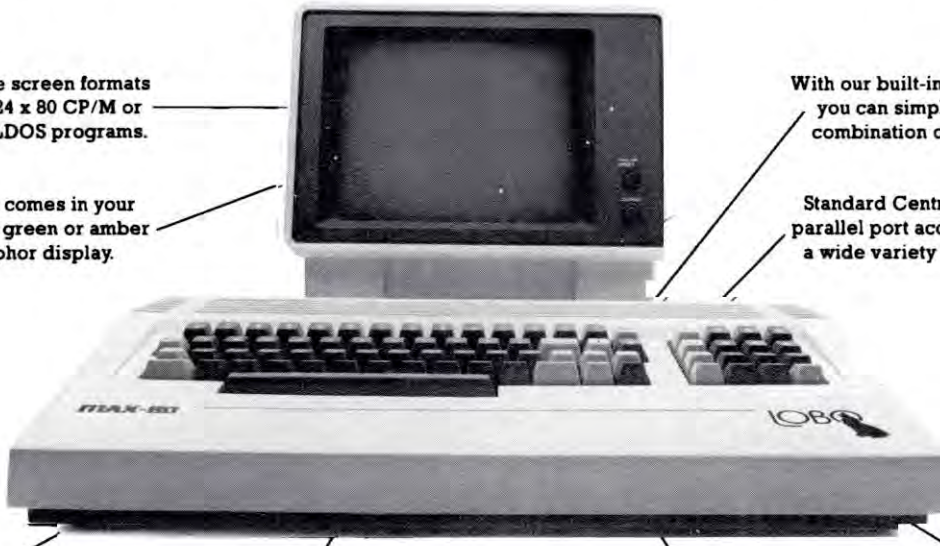
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the Soroc terminal should work without alteration. The cursor addressing routine is the same system used by the Osborne accounting packages, WordStar, and Wordmaster.

If you have 8-inch disk drive capability, Omikron's version of CP/M automatically supports it, assuming that drives A and B are 5¼-inch, and C and D are 8-inch. Since much software is sold on 8-inch disks, Omikron provides an option that lets you use control/C to warm-boot the system and make the 8-inch drives (physically located at positions C and D) the logical drives A and B.

If you have a special drive configuration, you can use the Options utility to preset the system to match your needs. The Options program controls other factors, including video graphics enable, blinking cursor, printer line counter and line feeds, RS-232 and keyboard swapping (lets you use a remote termi-

nal to control the system), and interrupt disable.

At the moment Omikron CP/M supports only 5¼-inch single- and double-density disk drives. As soon as they complete their 8-inch double-density board, it will support 8-inch single- and double-density disk drives. In the mean-

“... Omikron includes a Microsoft Basic disk with their CP/M system...”

time, Omikron CP/M reads 17 disk formats, including Osborne, IBM PC, Cromemco, Xerox, DEC, and Superbrain.

To aid the prospective programmer, Omikron includes a special utility program that lets you read Model III TRSDOS disks, and copy files and pro-

grams from TRSDOS to CP/M. These programs might or might not work under CP/M.

Machine-language programs that use their own input/output (I/O) routines won't work under CP/M, since the peripherals have all been remapped to new locations. Basic programs should work with MBasic, unless they have machine-language PEEKs and POKEs.

To help the Basic programmer, Omikron includes a Microsoft Basic (MBasic) disk with their CP/M system, so you can immediately begin using your system to create standard Basic programs (most Model III Basic commands are used in MBasic). This is important since CP/M doesn't include a Basic programming system, although some versions of CP/M include a public domain version of Basic called EBasic.

Finally, Omikron supplies a set of new CP/M and MBasic manuals that are truly superior to any I've seen on

The CP/M Story

The birth of CP/M resulted from a need for a microcomputer disk operating system back when micros were only the toys of computer hobbyists and professionals. A few pioneers in the industry had managed to build computer systems that included a CPU, had the capability of running a video display, and would let you input data and instructions from a keyboard.

Someone had even figured out how to connect disk drives to the machine and transfer data between the two. One programmer, at the request of a business friend, took one such system and wrote a program that supervised the operation of the computer, monitor, keyboard, printer, and disk drives. This original DOS design was for an 8080 Altair.

The program was so successful at controlling the computer without lots of work and attention from the user that other people began asking for copies. Finally, Digital Research Inc. began selling the DOS and it rapidly spread across the country.

It was so popular because it was designed to be device independent. The CP/M system used set addresses for sending and receiving information to and from the various peripherals. A new computer merely had to honor those addresses to be compati-

ble with CP/M and CP/M programs.

Of course, each model computer had different peripherals, some with wider displays or better keyboards, requiring different driver machine-code instructions, but CP/M doesn't care what the actual driver code looks like, only that the driver responds to the proper CP/M data address.

This means that a program written on a CP/M computer, as long as it honors the CP/M I/O calls, runs on almost any other CP/M computer. If your computer is from a new company, or even if you designed and built it yourself, you still have many CP/M programs available for it. Owners of non-CP/M computers have to wait for programmers to buy the computers and start writing programs for them.

As the oldest available DOS, CP/M has the most programs written for it. In many cases these programs are public domain, free for you to use and change. This public software is often of very high quality.

Other computer companies marketed their own DOSes for their computers, but CP/M had already become a standard. And people didn't want to buy a computer without software support.

When Tandy released the original Model I, they didn't design it to be a disk-based computer so they ignored

CP/M. When Level II came out, it too ignored the possibility of CP/M because CP/M requires the use of low memory for its driver addresses and high memory for its own code. The Radio Shack uses all low memory addresses for itself and high memory for programs.

To allow for both TRS-80 Basic and future CP/M expansion would have required that Tandy abandon their Level I customers or replace the entire CPU Level I board when they upgraded the machines to Level II. They would have to switch RAM and ROM, requiring a new circuit board layout. The mechanical problems of redesigning the computer and replacing the units in the field were too costly.

CP/M requires using the low addresses of RAM as its tie points to the peripherals. The Models I and III use the low addresses for other purposes, making them fundamentally incompatible.

For a while, a doctored version of CP/M was available for the Models I and III, but it experienced compatibility problems with much of the CP/M software. The software expected the peripheral connection addresses to be in low memory.

Now several companies have begun marketing boards that let Model I and III owners convert to CP/M operation while still maintaining compatibility with TRSDOS. ■

CP/M. The CP/M manual is 250 pages long in 8- by 11-inch format.

The MBasic manual was written in 5- by 7-inch format, but has been reproduced on 8- by 11-inch paper, with two 5- by 7-inch pages on one 8- by 11-inch piece of paper. It's a little confusing at first, but usable. Both manuals are typeset and punched for insertion in a three-ring binder.

VID-80

The Holmes CP/M system is a much larger board than the Mapper III, measuring 8 inches by 11 inches (see Photo 2). As with the Omikron board, you remove the Z80 CPU from the Model III and plug it into the Holmes board. However, you also remove the character generator ROM, the power supply connector, and the video connector from the old CPU board, and plug them into the Holmes board.

Then you attach two wires from the VID-80 to the Model III with small clamps, and plug the Holmes video controller into the slot on the old CPU board. These modifications make it possible for the Model III to run CP/M, and alter the video to use 80

characters by 24 lines as the standard display.

In fact, if you are only interested in an 80 by 24 display, you can buy the VID-80 board alone, and forget CP/M. CP/M is not required for the 80 by 24 display, and you can purchase it separately for \$120 extra.

This new display size has an important implication for CP/M operation: Some software on the market requires an 80 by 24 display. A display size other than that can cause problems when you try to use software designed for the larger display. Fortunately, much of the CP/M software doesn't have a display size requirement, so you can use a standard 64 by 16 screen display.

The documentation is a 34-page 8½- by 11-inch booklet that clearly explains every step for dismantling your computer, installing the Holmes board, and putting everything back together. It's not as slickly produced as the Omikron instructions, but is adequate to the task.

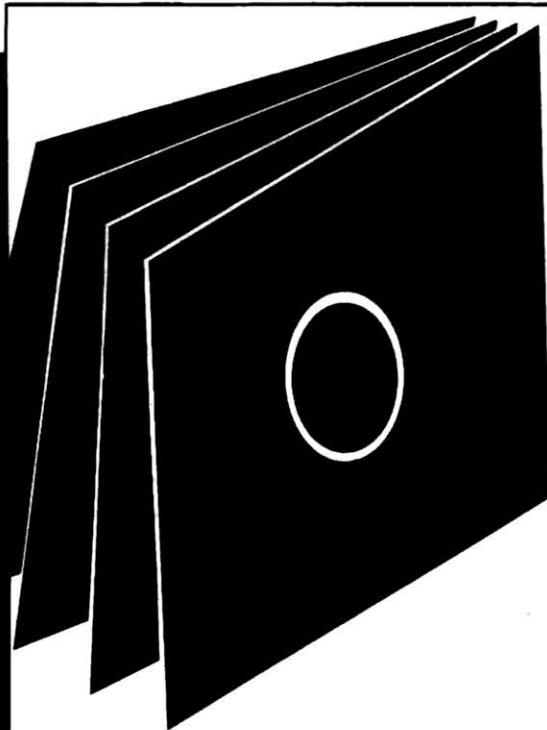
The instructions on CP/M are divided into two distinct sections. The first is part of the installation manual, and provides technical information

about the CP/M board and the Holmes CP/M Basic Input/Output System (BIOS) information. It also includes brief instructions on turning on and using your Holmes modified computer and an introduction to the CP/M operating system.

The second part of the CP/M instructions is in the form of the Sybex book about CP/M by Rodney Zaks, *The CP/M Handbook with MP/M*. Rather than plowing through the CP/M 2.2 Digital Research manuals, which tend to be confusing and hard to read, you can study a well-written tutorial on the CP/M system, with indexes and appendixes to help guide you through it.

The theory of operation for the Holmes board is simple: When you turn on the computer or press reset, the Holmes board bootstrap ROM checks to see if you're holding down the 6 key. If you are, the bootstrap ROM relinquishes control to the Model III ROM and your computer acts as though it's unmodified.

If you're not holding down the 6 key, the bootstrap ROM copies the Model III ROM to a 16K bank of RAM on the Holmes board, then patches the Model



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III ROM in RAM to use the new 80 by 24 display. Every point where the ROM would normally jump to the Radio Shack video driver changes to use the Holmes video driver.

The locations normally assigned to the video RAM (3C00 to 3FFF hexadecimal (hex)) aren't used for video; the system ignores them. The new video RAM location is the uppermost 2K of RAM in your computer (F800 to FFFF hex).

Normally this means that you wouldn't have a full 64K of user RAM, but the Holmes board uses a bank-switching technique to flip the video RAM into place when the computer wants to access it, and to flip normal RAM in place the rest of the time. Thus your high memory Model III drivers are preserved for your use without alteration.

This method works because the Z80 can do only one thing at a time: When it's working on video RAM it can't use the high memory drivers or information, and vice versa. This is an interesting and efficient method of handling the video memory problem.

Unfortunately, by moving the video RAM to a new location, any programs

that bypass the video's device control blocks by going directly to video locations in the range 3C00 to 3FFF hex won't work in the 80 by 24 display mode, so you have to remember to set the display to 64 by 16 when using those programs.

When you first install the Holmes board, you have to adjust the video dis-

*"The CP/M mode
is quite transparent..."*

play circuit board in the Model III to get all 24 lines on the screen. This takes only a few moments, and it's kind of fun watching the letters on the display scrunch down and new lines appear from the bottom.

The new 80 by 24 display requires that the individual characters be smaller, in order for all of them to fit on the screen. That's a small price to pay for almost doubling (from 1,024 to 1,920) the amount of information on your screen—an 80 percent increase.

Another disadvantage is the appearance of snow on the video whenever you update the display, much like the snow

on a normal Model III during high-speed display access (usually apparent during machine-language games). Fortunately, Holmes Engineering has a modification that makes the display clear and precise. Newer boards come with the modification.

This approach, moving ROM to RAM and modifying it to use the 80 by 24 display, lets you use almost any Model III DOS with the 80 by 24 display. For example, TRSDOS works quite well in the 80 by 24 mode, with only the DIR command requiring a patch [PATCH *6 (ADD=5AFA,FIND=3F,CHG=OF)] to operate correctly in both display modes. Similarly DOSPLUS 3.4, 3.5, and 4.x, NEWDOS80, LDOS, and MULTIDOS work with little or no alterations in both modes. They require no special software drivers.

One other feature, reverse video, is accessible from either Model III mode or CP/M mode.

The CP/M mode is quite transparent to the operator. Memory management on the Model III in CP/M mode gives you 62K of RAM (the other 2K is for disk I/O buffers and other miscellaneous data involved with the disk drives).

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The Holmes board uses a 4K EPROM for keyboard, video, and printer I/O. This EPROM is bank switched in and out of position in low memory as needed by the BIOS.

The Holmes board lets you read and write to disks formatted by the IBM PC, Kaypro II, Xerox 820, Xerox 820-II, Osborne-I, Zenith Z-100, Freedom Technology (Model III CP/M system), Memory Merchant Shuffleboard III (Model III CP/M), Omikron (Model I CP/M), and Morrow Micro-Decision.

If your computer has 8-inch disk drive capability, Holmes CP/M lets you use the 8-inch drives without patching. Eight-inch drive support includes the ability to read and write to disks formatted in IBM 3740 single density, Xerox 820 single density, and Xerox 820-II double density.

The Holmes board is available in two versions. The first, and cheaper, version has a 16K bank of RAM and uses the Model III's 48K RAM for the rest of the RAM it needs. The other version comes with 64K of on-board RAM and doesn't use the Model III RAM except as a RAM disk accessible from CP/M

for extremely fast data storage and retrieval.

When I wrote this review, no known incompatibilities existed between Holmes CP/M and other CP/M software. You can even run UCSD Pascal with the Holmes board.

Shuffleboard III

The Shuffleboard III (see Photo 3), a 64K CP/M 2.2 system, is as easy as the others to install. The only difference is that you remove one of the Model III memory chips, U25, and replace it with a 16-pin plug attached to the Shuffleboard unit. After installing the board, you put your TRSDOS disk or your CP/M disk in drive zero and press reset. Level II Basic is still available, of course.

Like Omikron, Memory Merchant has provided MBasic for Basic programmers. You can also purchase an 80 by 24 video board separately for \$275.

Actually, you have several hardware options with the Shuffleboard: If you want to, you can move a jumper on the board from its "Automatic boot from drive zero" position to another. This clears the screen and asks you which

drive contains the system disk (press zero for drive zero, one for drive 1, and so on).

Another board option lets you select operation of either a 2716 ROM, or 2732 or 2764 ROMs. The manual doesn't discuss this option, so it's probably being reserved for future developments and enhancements.

A unique feature of Shuffleboard is the ability to switch between CP/M and TRSDOS using the appropriate command. If you're in TRSDOS and want to go to CP/M, enter the DOS command CPM. From the CP/M prompt, enter DOS. These are memory erasing changes: Anything in memory is zeroed out, so you can't transfer between the two operating systems and maintain in-memory data integrity.

In its present form, Shuffleboard CP/M is compatible with 35-, 40-, 77-, and 80-track 5 1/4-inch disk drives. With the addition of the Memory Merchant disk controller, you can use 8-inch disk drives.

As with the Omikron board, you can use your Model III as a slave to a remote terminal, using the remote terminal for input instead of the keyboard.

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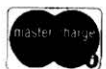
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And unlike the other two CP/M systems, Shuffleboard includes the Auto command as a valid command, which operates just like the TRSDOS Auto command. The length of the command is limited to one screen line (64 characters).

Memory Merchant CP/M is configured to expect the CP/M drive A to be the physical drive zero, drive B to be drive 1, drive C to be drive 2, drive D to be drive 3, and drive E to be nonexistent. Drive E invokes a special Memory Merchant CP/M utility called a virtual drive. You also have drives F-I available as single-density drives.

The first two logical drives (A and B) are 5¼-inch, 40-track, double-density drives. The third drive is configured as an 8-inch, 77-track, double-density drive. You can reorganize the CP/M drive map to match any setup you have, including using physical drive 4 as the boot-up drive, logical drive A. You do all this by using a disk drive map that lets you match any of the logical drive parameters to the physical drives.

Now for the virtual drive. Memory Merchant has altered CP/M so you can logically change a disk drive assignment while running CP/M, a procedure not allowed with the other CP/M systems. This virtual drive capability means that you can make single-drive copies.

If you have two 5¼-inch drives and one 8-inch drive, you can use the virtual drive assignment to copy a file from one 8-inch disk to another. Otherwise, you'd have to copy the file to a 5¼-inch disk, change disks in the 8-inch drive, invoke a warm-boot on that drive, then

copy the file from the 5¼-inch drive to the new 8-inch disk.

This virtual assignment capability is reflected in the use of logical drives F-I. Physical drives 1-3 are given two logical drive numbers, B-D and F-H. Drive 1 is both logical drive B and logical drive F. The difference is that drive B is a double-density drive and drive F is a single-density drive.

You can copy files from or to a single-density disk without going to the disk drive assignment table and changing one of the drives to be logically sin-

*"All three boards
are easy to install."*

gle-density. To let you copy files between single density and double density on the same drive, logical drive I is used, just as logical drive E is used for single-drive, double-density file copying.

Speaking of copying, the Shuffleboard can read and write to Osborne I, Xerox 820, and IBM PC formatted disks.

Three manuals come with the Shuffleboard III. The user's manual is a 77-page, 8- by 11-inch printed booklet that covers all phases of board installation and CP/M use. The second manual is a bound edition of the new Digital Research documentation on CP/M.

The last manual is the Microsoft MBasic instruction book. Unlike the previous DRI manuals, these books are well written and easy to understand.

Both books top 250 pages in length.

Summary

All three boards are easy to install with only screwdrivers and a nail file. If you follow the instructions carefully, you should have no problems with the installation.

One disadvantage shared by all three boards is that they make it difficult for the CPU RFI shield to fit properly. The clearance between the RFI shield and the CPU board is almost, but not quite, enough room for the new piggy-back boards. On my Model III, I could only get the screws on the left side (looking at the CPU board from the rear of the computer) to go into place.

Putting the top and right side screws in place put a good deal of stress on the two boards, and actually forced the RFI shield to bulge. However, the three screws I used easily keep the shield in place, and should maintain the cage design of the Model III.

At present, the Holmes board has the largest base of CP/M disk formats that it can read and write, but the others are rapidly catching up. And all three companies offer excellent customer support, with customer hotline phone numbers.

As you can see, the final decision on which board is best depends on your needs. As a purely personal response, the Holmes Engineering board is my favorite; it seems to offer the most for my needs. ■

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
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
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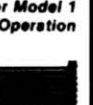
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Protected Tape Programs

by Dan Robinson

This pair of short routines safeguards your cassette programs against predators.

ProteK (with a K; see Program Listing 1) makes your system tape auto-start so spies can't jump into a monitor program. It adds a leader to your tape which befuddles copy programs like the RSM series or LMOFFSET by sending a false checksum. A double delay loop foils other copy cats that swallow programs until they think they've devoured the last byte.

The program includes pitfalls for

Protect your tape programs from predators with these two routines that prohibit copying.

those who load a monitor first and count on getting to your programs following a reboot: The entry points for TBUG, DEBUG, and RSM2 16K, 32K,

and 48K will take them back to the MEMORY SIZE? prompt.

ProteC (with a C; see Program Listing 2) converts your Basic program into a system tape with an auto-start feature and the same booby traps as its companion program. Furthermore, the program turns the trace off (TROFF) and disables the break key so that no one can list your program to the screen or a printer.

Instructions

To safeguard a Basic program, you can load ProteC either before or after your Basic file. As it completes its load, ProteC displays detailed instructions on the screen. The program then returns to the Basic READY prompt, and you're set to go.

ProteK does not list the instructions to the screen; you load it in series after the system program you wish to encode. When you load ProteK, it automatically boots up, asking for the name of the new system tape and the hexadecimal start/end/transfer address. The program prompts you to prepare the tape recorder, and then writes your encoded program.

Both ProteC and ProteK change some pointers and addresses, so once you've encoded your program it's wise to reset your TRS-80. ■

Contact Dan Robinson at 1625 Higgins Way, Pacifica, CA 94044.

Program Listing 1. ProteK routine.

```

00100 ;PROTEK 2.0---CASSETTE---SYSTEM TAPES ONLY
41E2      00110      ORG 41E2H ;SYSTEM RELAY FOR AUTO START
41E2 E9   00120      DEFB 0E9H
7E00      00130      ORG 7E00H ;PROTEK
7E00      00140      START EQU 5
7E00 CDC901 00150      CALL 01C9H ;CLEAR SCREEN
7E03 21797F 00160      LD HL,MSG1 ;DISPLAY PGM NAME PROMPT
7E06 CDA728 00170      CALL 28A7H
7E09 3E0D   00180      LD A,0DH
7E0B CD3A03 00190      CALL 033AH
7E0E 2AA740 00200      LD HL,(40A7H)
7E11 0615   00210      LD B,21
7E13 CDD905 00220      CALL 05D9H ;INPUT NAME & ADDRESSES
7E16 116D7F 00230      LD DE,NAME
7E19 7E     00240      LD A,(HL)
7E1A FE2F   00250      CP 2FH ;"/"
7E1C 2805   00260      JR Z,NAME2
7E1E 12     00270      LD (DE),A
7E1F 23     00280      INC HL
7E20 13     00290      INC DE
7E21 18F6   00300      JR NAME1
7E23 CD1D7F 00310      CALL HEX
7E26 32747F 00320      LD (STADR+1),A
7E29 CD1D7F 00330      CALL HEX
7E2C 32737F 00340      LD (STADR),A
7E2F 23     00350      INC HL
7E30 CD1D7F 00360      CALL HEX
7E33 32767F 00370      LD (ENDADR+1),A
7E36 CD1D7F 00380      CALL HEX
7E39 32757F 00390      LD (ENDADR),A
7E3C 23     00400      INC HL
7E3D CD1D7F 00410      CALL HEX
7E40 32787F 00420      LD (TRFADR+1),A
7E43 CD1D7F 00430      CALL HEX
7E46 32777F 00440      LD (TRFADR),A
7E49 3E0D   00450      LD A,0DH
7E4B CD3A03 00460      CALL 033AH
7E4E 21AA7F 00470      LD HL,MSG2 ;DISPLAY PREPARE RECORDER
7E51 CDA728 00480      CALL 28A7H
7E54 010000 00490      LD BC,0000
7E57 CD6000 00500      CALL 0060H
7E5A B7     00510      OR A
7E5B 3A4030 00520      LD A,(3040H) ;CHECK KEYBOARD FOR <ENTER>
7E5E FE01   00530      CP 01H
7E60 2087   00540      JR Z,REC
7E62 FE04   00550      CP 04 ;CHECK KEYBOARD FOR <BREAK>
7E64 CA007E 00560      JP Z,START ;RETURN TO BASIC

```

Listing 1 continued

The Key Box

Model I
16K RAM
Assembly Language
Editor/Assembler
Tape Recorder

Listing 1 continued

```

7E67 18F2 00570 JR READY
7E69 F3 00580 REC DI
7E6A 3E2A 00590 LD A,2AH
7E6C 323E3C 00600 LD (3C3EH),A ;STAR
7E6F 3E00 00610 LD A,0
7E71 CD1202 00620 CALL 0212H ;INITIALIZE RECORDER #1
7E74 CD8702 00630 CALL 0207H ;WRITE LEADER & SYNC BYTE
7E77 3E55 00640 LD A,55H ;SYSTEM TAPE ID
7E79 CD6402 00650 CALL 0264H ;WRITE BYTE
7E7C 116D7F 00660 LD DE,NAME
7E7F 0606 00670 LD B,6
7E81 1A 00680 WRTNAM LD A,(DE)
7E82 CD6402 00690 CALL 0264H
7E85 13 00700 INC DE
7E86 10F9 00710 DJNZ WRTNAM ;WRITE NAME
7E88 3E3C 00720 LD A,3CH ;DISABLE LMOFFSET
7E8A CD6402 00730 CALL 0264H
7E8D 3E01 00740 LD A,1
7E8F CD6402 00750 CALL 0264H
7E92 3E00 00760 LD A,00H
7E94 CD6402 00770 CALL 0264H
7E97 3E00 00780 LD A,00H
7E99 CD6402 00790 CALL 0264H
7E9C 3E00 00800 LD A,0
7E9E CD6402 00810 CALL 0264H
7EA1 CD6402 00820 CALL 0264H ;OUTPUT FALSE CHECKSUM
7EA4 213E3C 00830 LD HL,3C3EH
7EA7 DD21E07F 00840 LD IX,STAR
7EAB CD417F 00850 CALL SET
7EAE 010000 00860 LD BC,0000H ;DEFEAT TIMERS
7EB1 CD6000 00870 CALL 0060H
7EB4 CD6000 00880 CALL 0060H
7EB7 21A043 00890 LD HL,43A0H ;TBUG
7EBA CD3D7F 00900 CALL BLOCK
7EBD 21807F 00910 LD HL,7F80H ;RSM2 & 2D 16K
7EC0 CD3D7F 00920 CALL BLOCK
7EC3 2180BF 00930 LD HL,0BF80H ;RSM2D 32K
7EC6 CD3D7F 00940 CALL BLOCK
7EC9 2180FF 00950 LD HL,0FF80H ;RSM2D 48K
7ECC CD3D7F 00960 CALL BLOCK
7ECF 210F40 00970 LD HL,400FH ;DEBUB
7ED2 CD3D7F 00980 CALL BLOCK
00990 ;ADD BLOCKING ROUTINES HERE--LD HL,ADDR CALL BLOCK
7ED5 2A757F 01000 LD HL,(ENDADR)
7ED8 ED5B737F 01010 LD DE,(STADR)
7EDC B7 01020 OR A
7EDD ED52 01030 SBC HL,DE
7EDF EB 01040 EX DE,HL
7EE0 E5 01050 PUSH HL
7EE1 DDE1 01060 POP IX
7EE3 7A 01070 LD A,D
7EE4 FE00 01080 CP 0
7EE6 2000 01090 JR Z,WRT2
7EE8 0600 01100 WRT1 LD B,0
7EEA CD437F 01110 CALL PUNCH
7EED 15 01120 DEC D
7EEE 20F8 01130 JR NZ,WRT1
7EF0 7B 01140 WRT2 LD A,E
7EF1 FE00 01150 CP 0
7EF3 CAF7E 01160 JP Z,WRT3
7EF6 43 01170 LD B,E
7EF7 CD437F 01180 CALL PUNCH
7EFA 0601 01190 WRT3 LD B,1
7EFC DD216C7F 01200 LD IX,LIST
7F00 21E241 01210 LD HL,41E2H ;SYSTEM/AUTO-START RELAY
7F03 CD437F 01220 CALL PUNCH
7F06 ED5B777F 01230 LD DE,(TRFADR)
7F0A 3E78 01240 LD A,78H ;TRANSFER BLOCK
7F0C CD6402 01250 CALL 0264H
7F0F 7B 01260 LD A,E
7F10 CD6402 01270 CALL 0264H
7F13 7A 01280 LD A,D
7F14 CD6402 01290 CALL 0264H
7F17 CDF801 01300 CALL 01F8H ;TURN OFF RECORDER
7F1A C3007E 01310 JP START
7F1D 23 01320 HEX INC HL ;ASCII TO HEX
7F1E 7E 01330 LD A,(HL)
7F1F D630 01340 SUB 30H
7F21 FE0A 01350 CP 10
7F23 F43A7F 01360 CALL P,ADJ
7F26 CB27 01370 SLA A
7F28 CB27 01380 SLA A
7F2A CB27 01390 SLA A
7F2C CB27 01400 SLA A
7F2E 47 01410 LD B,A
7F2F 23 01420 INC HL
7F30 7E 01430 LD A,(HL)
7F31 D630 01440 SUB 30H
7F33 FE0A 01450 CP 10
7F35 F43A7F 01460 CALL P,ADJ
7F38 80 01470 ADD A,B
7F39 C9 01480 RET
7F3A D607 01490 ADJ SUB 7
7F3C C9 01500 RET
7F3D DD216B7F 01510 BLOCK LD IX,RESET
7F41 0601 01520 SET B,1
7F43 3E3C 01530 PUNCH LD A,3CH ;BLOCK SYNC
7F45 CD6402 01540 CALL 0264H ;WRITE BYTE
7F48 78 01550 LD A,B ;BYTE COUNT
7F49 CD6402 01560 CALL 0264H
7F4C 7D 01570 LD A,L ;LSB ADDRESS
7F4D CD6402 01580 CALL 0264H
7F50 4F 01590 LD C,A ;SAVE FOR CHECKSUM
7F51 7C 01600 LD A,H ;MSB ADDRESS
7F52 CD6402 01610 CALL 0264H
7F55 81 01620 ADD A,C
7F56 4F 01630 LD C,A

```

Listing 1 continued

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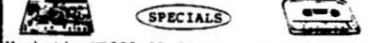
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Listing 1 continued

```

7F57 DD7E00 01640 PUN1 LD A,(IX)
7F5A CD6402 01650 CALL 0264H
7F5D 23 01660 INC HL
7F5E DD23 01670 INC IX
7F60 81 01680 ADD A,C
7F61 4F 01690 LD C,A
7F62 10F3 01700 DJNZ PUN1
7F64 CD6402 01710 CALL 0264H ;OUTPUT CHECKSUM
7F67 CD2C02 01720 CALL 022CH ;BLINK STAR
7F6A C9 01730 RET
7F6B 76 01740 RESET DEFB 76H ;HALT CODE
7F6C E9 01750 LIST DEFB 0E9H
7F6D 20 01760 NAME DEFB 20H
7F6E 20 01770 DEFB 20H
7F6F 20 01780 DEFB 20H
7F70 20 01790 DEFB 20H
7F71 20 01800 DEFB 20H
7F72 20 01810 DEFB 20H
0002 01820 STADR DEFS 2 ;STORE START ADDRESS
0002 01830 ENADR DEFS 2 ;STORE END ADDRESS
0002 01840 TRFADR DEFS 2 ;STORE ENTRY ADDRESS
7F79 45 01850 MSG1 DEFM 'ENTER PROGRAM NAME/START/END/ENTRY HEX ADDR
ESSES'
4E 54 45 52 20 50 52 4F
47 52 41 4D 20 4E 41 4D
45 2F 53 54 41 52 54 2F
45 4E 44 2F 45 4E 54 52
59 20 48 45 58 20 41 44
44 52 45 53 53 45 53
7FA9 00 01860 DEFB 0
7FAA 20 01870 MSG2 DEFM ' PREPARE RECORDER AND PRESS RECORD & PL
AY <ENTER>'
20 20 20 20 50 52 45 50
41 52 45 20 52 45 43 4F
52 44 45 52 20 41 4E 44
20 50 52 45 53 53 20 52
45 43 4F 52 44 20 26 20
50 4C 41 59 20 3C 45 4E
54 45 52 3E
7FDF 00 01880 DEFB 0
7FE0 2A 01890 STAR DEFB 2AH
7E00 01900 END START
00000 TOTAL ERRORS
    
```

Program Listing 2. ProteC routine.

```

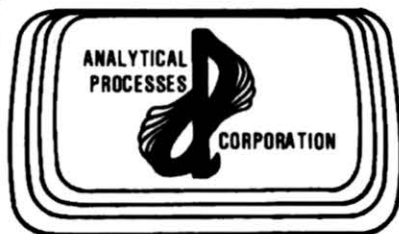
00100 ;PROTEC 1.1---BASIC CASSETTE TAPES ONLY
41E2 00110 ORG 41E2H ;SYSTEM RELAY FOR AUTO START
41E2 E9 00120 DEFB 0E9H
40B1 00130 ORG 40B1H ;BASIC TOP OF MEMORY PTR
40B1 1F7E 00140 DEFW START-1
418E 00150 ORG 418EH ;NAME VECTOR
418E C3 00160 DEFB 0C3H ;JUMP
418F 207E 00170 DEFW START
4049 00180 ORG 4049H ;MEMORY SIZE
4049 1F7E 00190 DEFW START-1
7E20 00200 ORG 7E20H ;PROTEC
7E20 00210 START EQU $
7E20 CDC901 00220 CALL 01C9H ;CLEAR SCREEN
7E23 31207E 00230 LD SP,START+8
7E26 21837F 00240 LD HL,MSG1 ;DISPLAY PGM NAME PROMPT
7E29 CDA728 00250 CALL 28A7H
7E2C 3E0D 00260 LD A,0DH
7E2E CD3A03 00270 CALL 033AH
7E31 2AA740 00280 LD HL,(40A7H)
7E34 0606 00290 LD B,6
7E36 CDD905 00300 CALL 05D9H ;INPUT NAME
7E39 117D7F 00310 LD DE,NAME
7E3C 7E 00320 NAME1 LD A,(HL)
7E3D 12 00330 LD (DE),A
7E3E 23 00340 INC HL
7E3F 13 00350 INC DE
7E40 10FA 00360 DJNZ NAME1
7E42 3E0D 00370 LD A,0DH
7E44 CD3A03 00380 CALL 033AH
7E47 21967F 00390 LD HL,MSG2 ;DISPLAY PREPARE RECORDER
7E4A CDA728 00400 CALL 28A7H
7E4D 010000 00410 LD BC,0000
7E50 CD6000 00420 CALL 0060H
7E53 B7 00430 OR A
7E54 3A4038 00440 READY LD A,(3840H) ;CHECK KEYBOARD FOR <ENTER>
7E57 FE01 00450 CP 01H
7E59 2807 00460 JR Z,REC
7E5B FE04 00470 CP 04 ;CHECK KEYBOARD FOR <BREAK>
7E5D CA191A 00480 JP Z,1A19H ;RETURN TO BASIC
7E60 10F2 00490 JR READY
7E62 F3 00500 REC DI
7E63 3E2A 00510 LD A,2AH
7E65 323E3C 00520 LD (3C3EH),A ;STAR
7E68 3E00 00530 LD A,0
7E6A CD1202 00540 CALL 0212H ;INITIALIZE RECORDER #1
7E6D CD8702 00550 CALL 0287H ;WRITE LEADER & SYNC BYTE
7E70 3E55 00560 LD A,55H ;SYSTEM TAPE ID
7E72 CD6402 00570 CALL 0264H ;WRITE BYTE
7E75 117D7F 00580 LD DE,NAME
7E78 0606 00590 LD B,6
7E7A 1A 00600 WRTNAM LD A,(DE)
7E7B CD6402 00610 CALL 0264H
7E7E 13 00620 INC DE
7E7F 10F9 00630 DJNZ WRTNAM ;WRITE NAME
7E81 3E3C 00640 LD A,3CH ;DISABLE TRACE
    
```

Listing 2 continued

Listing 2 continued

7E83 CD6402	00810	CALL	0264H	
7E86 3E01	00820	LD	A,1	
7E88 CD6402	00830	CALL	0264H	
7E8B 3E1B	00840	LD	A,1BH	
7E8D CD6402	00850	CALL	0264H	
7E90 3E41	00860	LD	A,41H	
7E92 CD6402	00870	CALL	0264H	
7E95 3E00	00880	LD	A,0	
7E97 CD6402	00890	CALL	0264H	
7E9A CD6402	00900	CALL	0264H	;OUTPUT FALSE CHECKSUM
7E9D 213E3C	00910	LD	HL,3C3EH	
7EA0 DD21CC7F	00930	LD	IX,STAR	
7EA4 CD477F	00940	CALL	SET	
7EA7 010000	00942	LD	BC,0000	;DEFEAT TIMERS
7EAA CD6000	00944	CALL	0060H	
7EAD CD6000	00946	CALL	0060H	
7EB0 210000	00950	LD	HL,0000	;LMOFFSET
7EB3 CD437F	00970	CALL	BLOCK	
7EB6 21A043	00980	LD	HL,43A0H	;TBUG
7EB9 CD437F	00990	CALL	BLOCK	
7EBC 21007F	01000	LD	HL,7F00H	;RSM2 & 2D, 16K
7EBF CD437F	01010	CALL	BLOCK	
7EC2 2100BF	01020	LD	HL,0BF00H	;RSM2D 32K
7EC5 CD437F	01030	CALL	BLOCK	
7EC8 2100FF	01040	LD	HL,0FF80H	;RSM2D 48K
7ECB CD437F	01050	CALL	BLOCK	
7ECE 210F40	01052	LD	HL,40F0H	;DEBUG
7ED1 CD437F	01054	CALL	BLOCK	
7ED4 210C40	01056	LD	HL,400CH	;DISABLE BREAK KEY
7ED7 DD217A7F	01058	LD	IX,BREAK	
7EDB 0603	01060	LD	B,3	
7EDD CD497F	01062	CALL	PUNCH	
7EE0 2AF940	01064	LD	HL,(40F9H)	;SIMPLE VARIABLES PTR
7EE3 ED5BA440	01066	LD	DE,(40A4H)	;START OF BASIC PGM PTR
7EE7 B7	01068	OR	A	
7EE8 ED52	01070	SBC	HL,DE	
7EEA 2B	01072	DEC	HL	
7EEB EB	01074	EX	DE,HL	
7EEC E5	01076	PUSH	HL	
7EED DDE1	01078	POP	IX	
7EEF 7A	01080	LD	A,D	
7EF0 FE00	01082	CP	0	
7EF2 2808	01084	JR	Z,WRT2	
7EF4 0600	01100	LD	B,0	
7EF6 CD497F	01110	CALL	PUNCH	
7EF9 15	01120	DEC	D	
7EFA 20F8	01130	JR	NZ,WRT1	
7EFC 7B	01140	LD	A,E	
7EFD FE00	01150	CP	0	
7EFF CA067F	01160	JP	Z,WRT3	
7F02 43	01170	LD	B,E	
7F03 CD497F	01180	CALL	PUNCH	
7F06 E5	01190	PUSH	HL	;SAVE FOR TRANSFER
7F07 DD21727F	01200	LD	IX,LIST	
7F0B 0607	01210	LD	B,7	
7F0D CD497F	01220	CALL	PUNCH	
7F10 21E241	01240	LD	HL,41E2H	;SYSTEM/AUTO-START RELAY
7F13 CD477F	01250	CALL	SET	
7F16 0602	01290	LD	B,2	
7F18 21F940	01300	LD	HL,40F9H	;SIMPLE VARIABLES PTR
7F1B E5	01310	PUSH	HL	
7F1C DDE1	01312	POP	IX	
7F1E CD497F	01320	CALL	PUNCH	
7F21 21A440	01330	LD	HL,40A4H	;START OF BASIC PTR
7F24 E5	01340	PUSH	HL	
7F25 DDE1	01342	POP	IX	
7F27 0602	01350	LD	B,2	
7F29 CD497F	01360	CALL	PUNCH	
7F2C D1	01370	POP	DE	;RECOVER RUN BLOCK
7F2D 3E78	01380	LD	A,78H	;TRANSFER BLOCK
7F2F CD6402	01390	CALL	0264H	
7F32 7B	01400	LD	A,E	;RUN ROUTINE
7F33 CD6402	01410	CALL	0264H	
7F36 7A	01420	LD	A,D	
7F37 CD6402	01430	CALL	0264H	
7F3A CDF801	01440	CALL	01F8H	;TURN OFF RECORDER
7F3D CDC901	01480	CALL	01C9H	;CLEAR SCREEN
7F40 C3191A	01490	JP	1A19H	;RETURN TO BASIC
7F43 DD21717F	01500	LD	IX,RESET	
7F47 0601	01510	LD	B,1	
7F49 3E3C	01520	LD	A,3CH	;BLOCK SYNC
7F4B CD6402	01530	CALL	0264H	;WRITE BYTE
7F4E 78	01540	LD	A,B	;BYTE COUNT
7F4F CD6402	01550	CALL	0264H	
7F52 7D	01560	LD	A,L	;LSB ADDRESS
7F53 CD6402	01570	CALL	0264H	
7F56 4F	01580	LD	C,A	;SAVE FOR CHECKSUM
7F57 7C	01590	LD	A,H	;MSB ADDRESS
7F58 CD6402	01600	CALL	0264H	
7F5B 81	01610	ADD	A,C	
7F5C 4F	01620	LD	C,A	
7F5D DD7E00	01630	LD	A,(IX)	
7F60 CD6402	01640	CALL	0264H	
7F63 23	01650	INC	HL	
7F64 DD23	01660	INC	IX	
7F66 81	01670	ADD	A,C	
7F67 4F	01680	LD	C,A	
7F68 10F3	01690	DJNZ	PUN1	
7F6A CD6402	01700	CALL	0264H	;OUTPUT CHECKSUM
7F6D CD2C02	01710	CALL	022CH	;BLINK STAR
7F70 C9	01720	RET		
7F71 76	01722	DEFB	76H	;HALT CODE
7F72 21	01730	DEFB	21H	
7F73 1E	01740	DEFB	1EH	
7F74 1D	01750	DEFB	1DH	
7F75 E5	01760	DEFB	0E5H	
7F76 C3	01770	DEFB	0C3H	

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```

7F77 5D      01700      DEFB  5DH
7F78 1B      01790      DEFB  1BH
7F79 E9      01800      DEFB  0E9H
7F7A C3      01810      BREAK
7F7B 98      01820      DEFB  98H
7F7C 0A      01830      DEFB  0AH
7F7D 20      01840      NAME  DEFB  20H
7F7E 20      01842      DEFB  20H
7F7F 20      01844      DEFB  20H
7F80 20      01846      DEFB  20H
7F81 20      01848      DEFB  20H
7F82 20      01849      DEFB  20H
7F83 45      01850      MSG1  DEFM  'ENTER PROGRAM NAME'
4E 54 45 52 20 50 52 4F
47 52 41 4D 20 4E 41 4D
45
7F95 00      01860      DEFB  0
7F96 20      01870      MSG2  DEFM  'PREPARE RECORDER AND PRESS RECORD & PL
AY <ENTER>'
20 20 20 20 50 52 45 50
41 52 45 20 52 45 43 4F
52 44 45 52 20 41 4E 44
20 50 52 45 53 53 20 52
45 43 4F 52 44 20 26 20
50 4C 41 59 20 3C 45 4E
54 45 52 3E
7FCB 00      01880      DEFB  0
7FCC 2A      01890      STAR  DEFB  2AH
3C00      01910      ORG   3C00H ;WRITE INSTRUCTIONS
3C00 20      01920      DEFM  'PROTEC
'
20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20
20 20 20 20 50 52 4F 54
45 43 20 20 20 20 20 20
20 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20
20 20 20 20 20 20
3C3F 20      01930      DEFM  'WHEN YOU ARE READY TO ENCODE YOUR BASI
C PROGRAM, TYPE NAME'
20 20 20 20 57 48 45 4E
20 59 4F 55 20 41 52 45
20 52 45 41 44 59 20 54
4F 20 45 4E 43 4F 44 45
20 59 4F 55 52 20 42 41
53 49 43 20 50 52 4F 47
52 41 4D 2C 20 54 59 50
45 20 4E 41 4D 45
3C7E 20      01940      DEFM  ' <ENTER>. YOU WILL BE PROMPTED TO ENTER U
P TO SIX CHARACTERS '
20 3C 45 4E 54 45 52 3E
2E 20 20 59 4F 55 20 57
49 4C 4C 20 42 45 20 50
52 4F 4D 50 54 45 44 20
54 4F 20 45 4E 54 45 52
20 55 50 20 54 4F 20 53
49 58 20 43 48 41 52 41
43 54 45 52 53 20
3CBD 20      01950      DEFM  ' UNDER WHICH YOUR ENCODED PROGRAM WILL OP
ERATE AS A SYSTEM TAPE'
20 20 55 4E 44 45 52 20
57 48 49 43 48 20 59 4F
55 52 20 45 4E 43 4F 44
45 44 20 50 52 4F 47 52
41 4D 20 57 49 4C 4C 20
4F 50 45 52 41 54 45 20
41 53 20 41 20 53 59 53
54 45 4D 20 54 41
3CFC 50      01960      DEFM  'PE <ENTER>. YOU WILL THEN BE PROMPTED TO
PREPARE THE RECORDER'
45 20 20 3C 45 4E 54 45
52 3E 2E 20 20 59 4F 55
20 57 49 4C 4C 20 54 48
45 4E 20 42 45 20 50 52
4F 4D 50 54 45 44 20 54
4F 20 50 52 45 50 41 52
45 20 54 48 45 20 52 45
43 4F 52 44 45 52
3D3B 2C      01970      DEFM  ' , PRESSING RECORD AND PLAY <ENTER>. YOUR
BASIC PROGRAM WILL'
20 20 20 20 50 52 45 53
53 49 4E 47 20 52 45 43
4F 52 44 20 41 4E 44 20
50 4C 41 59 20 3C 45 4E
54 45 52 3E 2E 20 59 4F
55 52 20 42 41 53 49 43
20 50 52 4F 47 52 41 4D
20 57 49 4C 4C
3D79 20      01980      DEFM  ' BE ENCODED AS A SYSTEM TAPE. TO RUN YOU
R TAPE, TYPE SYSTEM'
42 45 20 20 20 20 45 4E
43 4F 44 45 44 20 41 53
20 41 20 53 59 53 54 45
4D 20 54 41 50 45 2E 20
54 4F 20 52 55 4E 20 59
4F 55 52 20 54 41 50 45
2C 20 54 59 50 45 20 53
59 53 54 45 4D
3DB7 20      01990      DEFM  ' <ENTER>. AT THE PROMPT *? ENTER THE NAM
E UNDER WHICH THE'
3C 45 4E 54 45 52 3E 2E
20 20 20 20 41 54 20 54
48 45 20 50 52 4F 4D 50
54 20 2A 3F 20 45 4E 54
45 52 20 54 48 45 20 4E

```

Listing 2 continued

Listing 2 continued

```

41 4D 45 20 55 4E 44 45
52 20 57 48 49 43 48 20
54 48 45
3DF3 20 02000 DEFM ' PROGRAM WASENCODED <ENTER>. YOUR ENCODED
PROGRAM WILL LOAD'
20 50 52 4F 47 52 41 4D
20 57 41 53 45 4E 43 4F
44 45 44 20 3C 45 4E 54
45 52 3E 2E 20 20 59 4F
55 52 20 45 4E 43 4F 44
45 44 20 50 52 4F 47 52
41 4D 20 57 49 4C 4C 20
4C 4F 41 44
3E30 20 02010 DEFM ' AND AUTOMATIC- ALLY BEGIN TO OPERATE. USE
RS WILL BE UNABLE TO'
41 4E 44 20 41 55 54 4F
4D 41 54 49 43 2D 20 41
4C 4C 59 20 42 45 47 49
4E 20 54 4F 20 4F 50 45
52 41 54 45 2E 20 20 55
53 45 52 53 20 57 49 4C
4C 20 42 45 20 55 4E 41
42 4C 45 20 54 4F
3E6F 20 02020 DEFM ' LIST, LLIST OR USE THE BREAK KEY. POPULA
R MONITORS SUCH AS'
20 4C 49 53 54 2C 20 4C
4C 49 53 54 20 4F 52 20
55 53 45 20 54 48 45 20
42 52 45 41 4B 20 4B 45
59 2E 20 20 50 4F 50 55
4C 41 52 20 4D 4F 4E 49
54 4F 52 53 20 53 55 43
48 20 41 53
3EAC 20 02030 DEFM ' THE RSM2 SERIES, SYSTEM COPY AND TBUG WI
LL BE DISABLED, AS W'
54 48 45 20 52 53 4D 32
20 53 45 52 49 45 53 2C
20 20 20 53 59 53 54 45
4D 20 43 4F 50 59 20 41
4E 44 20 54 42 55 47 20
57 49 4C 4C 20 42 45 20
44 49 53 41 42 4C 45 44
2C 20 41 53 20 57
3EEB 49 02040 DEFM ' ILL THE TRACE FUNCTION. YOU MAY NOW
CLOAD YOUR BASIC PR'
4C 4C 20 54 48 45 20 54
52 41 43 45 20 20 20 20
20 20 20 20 46 55 4E 43
54 49 4F 4E 2E 20 20 59
4F 55 20 4D 41 59 20 4E
4F 57 20 43 4C 4F 41 44
20 59 4F 55 52 20 42 41
53 49 43 20 50 52
3F2A 4F 02050 DEFM ' OGRAM IF IT HAS NOT ALREADY BEEN LOADED.
'
47 52 41 4D 20 49 46 20
49 54 20 48 41 53 20 4E
4F 54 20 20 20 41 4C 52
45 41 44 59 20 42 45 45
4E 20 4C 4F 41 44 45 44
2E 20 20 20 20 20 20 20
20 20 20 20 20 20 20 20
20
4020 02060 ORG 4020H
4020 803F 02070 DEFW 3F80H
1A19 02080 END 1A19H ;BASIC RE-ENTRY
00000 TOTAL ERRORS

```

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Channels of Communication

by Dan Keen and Dave Dischert

Home satellite receiving dishes can bring you more than 140 cable stations free. This article explains dish technology and positioning.

You're sitting at home on a Friday night, looking for something entertaining to watch on television. But all that's on are reruns of *The Dukes of Hazzard*, a show on how to train your dog, and the Miss Teen U.S.A. pageant.

You do have an alternative—more than 140 TV and movie stations, each of which comes into your home free. All you need is a satellite receiver and a

Model I or III.

In this article we discuss how satellite receivers work, how to get one, the costs and time involved, and how to use your Model I or III to position your receiving dish to pull in signals from different satellites.

Satellite Receiver Boom

Home satellite receivers are gaining in

popularity. Currently, more than 100,000 U.S. homes have receivers. As more dishes are set up and newer, less expensive technology becomes available, dish receivers will drop in price and come within reach of almost everyone. As it is, satellite receiver systems are significantly less expensive today than they were five years ago. You can get a complete system now for as little as \$2,500.

The Technology

Cable program signals travel around the United States via satellite (see Fig. 1). The transmitting station that generates the microwave signal beams it up to an orbiting satellite.

The satellite receives the signal, cleans it up, and rebroadcasts it to receiving stations scattered across the United States. These receiving stations then send the signal, via ground-based cables, to homes.

Home receiving dishes work just like their commercial counterparts. They, too, pick up signals from satellites, but instead of sending them out over commercial cables, they shunt the signal to your home television set.

Communications satellites orbit directly over the equator in a geostationary orbit at an altitude of 22,300 miles. Satellites occur in the North American continent in an equatorial arc of from roughly 83 to 135 degrees longitude, with a spread of about four degrees.

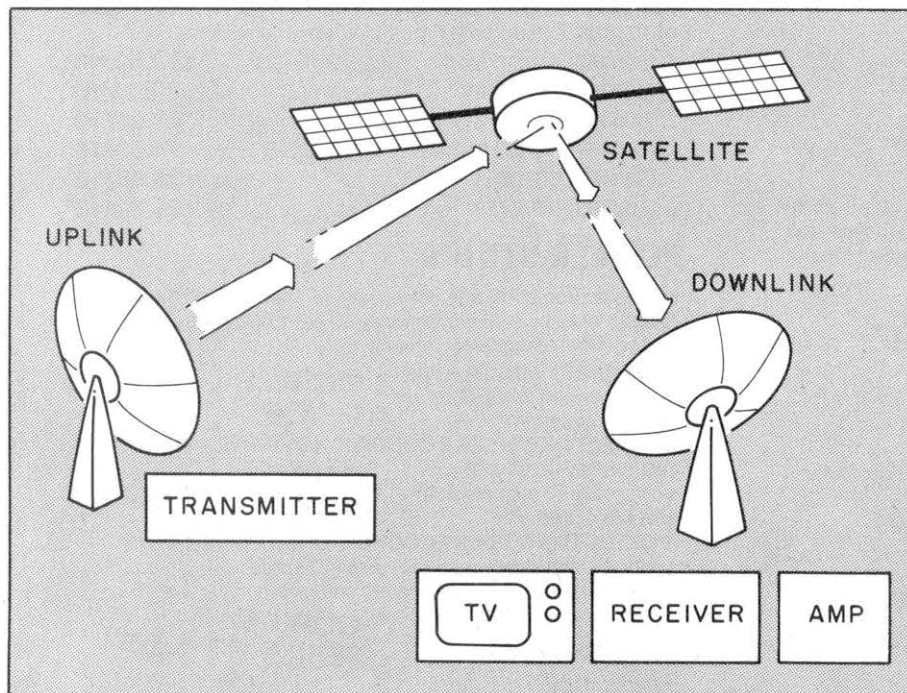


Figure 1. The basic components of a satellite TV system.

The Key Box

Model I and III
16K RAM Cassette Basic
32K RAM Disk Basic

Television Stations

Typically, satellites have either 12 or 24 channels, called transponders. Several communications satellites carry a full load (24 channels) devoted to television programming.

Some programs are free religious or commercial stations, such as Satellite News Channel and Music Television. Other channels may be illegal to receive, such as Home Box Office and Showtime, but comprehensive laws governing this medium are still being debated.

Satcom F3R, the most widely accessed satellite, is one of the few that dedicates all 24 transponders to television programming. It carries Nickelodeon, The Movie Channel, ESPN (entertainment sports), MTV (Music Television), Cable News Network, the Christian Broadcast Network, and superstations WGN and WTBS. The Program Listing contains all the stations available through Satcom F3R.

U.S. companies launch more satellites each year, providing a larger selection of programming services from which to choose.

Getting the Signal

Communications satellites send out polarized microwave beams in either a horizontal or vertical format. For example, RCA's Satcom F3R satellite has horizontal polarization on even transponders and vertical polarization on odd transponders. The Westar 3 satel-

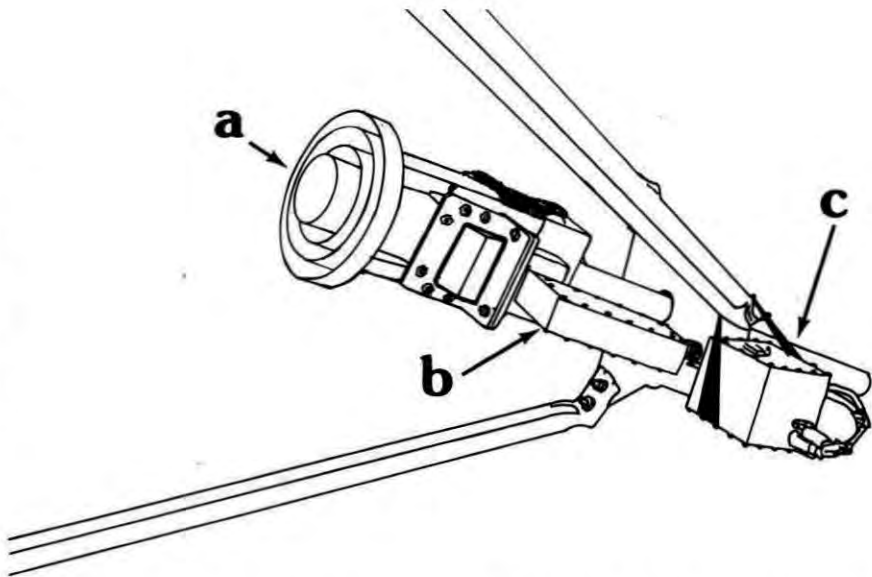


Figure 2. The feed assembly, consisting of the (a) antenna, (b) low-noise amplifier, and (c) downconverter.

lite polarizes all its signals horizontally.

Even though all communications satellites (about 12 currently in operation) broadcast on the same frequencies, there is no interference between them because the receiving antennas are highly directional.

To pick up these signals, you need to rotate your dish antenna. You can equip your antenna with a remote control motor to rotate the dish from inside your house. Other satellite systems provide electronic switches that correctly position the antenna.

Earth transmitters send TV signals to satellites at 1,000 watts. This is called the

uplink of the transmission. The satellite receives the signal, usually at around 6 gigahertz in frequency, cleans it up, and retransmits it back over the United States (see the schematic in Fig. 1).

The return signal arrives at between 3.7 and 4.2 gigahertz and at a power of 5 watts. Because the signal is so weak, you need a large receiving dish to gather and concentrate the signal (see the Photo). For most of North America, a 10-foot dish is the minimum required for a good picture. The dish gathers and concentrates the signal, and bounces it back into the feed assembly, a combination receiver/amplifier suspended opposite the center of the dish (see Fig. 2). The feed assembly directs signals into the receiving amplifier, called a low-noise amplifier, or LNA.

The LNA amplifies the signal and sends it to the downconverter, also part of the feed assembly. The downconverter changes the high-frequency microwave signal to a lower, more manageable signal of about 70 MHz. It then sends the signal along a standard TV cable wire (Radio Shack part number RG-59U) into your home.

Finally, the signal travels indoors to the receiver, letting you select a channel from 1 to 24. You receive the signal through a radio frequency signal (usually on channels 2, 3, or 4) connected to the antenna input of any television. Direct video/audio outputs are included for connection to a video tape recorder or a large-screen projection TV.

Broadcast Scrambling

Potential satellite owners need not worry about spending money for a receiving system that only picks up scrambled signals. As of this writing, scrambling



Photo. One of the authors' microwave antennas.

Program Listing. Satellite guide and site survey program.

```

10 CLS:PRINT@512,"ENTER YOUR CHOICE <S>ITE SURVEY <P>ROGRAM GUIDE
";GOSUB640:IFIK$="S"THENGOTO100ELSEIFIK$<>"P"THENGOTO10
20 CLEAR1000:DIM A$(24),S(75):GOSUB500
30 DATA Nickelodeon/Arts,PTL,WGN,Spotlight,The Movie Channel,WTBS,
E.S.P.N. Entertainment & Sports Programming Net,A.E.T.N./Christian
Broadcasting Network,USA Cable Network/C-Span,Showtime,MTV (Music
Television),Showtime
40 DATA Home Box Office,Cable News Network,Cable News Network Headl
ine News
50 DATA HTN Plus/ASCN/National Jewish Television,Cable Health Netw
ork,Reuters Monitor Service/Eternal Word Television,C-Span,Cinemax
,The Weather Channel,Modern Satellite Network/Daytime/HBO/USA Net.
,Cinemax,HBO
60 FORZ=1TO24:READA$(Z):NEXT:CLS
80 PRINT@87,CHR$(176);CHR$(176);STRING$(9,188);CHR$(176);CHR$(176)
90 PRINT@148,CHR$(184);CHR$(190);STRING$(15,191);CHR$(189);CHR$(18
0);CHR$(144)
100 PRINT@210,CHR$(184);STRING$(21,191);CHR$(189);CHR$(144)
110 PRINT@273,CHR$(186);STRING$(24,191);CHR$(144)
120 PRINT@337,STRING$(25,191);CHR$(149)
130 PRINT@401,CHR$(138);STRING$(24,191)
140 PRINT@466,CHR$(139);CHR$(175);STRING$(20,191);CHR$(143);CHR$(1
29)
150 PRINT@532,CHR$(131);CHR$(143);STRING$(15,191);CHR$(143);CHR$(1
35);CHR$(129)
160 PRINT@599,CHR$(130);CHR$(131);CHR$(131);STRING$(7,143);CHR$(13
1);CHR$(131);CHR$(129)
170 PRINT@365,"Earth";
180 REM PLOT SATELLITES
190 SET(0,24):PRINT@513,"Satcom 3";:SET(2,28):PRINT@578,"Comstar D
4";
200 SET(5,33):PRINT@707,"Westar 5";:SET(11,38):PRINT@774,"Satcom 2
";
210 SET(18,41):PRINT@842,"Anik A3/A2";:SET(28,44):PRINT@976,"Anik
D1";
220 SET(47,46):PRINT@911,"Anik B";
230 SET(64,46):PRINT@993,"Westar 4";:SET(78,43):PRINT@937,"Comstar
D1/D2";
240 SET(87,40):PRINT@878,"Westar 3";:SET(0,21):PRINT@449,"Satcom F
1";
241 SET(0,18):PRINT@385,"Satcom F5";:SET(96,37):PRINT@817,"Comstar
D3";:REM F5 & D3
242 SET(101,34):PRINT@756,"Satcom F4";:SET(105,31):PRINT@694,"West
ar 1/2";:REM F4 & WEST 1/2
250 S=1:REM STAR TWINKLING
260 GOSUB550:X=0
270 FORA=1TO75:B=RND(1024):S=15359+B:C=PEEK(S):IFC>32THENNEXTELSEP
OKES,46:S(X)=S:X=X+1:NEXT
280 TW=RND(X):POKES(TW),32:FORDE=1TO20:IFINKEY$=" "THENNEXT:POKES(T
W),46:GOTO280
290 REM SATELLITE DATA VIDEO PAGE
300 CLS:GOSUB550
310 PRINT@128,"SATELLITE","POSITION","COUNTRY"
320 PRINT"-----"
330 PRINT"Satcom F3R","131 degrees","U.S.A."
340 PRINT"Comstar D1","127 degrees","U.S.A."
350 PRINT"Westar 5","123 degrees","U.S.A."
360 PRINT"Satcom F2","119 degrees","U.S.A."
370 PRINT"Anik 3","114 degrees","Canada"
380 PRINT"Anik B","109 degrees","Canada"
390 PRINT"Westar 4"," 99 degrees","U.S.A."
400 PRINT"Comstar D2"," 95 degrees","U.S.A."
410 PRINT"Westar 3"," 91 degrees","U.S.A."
420 PRINT"Comstar D3"," 87 degrees","U.S.A."
430 PRINT"Satcom F4"," 83 degrees","U.S.A."
440 GOSUB610
450 REM SATCOM DATA VIDEO PAGE
460 CLS:GOSUB550
470 PRINT:PRINT" Satcom F3R Programming Services For Transponders
1 Through 12"
480 X=194:FORP=1TO12:PRINT@X,P,A$(P):X=X+64:NEXT
490 GOSUB600:GOSUB610
500 CLS:GOSUB550
510 PRINT:PRINT" Satcom F3R Programming Services For Transponders
13 Through 24"
520 X=194:FORP=13TO24:PRINT@X,P,A$(P):X=X+64:NEXT
530 GOSUB600:GOSUB610
540 RUN
550 PRINT@7,"SATELLITE GUIDE - Hit any key for more information";
560 RETURN
580 REM
MAKE BORDER
590 A$=STRING$(63,131)+CHR$(191):FORA=1TO12:A$=A$+CHR$(26)+CHR$(8)
+CHR$(191):NEXT:FORA=1TO13:B$=B$+CHR$(191)+CHR$(26)+CHR$(8):NEXT:B
$=B$+CHR$(191)+STRING$(62,176):RETURN

```

Listing continued

is almost nonexistent in the satellite industry. Only Home Box Office has threatened to modify their signal in the future.

Some programming on Canada's Anik satellite is scrambled, but it has technological problems that are so significant that subscribing cable companies have appealed to them to discontinue this practice.

The Latest Developments

Satellites launched since 1982 have more power than previous units. Consequently, picture quality remains high with less efficient (and less expensive) receiving systems.

Because of these advances, great differences exist between equipment performance and cost. You can find dish antennas for around \$1,200 that give

"Satellites launched since 1982 have more power than previous units. Consequently, picture quality remains high with less efficient (and less expensive) receiving systems."

the same performance as those costing in excess of \$10,000. You can install complete systems today for about \$2,000 to \$3,000.

The latest line of receivers on the market are more attractively packaged than those of a few years ago. They also provide new features and innovations.

Richly furnished cabinets, illuminated meters, and digital channel readouts enhance front panel appearance. Several companies even offer handheld, infrared remote control.

The Program

Our program contains a satellite guide option and a site survey option. The satellite guide option lists all satellites and their position relative to earth, and prints a graphics display. It also lists the 24 TV channels on the Satcom F3R satellite.

The site survey option prompts you for your location and tells you if you



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Listing continued

```
600 PRINT@128,A$;:PRINT@128,B$;:POKE16383,191:RETURN
610 GOSUB550:FORX=1TO200:IFINKEY$=""THENNEXTELSERETURN
620 PRINT@25," ";:FORX=1TO50:IFINKEY$=""THENNEXT
630 GOTO610
640 IK$=INKEY$:IFIK$=""THENGOTO640ELSERETURN
1000 CLEAR100:DEFDBL A-Z
1010 PI=3.141592
1020 R=3963
1030 H=22300
1040 CLS:PRINT@18,"SATELLITE SITE SURVEY PROGRAM":PRINTSTRING$(64,
"-")
1050 PRINT"ENTER THE LONGITUDE OF THE SATELLITE. HOW MANY DEGREES
";
1060 INPUT SD:INPUT"HOW MANY MINUTES ";SM
1070 INPUT"IS IT WEST OR EAST LONGITUDE (ENTER W OR E) ";SB$
1080 SA=SD+SM/60:IF SB$="E"THEN SA=-SA
1090 INPUT"ENTER DISH (ANTENNA SITE) LONGITUDE. HOW MANY DEGREES
";DD
1100 INPUT"HOW MANY MINUTES ";DM
1110 INPUT"IS IT WEST OR EAST LONGITUDE (ENTER W OR E) ";DB$
1120 DA=DD+DM/60:IF DB$="E"THEN DA=-DA
1130 INPUT"ENTER DISH LATITUDE. HOW MANY DEGREES ";TD
1140 INPUT"HOW MANY MINUTES ";TM
1150 TA=TD+TM/60:TA=90-TA
1160 A=ABS((SA-DA)*PI/180)
1170 C=TA*PI/180
1180 CA=SIN(C)*COS(A):TA=SQR(1/(CA*CA)-1)
1190 AA=ATN(TA)
1200 BS=SIN(A)/SIN(AA)
1210 TB=1/SQR(1/(BS*BS)-1)
1220 BB=ATN(TB):BB=BB*180/PI
1230 IF SA>DA THEN TR=180+BB ELSE TR=180-BB
1240 PRINT"THE TRUE BEARING (ANTENNA HEADING) IS ";
1250 PRINTUSING"###.##";TR
1260 X=SQR(R*R+(R+H)*(R+H)-2*R*(R+H)*COS(AA))
1270 SE=(R+H)*SIN(AA)/X
1280 TE=1/SQR(1/(SE*SE)-1):EL=ATN(TE)
1290 EL=EL*180/PI
1300 EL=90-EL
1310 PRINT"THE ANGLE OF ELEVATION IS ";
1320 PRINTUSING"###.##";EL;:PRINT" DEGREES"
1330 PRINT:INPUT"HOW MANY DEGREES IS THE MAGNETIC DEVIATION OF YOU
R AREA ";MD
1340 INPUT"IS THAT WEST OR EAST (ENTER W OR E) ";A$
1350 IFA$="W"THEN MD=MD+TR ELSE MD=TR-MD
1360 PRINT"YOUR COMPASS HEADING SHOULD ";USING"###.##";MD;:PRINT"
DEGREES"
1370 INPUT"HIT <ENTER> FOR MENU ";OL$:RUN
```

can place a satellite receiving station on your property by calculating the heading and elevation of a dish for any given satellite.

The program first prompts you with a menu containing the two options. Hit the S key to perform a site survey or the P key for a satellite programming guide.

The satellite guide section presents a visual picture of the earth, with current satellites in their respective positions. The program displays information about the various satellites, including their longitude (true position) and their country of origin.

There must be an unobstructed line from your dish to the satellite. In the winter, trees have no effect on microwaves, but the addition of water in foliage in the spring and summer wipes out reception.

The mathematics used in the program involve spherical trigonometry and is beyond the scope of this article.

Data Input

It's easy to accurately determine the

latitude and longitude of your house by checking a map or referring to the deed to your house. You must also input the magnetic deviation (the difference between true north and magnetic north) in your area. You can get this information from your local airport or, if you live along the coast, from the local Coast Guard base.

Enter the longitude of the satellite you wish to find by copying the information from the satellite guide section in the program. Enter fractional degrees using either a decimal point or by answering the prompt for the number of minutes of arc. For example, if your latitude is 74 degrees, 50 minutes, you can enter this into the program in two ways:

```
ENTER DISH (ANTENNA) LONGITUDE
HOW MANY DEGREES? 74.8
HOW MANY MINUTES? 0
```

or

```
ENTER DISH (ANTENNA) LONGITUDE
HOW MANY DEGREES? 74
HOW MANY MINUTES? 50
```

Installing It Yourself

If you're interested in purchasing your own satellite receiver, we suggest you talk to your local satellite dealer. Unless you're mechanically inclined, a site inspection for reception quality, and siting the antenna should be done by a professional.

With a distance of 22,300 miles from satellite to the equator, an antenna situated off by 1 degree will miss its intended satellite by 1,000 miles. A preliminary inspection will save you a lot of wasted effort in an area of poor reception.

By running your own cable, pouring the concrete, and assembling the equipment yourself, however, you can save hundreds of dollars.

We purchased a Wilson Microwave system. The Wilson system is not a turnkey system; that is, the manufacturer does not supply all the material necessary to put the system into operation, but only a few connectors and some wire aren't included.

The wire is standard multiconductor cable. It runs the power supplied by the indoor receiver out to the low-noise amplifier and downconverter. You also need an RG-59U wire to bring the TV signal from the downconverter into the house. You can purchase both types of wire at Radio Shack.

One person cannot install this system alone. Laying the concrete foundation for the dish and assembling its panels are two-man operations.

An 11-foot dish has a surface area of 95 square feet. On a 100-square-foot area, an 80 mph wind exerts a 2½ ton force. This kind of stress makes a secure base essential.

Conclusion

In retrospect, the expense we incurred to construct a working earth satellite receiver system was higher than originally estimated. Several nuts and bolts, two special microwave connectors (available from a satellite system dealer), and wire and cables all were additional expenses.

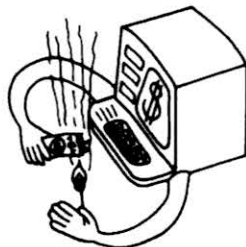
The system is fairly easy to operate, although you have to adjust the fine tuning every time you change stations.

During heavy rain, we pick up some snow on the picture, but other than that, picture quality is good.

What's on TV tonight? Everything! ■

Dan Keen and Dave Dischert can be reached at Soft Horizons Computer Software, RD1 Box 432, State Highway 83, Cape May Court House, NJ 08210.

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All versions of mailing list and data bank are programmed in compiler basic using 'ISAM' files to eliminate the need for time consuming, inefficient, and expensive sorting. Through the use of 'ISAM' files, the maximum number of records that can be handled by the computer is only limited by the availability of disk space and not by the amount of computer memory needed for sorting and the complete file is accessible at any time.

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Both versions of our inventory system are programmed in interpreter basic, utilizing both direct access and variable length records to maximize access speed and the use of available disk space.

The dedication, ability, and years of experience of both the system analyst and the programmer combine to make these programs and systems among the finest that you have had the opportunity to use and certainly one of the best values on the market.

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Builds and maintains user defined data file(s) with up to 16 (12 for model III) user defined data fields. The user specifies file name, control field data, data field names, and data field size. The system adds records, changes records, deletes records, displays individual records, prints all records in user defined format with user's choice of fields and order, and prints records by user defined search as to field and value in user defined format with user's choice of fields and order.

Model 2, 12 \$295.00
Model III \$275.00

MAILING LIST SYSTEM (Alpha Sequence)

Builds and maintains mailing list in alpha sequence by entire name. The system adds records and checks for duplicates, changes records, deletes records, displays individual records, prints all records, prints records by user specified zip code search, prints all mailing labels, prints individual labels (as many as requested), prints labels by user specified zip code search, & prints telephone directory. The data file created by this system can be used as input for the mailing list (zip code sequence) system.

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MAILING LIST SYSTEM (Zip Code Sequence)

Builds and maintains mailing list in alpha sequence within zip code sequence. This system adds records and checks for duplicates, changes records, deletes records, displays individual records, prints all records in alpha sequence within zip code, prints records by user specified zip code, prints all mailing labels in alpha sequence within zip code, prints individual labels (as many as requested), prints labels for user specified individual zip codes, prints telephone directory in alpha sequence within zip code, and reads in file(s) created by mailing list (alpha sequence).

Model 2, 12 \$250.00
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LOAN AMORTIZATION

Calculates personalized loan payments and interest. User specifies loan amount, interest rate, and length of loan. Displays monthly payment, displays monthly analysis, displays totals, prints monthly payments, prints monthly analysis, and allows user to enter over ride of monthly payments and recalculate totals and print or display monthly analysis.

Model 2, 12 \$125.00
Model III \$115.00

INVENTORY CONTROL SYSTEM (Retail, Wholesale, Manufacturer)

Builds and maintains records on all in stock items. Records contain user's part number, manufacturer's part number, on order quantity, in stock quantity, reorder point, wholesale price, retail price, sales history for preceeding month, year, same month last year, this year to date, last year to date. Displays individual item record, prints complete record for all items, and prints suggested purchase order. The add routine checks for duplicates.

Model 2, 12 \$275.00
Model III \$225.00

DESK CALENDAR

Each month prints on 14 1/2 x 11 paper. Each day is blocked to allow appointments entry. User specifies beginning month and number of months and number of calendars to be printed. 4 lines of user information may be printed on each month which makes it useful as an advertising media.

Model 2, 12 \$49.95
Model III \$49.95

WALL CALENDAR

Each year prints on 8 1/2 x 11 paper. User specifies beginning month and number of calendars to be printed. 4 lines of user information may be printed on each month which makes it useful as an advertising media.

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Model III \$49.95

For Additional Information Send for User Documentation — \$15.00 per copy.

Minimum Hardware Requirements

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Model 2, 12 64k 1 Disk

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These three direct-connect modems offer attractive alternatives to meet the

Choose one of these modems and get the right communication ability for your applications.

need to transmit information from your computer over telephone lines. They differ significantly in price and capabilities, but one of them is likely to suit your needs.

Each of the three modems works well and does all that it's supposed to. If you can get along with a 300 baud modem, the J-Cat is hard to beat in terms of price and performance. It's small, works perfectly, and is about as inexpensive a modem as you can buy.

If you need a 1,200 baud modem, in

addition to or instead of 300 baud operation, the Smart Cat offers a near-perfect alternative. It's remarkably small, offers all the features you're likely to need, and is competitively priced.

Alternatively, if you want a modem that can handle any 300 or 1,200 baud operation you might encounter, the UDS 212A/D is an excellent choice. It offers all the flexibility you're likely to need, is easy to operate, and includes diagnostic capabilities to isolate communications problems on the line, in the modem, or in the terminal equipment. All in all, it's a good product for commercial or industrial applications.

Table 1 summarizes major features. Which modem you choose depends on your finances and applications.

The three modems differ radically in size. The Novation J-Cat is scarcely larger than a pack of cigarettes. Its more capable companion, the 103/212 Smart Cat, resembles a tall paperback book. The UDC 212A/D, clearly intended for commercial use, has a footprint that is almost 3/4 of a square foot!

The J-Cat and UDC units are housed in plastic cases and the Smart Cat comes in a nonmagnetic metal case. All the units should retain their physical integrity in any ordinary use.

A conventional plug-in wall transformer powers the two Novation modems. The UDC unit has an integral alternating current (ac) power supply.

Neither of the Novation units has an on/off power switch, an unfortunate omission. The power requirements of these modems are nominal, however, ranging from 7-13.5 watts, so it's feasible to leave them turned on all the time.

J-Cat

The J-Cat is a simple, full duplex, 300 baud modem that has surprising capa-

Feature	J-CAT	103/212 Smart CAT	UDS 212A/D
Size (Inches)	5.0 x 1.9 x 1.3	10.0 x 4.7 x 1.2	10.85 x 9.76 x 2.42
Baud Rates	300	300/1200	300/1200
Auto Dial	See Text	Yes	Yes
Manual Answer	Yes	Yes	Yes
Auto Answer	Yes	Yes	Yes
Keyboard Dial	No	Yes	Yes
Manual Redial	Yes	Yes	Yes
Auto Redial	No	Yes	Yes
Dial Modes	See Text	Pulse/MFTD	Pulse/MFTD
Memory	None	Last #	5 #'s + Last #
Asynchronous	Yes	Yes	Yes
Synchronous	No	No	Yes
Resettable Defaults	No	Yes	No
Self Test	No	Yes	Yes
Analog Loopback	Yes	Yes	Yes
Local Digital Loopback	No	Yes	Yes
Remote Digital Loopback	No	Yes	Yes
Phone Jack(s)	RJ11C	RJ11C	RJ11C/RJ45S
Power (Watts)	8.0	13.5	7.0
Power Supply	Wall XFMR	Wall XFMR	Internal
Power Switch	No	No	Yes
Status Response	LED	DISPLAY	DISPLAY
Phone Service	1*	1*	1, 2, 3*
Cables Provided	All	Phone Line	Phone Line
Price	145.00	595.00	745.00

*Phone Service: 1 - Permissive, 2 - Programmable, 3 - Private Line

Table 1. Summary of modem characteristics.

bility in spite of its tiny size. You operate it with two push buttons; it has two LEDs that indicate its status. One push button puts the modem on line; the second disconnects it. Pressing the two buttons simultaneously puts the modem in analog loopback mode, so that its output connects to its input—an invaluable test to verify its operation.

You select auto answer or manual answer modes with a slide switch on the back of the unit. The two LEDs indicate when the modem is off-hook and ready for operation.

Although the J-Cat is not directly usable in auto-dial mode, you can implement auto pulse dialing with dial tone detect if 1 input and 1 output bit are available from another port. The operations manual provides a simple program to implement directory dialing and automatic redial using these bits. The program is written in Applesoft Basic but you can readily adapt it to Microsoft Basic.

The J-Cat is relatively unique among modems in providing automatic mode selection. When on line, the modem alternates between originate mode for two seconds and answer mode for four. As soon as it detects a carrier, the modem locks in its current mode. This relieves the user of any concern for selecting the modem's operating mode—a very useful feature.

The J-Cat comes with all the required cables, including one terminated with a female RS-232C D-connector that plugs into the output of your serial interface. A Y cable is also provided; one end of it plugs into the phone line via an RJ11C plug. The other leg of the Y terminates in a socket that accepts the RJ11C plug on the telephone.

You don't need to buy anything else. Simply hook up the modem according to the clear directions in the operations manual, load your terminal program, and you're ready to communicate.

The J-Cat's operating manual is a 4¼- by 9½-inch booklet of 21 pages that is clearly written and provides all the necessary information to install and operate the modem. A schematic is included, with detailed pin-outs for the connectors on the back of the unit.

103/212 Smart Cat

The 103/212 Smart Cat is the J-Cat's big brother. In addition to operation at both 300 and 1,200 baud, the user-programmable Smart Cat provides numerous operating conveniences.

In normal operation this modem has no visible controls. You select all operating modes by entering commands

from the terminal or computer keyboard. As a consequence, you can tuck the modem away from the operating position in the most convenient location. You can even place it inside a piece of equipment if the thermal environment isn't severe.

The Smart Cat has five option switches located behind its front panel. These are readily accessible if you pry the panel off with a small screwdriver. Once you set them, these switches will not normally need resetting.

Switch 1 sets the command mode. It determines the character you must send from the terminal to indicate to the modem that a command follows. Normally, the percent sign is the command indicator. By using the option switch, you can select any other character, including a control character, and substitute it for the percent sign. You terminate all commands with a carriage return.

Switch 2 sets the response mode and gives the user the option of receiving modem responses on the terminal screen in full English words or in the terse mode as single characters.

Switch 3 sets the data rate to which the modem is automatically set when you turn on the system. Naturally, you can change the rate afterward from the terminal keyboard.

Switch 4 enables or disables the auto answer mode. You cannot subsequently reset this switch selection from the keyboard.

Switch 5 determines whether the modem senses the Data Set Ready (DSR) and Clear To Send (CTS) lines all the time or only after detection of a carrier on the phone line.

You maintain normal control of the Smart Cat with 21 commands that you can enter directly from the terminal or computer keyboard. Depending on the type of command, some have arguments and/or default values.

Initialize puts the modem in its normal working state, while Hangup disables the modem, waits three seconds, and hangs up the phone. You cannot receive data during the three-second wait.

Dial, followed by a string of up to 32 characters, takes the phone line off hook and dials in accord with the character string contents. Allowable characters comprise 0-9, #, *, I, P, and W. I indicates that the modem generates telephone pulses rather than tones until the next P or W.

P forces a wait for a dial tone; if no dial tone occurs in five seconds, the modem hangs up and gives a No Dial

response. W forces a five-second wait before the modem begins dialing.

You can use another dialing command, Count, followed by an integer, to determine how many rings the modem waits for before aborting a call. Redial dials the last number at intervals of 40 seconds until you reach the number or you've dialed it 10 times.

Voice puts the modem in voice mode, and Modem puts it in data mode. Pick-up puts the phone line off hook, and also puts the modem in voice mode. Answer and Originate put the Smart Cat in answer or originate mode, respectively; they both take the phone line off hook. You must follow the last mode command, Giveback, with zero or 1 to put the modem in full or half duplex mode 1, respectively.

Speed, followed by 1 or 2, sets the

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modem speed to 300 or 1,200 baud. In answer mode, the modem automatically sets itself to the incoming data's speed, irrespective of speed selection.

Follow New with a single ASCII character to substitute that character for the current command character. Use Echo followed by zero or 1 (with a default of zero) to enable (zero) or disable (1) the echo of commands back to the terminal. The modem does not echo data.

Query forces the modem to return a single character that describes its status. Long, followed by zero or 1, causes the modem to provide full English (zero) or single-character (1) responses. Break, followed by an integer n, sends a space on the phone line. The length of the space is n times 250 milliseconds.

With the modem in voice mode, XMIT followed by a phone number transmits the DTMF tone pairs corresponding to the given number.

Follow Unlisten with a one- to four-character hexadecimal (hex) argument to transmit the number of bytes given by the hex argument as data. This permits transmission of data that the modem would otherwise interpret as command strings.

Format followed by a single-character argument establishes the number of data and stop bits, and the parity of data transmitted over the phone line. The allowable arguments and their interpretations are shown in Table 2.

Test, followed by an integer from zero to 3, selects, respectively, hardware integrity, analog loopback, remote digital loopback, or local digital loopback test modes. The hardware integrity test also occurs automatically when you turn on the machine. It verifies the modem's operation and correct connection of the RS-232C cable.

The responses the Smart Cat provides are clear and easy to understand. Ring

indicates that the modem detects a ring-back tone, and Busy indicates a busy signal. No Dial, CONN Lost, and No ANS are self-explanatory, although the No ANS occurs only after the specified number of rings.

UNSUCC means that for some unspecified reason the modem cannot complete the call. Ready means that carrier is acquired and communication established. Ring In tells you the modem detects an incoming ring. Finally, OK tells you that your last command is complete and the modem is ready for another.

While this description sounds complicated at first reading, operating the Smart Cat becomes second nature with a little use. The operations manual, identical in size to that of the J-Cat, is only slightly longer, yet it provides a fully adequate description of all the modem's operational and test features.

The Smart Cat package includes the wall mount power transformer and a cable to connect the modem to an RJ11C phone jack. An RJ11C socket on the back of the modem lets you plug the telephone directly into the unit.

The manufacturer provides no RS-232C cable, so you have to make one up yourself or buy one ready-made. The manual describes the necessary pin-out details at the cable's modem end. You have to determine the corresponding pin-outs at the serial connector on your terminal or computer.

UDS 212A/D

The UDS 212A/D includes most of the features available in the Smart Cat as well as a number of others that make it a natural selection for system houses that want to carry only a single modem that can be configured to meet most communications needs.

Additional features available in the 212A/D include selectable permissive or programmable transmit levels, operation with private phone lines, optional synchronous operation at 1,200 baud, battery-backed memory for five 30-character dial strings, and capability to wait for a second dial tone. The modem also displays and edits stored dial strings, and has a Help command to display and describe commands.

The 212A/D is built on two circuit boards. The top board contains the modem circuitry, and the bottom the automatic calling unit (ACU) and the power supply. DIP (dual in-line package) switches on the top board permit setting a variety of options.

These include forced answer, forced

originate modes, and private line operation. You can disconnect on long receive or transmit space, loss of Data Terminal Ready (DTR), or loss of carrier. The 212A/D also has auto answer always or only when DTR is enabled, synchronous or asynchronous operation, and 9-, 10-, or 11-bit characters (including stop bits).

Strapping options on the board permit grounding or ungrounding the modem chassis; selecting internal, external, or slave transmit clock options; and selecting permissive or programmable transmit levels. A DIP switch on the lower board enables or disables the automatic calling unit.

In operation, you should think of these option selections as permanent, since you must remove the modem cover to change them—not something you care to do often.

The 212A/D starts up in initialization mode. It expects to receive an uppercase, two-character string, EN, from the terminal or computer. The modem uses this input to establish the operational character rate and data format. After it receives EN, the modem responds with:

```
(CR) (LF)
UDS 212 DIALER
(CR) (LF)
:
```

The colon is the prompt from the ACU and indicates that the unit is ready to receive commands. Eleven commands, input as single, uppercase letters, are available to control the operation of the ACU.

H, the Help command, displays a brief summary of the available commands on the terminal or computer screen.

D lets you dial a telephone number directly from the keyboard. You can specify a number of up to 30 characters long containing both digits and operators. Five operators are available: W, D, E, A#, and space. W in the dial string causes the ACU to wait for a second dial tone. This important feature permits use of the modem with alternative carriers such as MCI, Sprint, and so on.

D in the dial string introduces a pause of 1.5, 3.0, or 4.5 seconds in the dialing operation. You select the length of the pause. E at the end of the dial string immediately terminates the calling sequence and connects the telephone to the phone line for voice communication.

A#, after all other digit entries and where # is a digit from 1 to 5, takes the dial string from the memory register

Argument	Stop Bits	Data Bits	Parity
0	1	7	Mark
1	1	7	Space
2	1	7	Odd
3	1	7	Even
4	1	8	None
8	2	7	Mark
9	2	7	Space
A	2	7	Odd
B	2	7	Even
C	2	8	None

Table 2. Format allowable arguments and interpretations for the Smart Cat.

identified by # to complete the original dial string. The space character is purely a cosmetic operator to improve the string's readability.

ACU command L, followed by a digit from 1 to 5, loads any of the five memory registers with a dial string. The ACU repeats the loaded string back to the CRT and returns to command mode with the display of the : prompt. P, the Print command, displays the contents of all loaded memory registers on the screen.

C, followed by a digit from 1 to 5, clears the contents of the correspondingly numbered memory register. If C is followed by the character L rather than a digit, all memory registers clear. Where # is a digit from 1 to 5, # causes the ACU to dial the dial string in the memory register identified by #.

R redials the last number dialed, and X redials the last used dial string continually until the modem detects an Answer Back Tone.

Q, the Quit command, aborts any ACU operation. B takes the phone line off hook, and N cancels the B command and returns the phone line to on hook status.

A primitive, although entirely adequate, editing capability lets you correct mistakes made when you enter dial strings from the keyboard. Enter the character @ to delete the last character entered. If you enter several @ characters, the program deletes the corresponding number of previous keyboard entries.

The 212A/D provides simple English responses to the terminal or computer screen to indicate the status and disposition of ACU actions. These are self-explanatory and include such responses as Off Hook when you initiate dialing, No D.T if the modem detects no dial tone, echo of the number dialed, No ABT if the modem receives no Answer Back Tone, and Busy, Complete, or Abort to indicate call disposition.

In addition to the options you set on the modem board itself, you can set six more options from the keyboard. OA#, where # is zero or 1, requires dial tone detection before dialing (zero) or waits four seconds and then dials (1) even though no dial tone is present. Zero is the default.

OB# provides pulse dialing, the default, where # is zero and multifrequency tone dialing where # is 1. OC# provides DSR active if # is zero, the default, or inactive if # is 1.

OD# sets the wait time before an unsuccessful dialing attempt aborts. Values of # from zero to 4 give wait times from 15 to 75 seconds. The de-

fault is 30 seconds. OE# sets the delay produced by the D command in a dial string. Values of # from zero to 2 give delays of 1.5 to 4.5 seconds. Three seconds is the default.

OF# lets you turn on or off the echo of commands back to the screen. A value of zero for # turns off the echo and 1 turns it on. Echo On is the default. OG0 reinitializes the modem to its start-up condition and requires entry of the initialization sequence EN to enable the automatic calling unit.

While it is convenient to set some of the modem parameters with the OA-OF commands, whatever settings you've established are lost if you turn off the modem or reinitialize it by using OG0.

Finally, six buttons on the modem's front panel provide the last remaining elements of control. Four of these activate a modem self-test or the three loopback test modes. A fifth forces the modem into 1,200 baud mode, and the sixth puts the telephone set on or off line.

Overview

All the modems are covered by a one year warranty on parts and labor. None of them is readily repairable by the user, nor is this recommended.

You must return the two Novation modems to the factory for repair. You can have the UDS modem repaired at the factory or at a number of authorized service locations. Since none required service as I prepared the review, I don't have information on the turnaround time for repair.

Reliability of the Novation units should be very good since they use a high degree of integration—the J-Cat has four integrated circuits and the Smart Cat has only a few more.

The UDS 212A/D might be very reliable as well, but the extraordinary parts count is a potential source of worry—the modem board alone has 83 integrated circuits!

None of the three modems comes with communications software. I operated all of them for test purposes with the Lobo Max-80 using both the COM-M/CMD terminal program that is integral with LDOS and SMODEM, a recent version of the widely available, public domain MODEM7, operating under CP/M 2.2.

I accessed CompuServe and several local bulletin board systems at both 300 and 1,200 baud (only 300 baud for the J-Cat) to verify the modems' operational features. Each performed exactly as represented in the respective manuals,

and I encountered no problems of any kind.

Most of my complaints are minor. The J-Cat's remarkably small size makes you wish you could tuck it inside a terminal or a computer case. Unfortunately, you must use the unit's push buttons to put it on line and back off line. It's also aesthetically annoying that the label on the face of the modem is printed upside down.

The Smart Cat leaves little room for complaint. It does what it's supposed to do and does it well, although it would be nice to have a power switch.

The UDC modem has some problems. As I mentioned, you must take the cover off to set the character size. This is a minor annoyance that becomes a major one when you remove the cover and the front panel falls off. It turns out to be devilishly difficult to get back in place.

A more serious problem exists with the telephone set. Although you can plug the phone into the back of the modem and activate it with the talk switch on the front panel, you can't use the phone at all unless the modem is turned on.

It is also unfortunate that, although you can reset a number of modem parameters from the keyboard, you can't reset the defaults for these parameters and you are returned to the built-in defaults whenever you turn off or reinitialize the modem.

The UDS manual deserves special mention. Unlike the manuals for the Novation units, the UDS manual tells you both too much and too little. It is full of acronyms, usually defined long after they are first introduced if they are defined at all.

It tersely describes the bewildering array of available options that you can set or strap on the modem board, but you get no guidance as to what options you should select in what circumstances. An entire chapter is devoted to "theory of operation," but after reading it you know nothing useful about the modem.

Last, although the battery-backed memory for dial strings is a convenience and works perfectly, I can't understand why, with the low price of CMOS memory, storage is provided for only five numbers. Except in dedicated service, five numbers don't seem to be enough. ■

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Real World Control—Part II

by David L. Engelhardt

Use your Model III to control a burglar alarm, sprinkler system, or other household device. These programs work with the hardware in Part I.

This is the second of a two-part article for advanced builders to utilize a real-world interface and clock to operate a burglar alarm and sprinkler system with room for other real-world applications.

The four Assembly-language programs in this article let you implement home control devices through your Model III, a real-time clock, and the input/output (I/O) board described in Part I (November 1983, p. 216).

After you build and test your I/O board, you're ready to program your computer to take over some mundane household chores.

Clock Program

Program Listing 1 is almost identical to the one in "Real World, It's About Time" (*80 Micro*, March 1983, p. 342). I made a few slight changes to allow a relationship with the sprinkler and bur-

glar alarm programs. The principal addition is the patch in lines 1270-1320. If activated, the sprinkler and burglar alarm programs patch themselves here.

These patches contain a jump address to the scan sections of the appropriate program. The clock's one-second interrupts trigger one-second scans of each program. If either or both of the programs become deactivated, they disengage themselves from the clock's patch region.

Burglar Alarm Program

Program Listing 2 is heavily commented. When executed, the program prompts you with specific questions regarding system status and locations where the alarm system is activated. I'll describe some of its basic functions below.

When you run the program, it indicates its status and asks for the code word allowing it to swap its state. The code word I used is Mom, but you can change it. The program shows each location where the alarm is on. This lets you decide which point to deactivate when you turn off the system.

An alarm system must allow time for you to exit and enter the building before the siren sounds. In this case there is a two-minute exit delay and a 30-second entrance delay. Two minutes after you leave, the system activates itself and starts scanning all of the activated alarm points. Upon entering, you must deactivate the system within 30 seconds or the

Program Listing 1. Clock Initialization.

```

00010 ;CLOCK INITIALIZATION AND INTERRUPT READ PROGRAM
00020 ;WRITTEN BY DAVE ENGELHARDT 3/15/82
00030 ;SAVE MEMORY SIZE OF -32447- (THIS WILL ALLOW ROOM
00040 ; FOR PATCHING IN FUTURE
00050 ; PROGRAMS.)
00060 ;EXECUTE WITH A /32448
00070 ;
00080 ; INITIALIZATION SECTION
00090 ;
00100 ORG 7EC0H ;INITIALIZATION SECTION
00110 DEFW 00H ;SPARE
00120 BEGIN DI ;DISABLE INTERRUPTS
00130 LD A,12 ;USED TO SET INTERRUPTS
00140 LD (4213H),A ;ENABLE EXT INTERRUPTS
00150 LD HL,START ;LOAD START OF CLOCK
00160 LD (403EH),HL ; TO INTERRUPT VECTOR
00170 LD A,16
00180 OUT (0ECH),A ;ENABLE TRS MAIN BUS
00190 LD A,128 ;SET UP 8255 FOR
00200 OUT (SETUP),A ; MODE 0
00210 XOR A
00220 OUT (OUTC),A ;MAKE SURE PC7 IS OFF
00230 OUT (0ECH),A ;SHUT OF MAIN BUS
00240 IM 1 ;SET MODE 1 INTERRUPT
00250 EI ;ENABLE INTERRUPTS
00260 EXI JP 1A19H ;BACK TO BASIC
00270 ;
00280 ;
00290 INPUTA EQU 30H ;USED TO CONTROL CLOCK DATA LINES
00300 OUTB EQU 31H ;USED TO CONTROL CLK ADDRSS LINES
00310 OUTC EQU 32H ;USED TO CONTROL CLK FUNCTIONS
00320 SETUP EQU 33H ;USED TO CONFIGURE 8255
00330 ;
00340 ; CLOCK INTERRUPT/READ PROGRAM
00350 ;
00360 START PUSH HL ;SAVE REGISTERS
00370 PUSH DE
00380 PUSH BC
00390 PUSH IX
00400 PUSH IY
00410 PUSH AF
00420 LD A,16 ;VALUE FOR TRS BUS

```

Listing 1 continued

The Key Box

Model III
16K RAM Cassette Basic
32K RAM Disk Basic
Assembly Language
Editor/Assembler

siren sounds.

Upon re-entry to the program, you must enter the code word to deactivate the system. It allows three attempts to enter the code word correctly. In case of a code entry error, the program jumps back to Basic. I label user-changable parameters in the listings. Just remember to keep the time delay parameters in units of seconds.

Also, in regard to the time delays, note that I allow two points in Port 2 for entry time delays. I label these in the listing under the individual alarms. If you need more points, double up some of them so that one point covers two doors.

In case of an illegal entry, the program sounds a buzzer attached to Port 1, bit 16. This buzzer turns on and off for 30 seconds prior to activation of the main siren. The siren stays on for two minutes then shuts off. After a 30-second wait, the program checks its status again and recycles if an alarm condition still exists.

There are also provisions in the program to make sure the relays shut off when they should. If the relay isn't off or fails to turn off the first time, there is one last attempt to shut it off. The system turns on the buzzer and prints an error message to attract your attention.

This is usually the result of a hardware problem. The relay may actually shut off but the indication read back is in error. An asterisk blinks once a second in the upper right-hand corner indicating the system is active.

I designed this system to be simple to use, fairly burglar proof, and adaptable to your needs. It is not a guarantee of protection but only part of a home protection plan.

Sprinkler System Program

In Program Listing 3, I designate four sprinkler zones. It starts with a menu offering four options: Auto, Manual, Go, and Exit. This program is self-explanatory, but I'll briefly describe each mode.

The Auto mode patches the scan section of this program into the clock program. Once this is done, the program checks the time of day (am/pm), day code, and time to start. You can change this to suit your needs. When this mode starts, each zone runs for 15 minutes for a total of two cycles. The Go mode is the same as the Auto mode except that it starts on your request.

The Manual mode lets you turn on any zone for up to a maximum of 39 minutes. The program checks for illegal

Listing 1 continued

```

00430 OUT      (0ECH),A      ;ENABLE MAIN BUS
00440 LD      A,144      ;SET 8255 FOR CONTROL
00450 OUT      (SETUP),A ;CONFIGURE 8255
00460 LD      A,1       ;SET UP FOR READ
00470 OUT      (OUTC),A ;PORT C FOR READ
00480 LD      C,OUTB    ;C IS USED FOR OUT INSTR.
00490 LD      B,12     ;USED TO ADDRESS COUNTERS
00500 LD      HV,BUFFER ;START OF TIME STORAGE
00510 CALL    GET       ;GET Y10
00520 CALL    GET       ;GET Y1
00530 LD      (HL), '/' ;PUT / IN WORD
00540 INC     HV        ;INC TO NEXT LOC IN BUFF
00550 CALL    GET       ;GET M10
00560 CALL    GET       ;GET M1
00570 LD      (HL), '/' ;PUT IN SEPERATOR
00580 INC     HL        ;INC TO NEXT POSITION
00590 CALL    GET       ;GET D10
00600 BIT     2,A       ;IS LEAP BIT SET?
00610 JR     Z,GETD1  ;SKIP OF NOT SET
00620 AND    33H      ;STRIP OFF LEAP BIT
00630 DEC     HL       ;BACK UP 1 POSITION
00640 LD      (HL),A   ;PUT CORRECT VALUE IN
00650 INC     HL       ;INC TO NEXT POSITION
00660 GETD1 CALL    GET ;GET D1
00670 CALL    FILL     ;INSERT 2 SPACES
00680 CALL    GET       ;GET DAY DIGIT (0-6)
00690 AND    07H      ;MASK FOR DAY CODE
00700 LD      (DIGIT),A ;SAVE FOR SPINKLER PROG
00710 DEC     HL       ;RE-ALIGN BUFF PTR
00720 LD      DE,SU   ;GET ADDRESS OF TABLE
00730 RLA      ;SHIFT FOR 2 WORD OFFSET
00740 ADD    A,E      ;ADD DAY INDEX TO A
00750 LD      E,A     ;PUT INDEX TO A REG
00760 PUSH   BC       ;SAVE PORT & ADDRSS CONTRL
00770 LD      A,(DE)  ;GET PTR TO DAY CODE
00780 LD      (TEMP1),A ;SAVE LSB OF DAY CODE
00790 INC     DE      ;INDEX TO GET NEXT PTR
00800 LD      A,(DE)  ;GET NEXT PTR TO DAY CODE
00810 LD      (TEMP2),A ;SAVE MSB OF DAY CODE
00820 LD      DE,(TEMP1) ;GET ADDRESS OF DAY
00830 EX     DE,HL   ;SWAP PTRS FOR LDIR MOVE
00840 LD      BC,3    ;SET CTR TO MOVE 3 BYTES
00850 LDIR   ;MOVE IT
00860 EX     DE,HL   ;RESTORE PTRS.
00870 POP    BC      ;RESTORE PORT & ADDRESS'S
00880 CALL   FILL    ;FILL WITH SPACES
00890 CALL   GET     ;GET H10
00900 DEC   HV      ;SET BACK BUFF PTR
00910 PUSH  AF      ;SAVE A REG FOR AM CHECK
00920 AND  33H     ;MASK FOR H10 VALUE
00930 LD   (HL),A   ;PUT H10 VALUE TO BUFFER
00940 INC   HV     ;NEXT BUFFER LOCATION
00950 CALL  GET     ;GET H1
00960 LD   (HL), ':' ;PUT IN COLON
00970 INC   HL     ;NEXT BUFFER LOCATION
00980 CALL  GET     ;GET M10
00990 CALL  GET     ;GET M1
01000 LD   (HL), ':' ;PUT IN COLON
01010 INC   HL     ;NEXT BUFFER LOCATION
01020 CALL  GET     ;GET S10
01030 CALL  GET     ;GET S1
01040 CALL  FILL    ;FILL WITH SPACES
01050 POP   AF      ;RESTOR AM/PM INFO
01060 BIT   3,A     ;IS THIS 24 HOUR FORMAT?
01070 JR   Z,AMPM  ;SKIP AM/PM DISPLAY SECT
01080 CALL  FILL    ;BLANK WHERE AM WAS TO BE
01090 JR   DISPLY  ;GO AND DISPLAY TIME
01100 AMPM BIT   2,A ;IS PM BIT SET?
01110 JR   NZ,PM   ;PM BIT SET
01120 AM   LD   (HL), 'A' ;AM CODE
01130 JR   CONT   ;
01140 PM   LD   (HL), 'P' ;PM CODE
01150 CONT INC   HL   ;INC TO NEXT BUFFER PTR
01160 LD   (HL), 'M'  ;PUT IN THE M FOR AM/PM
01170 DISPLY LD  HV,BUFFER ;BEGIN OF TIME INFO
01180 LD   DE,3C24H  ;DESTINATION TO SCREEN
01190 LD   BC,27    ;NUMBER OF TIME WORDS
01200 LDIR   ;MOVE THE TIME TO SCREEN
01210 NODISP LD  A,15 ;FOR CLOCK ADDRESSES
01220 OUT  (OUTB),A ;SET ADDRESS LINES HIGH
01230 LD  A,129   ;SET READ HIGH-ENABLE INT
01240 OUT  (OUTC),A ;TURN ON INTRUPTS VIA PC7
01250 XOR  A     ;CLEAR A REG
01260 OUT  (0ECH),A ;TURN OFF TRS MAIN BUS
01270 WATER NOP      ;THIS IS WHERE
01280 WATER1 NOP     ; THE SPRINKLER SYSTEM
01290 WATER2 NOP     ; IS PATCHED IN.
01300 BURG  NOP     ;THIS IS WHERE
01310 BURG1 NOP     ; THE BURGLER ALARM
01320 BURG2 NOP     ; IS PATCHED IN.
01330 POP   AF      ;RESTORE REGISTORS
01340 POP   IY
01350 POP   IX
01360 POP   BC
01370 POP   DE
01380 POP   HL
01390 EI          ;ENABLE INTERRUPTS
01400 RST        ;RETURN TO INTERRUPTED PT
01410 ;
01420 ;
01430 ;
01440 SU     DEFW   SUN
01450 MO     DEFW   MON
01460 TU     DEFW   TUE
01470 WE     DEFW   WED

```

Continued on p. 158

Listing 1 continued

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Listing 1 continued

```

01480 TR      DEFW  THR
01490 FR      DEFW  FRI
01500 SA      DEFW  SAT
01510 ;
01520 ;
01530 DIGIT   DEFB   00          ;USED FOR SPRINK DAY CODE
01540 TEMP1   DEFB   0          ;LSB STORAGE FOR DAY
01550 TEMP2   DEFB   0          ;MSB STORAGE FOR DAY
01560 BUFFER   DEFS   28          ;TIME INFORMATION BUFFER
01570 ;
01580 ;          TABLE OF DAY MESSAGES
01590 ;
01600 SUN     DEFM   'SUN'
01610 MON     DEFM   'MON'
01620 TUE     DEFM   'TUE'
01630 WED     DEFM   'WED'
01640 THR     DEFM   'THR'
01650 FRI     DEFM   'FRI'
01660 SAT     DEFM   'SAT'
01670 ;
01680 ;          SUBROUTINE TO READ THE CLOCK'S COUNTERS
01690 ;
01700 GET     OUT    (C),B        ;SET UP ADDRSS FOR READ
01710         OUT    (C),B        ;DO AGAIN FOR TIME DELAY
01720         IN     A,(INPUTA)    ;READ TIME
01730         ADD   A,30H         ;OBTAIN ASCII VALUE
01740         LD    (HL),A        ;PUT VALUE TO BUFFER
01750         INC   HI            ;INC TO NEXT BUFFER PTR
01760         DEC   B            ;DEC B FOR NEXT COUNTER
01770         RET                    ;FINISHED!
01780 ;
01790 ;          ROUTINE TO PUT SPACES BETWEEN TIME INFO
01800 ;
01810 FIL.    LD    (HL),20H      ;ASCII SPACE CODE
01820         INC   HI            ;INC NEXT SPACE
01830         LD    (HL),20H      ;PUT IN NEXT SPACE
01840         INC   HI            ;INC BUFFER PTR.
01850         RET                    ;DONE
01860 ;
01870         END    BEGIN

```

Program Listing 2. Burglar Alarm.

```

00010 ; BURGLER ALARM PROGRAM
00020 ; WRITTEN BY DAVE ENGELHARDT 10/82
00030 ;
00040 ; MAY BE EXECUTED WITH A /30992...OR
00050 ; COMMAND 'ALARM', WITH USE OF -CMDTBL- PROGRAM.
00060 ;
00070         ORG    7910H
00080 BASIC   EQU   1A19H        ;JUMP TO BASIC
00090 BURG    EQU   7F99H        ;EXTERNAL IN CLK
00100 BURGL   EQU   7F9AH        ;EXTERNAL IN CLK
00110 BURG2   EQU   7F9BH        ;EXTERNAL IN CLK
00120 CLEAR   EQU   1C9H        ;CLEAR SCREEN
00130 DORDLY  EQU   120         ;2 MIN TIME DELAY
00140 ENTDLY  EQU   31          ;31 SEC ENT DLY (ODD VAL)
00150 SIREN   EQU   120         ;2 MIN SIREN ON TIME
00160 TOCLK   EQU   7F9CH        ;EXTERNAL JUMP TO CLK
00170 ;*****
00180 ; START OF PROGRAM
00190 ;*****
00200 ALARM    CALL   CLEAR        ;CLS
00210         LD    HI,MESS1
00220         CALL  21BH          ;PRINT INTRO MESSAGE
00230         LD    A,(ALSTAT)    ;TEST TO SEE IF ALARM
00240         CP    0            ;ACTIVATED OR DEACT
00250         JR    NZ,ALMACT     ;GO IF ACTIVATED
00260         LD    HL,MESS2
00270         CALL  21BH          ;PRINT DEACT MESSAGE
00280         JR    AA            ;SKIP ACTIVATED MESSAGE
00290 ALMACT  LD    HI,MESS3
00300         CALL  21BH          ;PRINT ACTIVATED MESSAGE
00310 AA      LD    HI,MESS4
00320         CALL  21BH          ;PRINT CODE MESS
00330         LD    B,4            ;3 TRYS FOR CODE-LOOP
00340         CALL  CODE          ;GO AND TRST FOR CODE
00350         CALL  BUSON        ;TURN ON TRS INTERNAL BUS
00360         IN     A,(1H)       ;INPUT RFLAY ALARM PORT
00370         CPL                    ;COMPLIMENT VALUE
00380         AND   30H          ;MASK RELAY BITS 4 & 5
00390         CP    0            ;ARE THE ALARMS OFF?
00400         JR    Z,ALT         ;SKIP IF RELAYS ARE OFF
00410         OUT   (1H),A       ;TURN OFF RELAYS
00420         CALL  DLY          ;GIVE THEM TIME TO LATCH
00430         JR    Z,ALT         ;SKIP IF OFF FOR SURE
00440         LD    HI,ALMFLT
00450         CALL  21BH          ;PRINT RELAY FAULT MESS
00460         JR    OFFA
00470 ALT     LD    A,(ALSTAT)    ;FLAG USED TO PUT
00480         CPL                    ;SYSTEM IN IT'S
00490         LD    (ALSTAT),A    ;OPPOSITE STATE
00500         CP    0            ;IS IT SET?
00510         JR    NZ,ACTALM    ;GO TO ACT SYSTM
00520         CALL  CLEAR        ;CLEAR SCREEN
00530         LD    HI,MESS2
00540         CALL  21BH          ;PRINT DEACTIVATE MESS
00570 ;*****
00580 ; DISABLE ALARM PROGRAM
00590 ;*****
00600 OFFA    XOR    A            ;CLR A

```

Listing 2 continued



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Listing 2 continued

```

00610 DI ;DISABLE INTERRUPTS
00620 LD (BURG) ,A ;CLEAR OUT JUMP
00630 LD (BURG1) ,A ; FROM CLK TO
00640 LD (BURG2) ,A ; ALARM PROGRAM
00650 LD (ALMFLG) ,A ;CLEAR SYSTEM FLAGS

00660 LD (BYPASS) ,A ;CLEAR TIME DELAY FLAGS
00670 LD (ALSTAT) ,A ;CLEAR SWAP FLAG
00680 EI ;ENABLE INTERRUPTS
00690 JP BASIC ;JUMP TO BASIC
00700 ;*****
00710 ; ENABLE ALARM PROGRAM
00720 ;*****
00730 ACTALM XOR A ;CLR A RFG
00740 LD (SHFCTR) ,A ;CLR FOR ALARM MESSAGES
00750 LD (MASK1) ,A ;CLR PORT 2 MASK
00760 LD (MASK2) ,A ;CLR PORT 3 MASK
00770 ;*****
00780 ; SCAN ALARMS FOR SELECTIVE DEACTIVATION
00790 ;*****
00800 UPDATE CALL SECT1 ;SET-UP FOR PORT 2 ALRMS
00810 CALL CHECK ;PRINT PORT 2 ALARMS
00820 CALL SECT2 ;SET-UP FOR PORT 3 ALRMS
00830 CALL CHECK ;PRINT PORT 3 ALARMS
00840 DI CALL 49H ;SCAN KEYBD
00850 CP 'R' ;RE-SCAN & DISPLAY ALARMS
00860 JR Z,ACTALM ;Z.ACTALM
00870 CP 'C' ;CONTINUE WITH PROGRAM
00880 JR NZ,D1 ;GO BACK TO KEYBD SCAN
00890 LD HL,MESS6 ;PRINT ALARMS DEACT MESS
00900 CALL 21BH ;PRINT ABOVE DEACT MESS
00910 LD A,5H ;SET FOR TML00P
00920 TML00P PUSH AF ;SAVE A CTR FOR TIME DLY
00930 CALL 6BH ;CALL TIME DELAY ROUTINE
00940 POP AF ;GET A BACK AND
00950 DEC A ; DEC LOOP CTR
00960 CP 0 ;IS A ZERO YET?
00970 JP NZ,TML00P ;GO BACK IF NOT DONE
00980 CALL CLEAR ;CLS
00990 LD HL,MESS7 ;PRINT DO YOU WANT TIME
01000 CALL 21BH ; DELAY MESS?
01010 QTD CALL 49H ;QUESTION FOR TIME DELAY
01020 CP 'Y' ; IF NO -- CONTINUE
01030 JR Z,DLYARM ;DO TIME DELAY
01040 CP 'N' ;CONTINUE IF NO
01050 JR NZ,QTD ;RE-SCAN KEYBD
01060 ARM LD HL,BYPASS ;GET TIME DLY CONTRL BYTF
01070 SET 0,(HL) ;SET TO BYPASS ENTR DELAY
01080 JR ARMIT ;SKIP TIME DELAY SETUP
01090 DLYARM LD HL,BYPASS ;GET TIME DLY CONTRL BYTF
01100 SET 1,(HL) ;SET FOR ENTRANCE DELAY
01110 LD HL,TIMER ;GET EXIT DELAY VALUE
01120 LD (HL),DORDLY ;2 MIN DOOR EXIT DELAY
01130 ; AND 30 SEC ENTR DELAY
01140 ;*****
01150 ; PATCH ALARM PROGRAM TO CLK
01160 ;*****
01170 ARMIT LD A,0C3H ;PATCH JUMP INSTR TO CLK
01180 DI ;DISABLE INTERRUPTS
01190 LD (BURG) ,A ;1ST PART OF JUMP INSTR.
01200 LD HL,CONNECT ;GET JUMP ADDRESS IN ALRM
01210 LD (BURG1) ,HL ;LOAD TO CLK ALARM JUMP
01220 XOR A ;A R M T H E
01230 LD (ALMFLG) ,A ; B U R G L E R S Y S
01240 CALL BUSON ;TURN ON INTERNAL BUS
01250 IN A,(2H) ;GET AND STORE
01260 LD (MASK1) ,A ; PORT 2 MASK
01270 IN A,(3H) ;GET AND STORE
01280 LD (MASK2) ,A ; PORT 3 MASK
01290 CALL BUSOFF ;TURN OFF INTERNAL BUS
01300 CALL CLEAR ;CLR SCREEN
01310 LD HL,MESS3 ;PRINT SYSTEM
01320 CALL 21BH ; ACTIVATED MESSAGE
01330 EI ;ENABLE INTERRUPTS
01340 JP BASIC ;JUMP TO BASIC
01350 ;*****
01360 ; SECTION SCANNED BY CLK ONCE A SECOND
01370 ;*****
01380 CONECT LD HL,3C3FH ;GET SCREEN LOC FOR '*'
01390 LD A,(SWITCH) ;GET SWAP CONTROL BYTF
01400 CPL ;COMPLIMENT VALUE
01410 LD (SWITCH) ,A ;STORE VALUE BACK
01420 CP 0 ;IS IT ZERO?
01430 JR Z,ASTRIK ;SKIP IF ZERO
01440 LD HL,' ' ;PUT BLANK TO SCREEN
01450 JR ASTRIK+2 ;SKIP
01460 ASTRIK LD HL,'*' ;PUT '*' TO SCREEN
01470 LD HL,BYPASS ;GET TIME DELAY BYTF
01480 BIT 1,(HL) ;IS IT SET FOR DELAY?
01490 JP NZ,THEOUT ;GO TO COUNTDOWN ROUTINE
01500 LD HL,ALMFLG ;GET ALARM CONTROL WORD
01510 BIT 5,(HL) ;SET FOR SIREN?
01520 JR NZ,THEOUT ;DO 30 SEC OFF INTERVAL
01530 BIT 6,(HL) ;IS MAIN SIREN ON?
01540 JR NZ,CNTDWN ;GO AND COUNT DWN ON TIME
01550 BIT 4,(HL) ;SET TO ALTERNATE SONA
01560 JR NZ,T30SEC ;BEEP SONA FOR 30 SEC
01570 BIT 3,(HL) ;SET TO BYPASS ALARM SCAN
01580 JR NZ,SKIP ; UNT'L SIREN CYCLE DONE
01590 CALL ACTSCN ;SCAN PORT 2 FOR ALARMS
01600 CALL CHECK ;ARE THERE ANY ALARMS?
01610 CALL SECT2 ;SCAN PORT 3 FOR ALARMS
01620 CALL CHECK ;ARE THERE ANY ALARMS?
01630 LD HL,ALMFLG ;GET ALARM CONTROL BYTF

```

Listing 2 continued

```

01640 BIT 3,(HL) ;WILL BE SET ON ALRM COND
01650 JP Z,TOCLK ;JUMP BACK TO CLK
01660 SKIP BIT 7,(HL) ;IS ENTRANCE TIME DLY SET
01670 JR NZ,T30SEC ;DONT TURN ON SIREN YET
01680 NODLAY CALL BUSON ;TURN ON INTERNAL BUS
01690 LD A,16 ;VALUE FOR SIREN
01700 OUT (1H),A ;TURN ON SIREN
01710 CALL BUSOFF ;SHUT OFF INTERNAL BUS
01720 LD HI,ALMFLG ;GET ALARM CONTROL BYTE
01730 SET 6,(HL) ;SET TO FLAG SIREN ON TME
01740 LD HI,TIMER ;GET TIME CONTROL WORD
01750 LD (HL),SIREN ;LOAD SIREN WAITING TIME
01760 JR CNTDWN ;GO AND DEC TIME UNTIL=0
01770 T30SEC LD HI,TIMER ;GET TIME CONTROL WORD
01780 XOR A ;CLR A FOR COMPARE
01790 DEC (HL) ;DEC ENTRANCE DLY 30 SEC
01800 CP (HL) ;TEST HL FOR ZERO
01810 JR Z,NODLAY ;TIME DONE-TURN ON SIREN
01820 LD HI,ALMFLG ;GET CONTROL BYTE
01830 SET 4,(HL) ;SET TO TURN ON SONA
01840 BIT 1,(HL) ;BIT USED TO SWITCH
01850 JR NZ,SWAP ; SONA (ON-OFF) TO ALERT
01860 SET 1,(HL) ; USER TO SHUT SYSTEM
01870 JR OUTSON ; OFF UPON ENTRY
01880 SWAP RES 1,(HL) ;RESET ALT FLAG
01890 OUTSON CALL BUSON ;TURN ON INTERNAL BUS
01900 LD A,32 ;VALUE TO TURN ON SONA
01910 OUT (1H),A ;TURN ON OR OFF SONA
01920 CALL BUSOFF ;TURN OFF INTERNAL BUS
01930 JP TOCLK ;JUMP TO CLK PROGRAM
01940 CNTDWN LD HI,TIMER ;COUNTDOWN SECTION TIMER
01950 XOR A ;CLR A FOR COMPARE
01960 DEC (HL) ;DEC TIME DELAY
01970 CP (HL) ;TEST FOR ZERO
01980 JP NZ,TOCLK ;SKIP IF NOT ZERO TO CLK
01990 CALL BUSON ;TURN ON INTERNAL BUS
02000 LD A,16
02010 OUT (1H),A ;TURN OFF SIREN
02020 CALL BUSOFF ;TURN OFF INTERNAL BUS
02030 LD HI,ALMFLG ;SET-UP FOR OFF INTERVAL
02040 SET 5,(HL) ;SET FOR SIREN OFF TIME
02050 LD HI,TIMER ;GET TIMER CONTROL WORD
02060 LD (HL),ENTDLY ;31 SEC PAUSE BWTN CYCLE
02070 TMEOUT LD HI,TIMER ;PAUSE INTERVAL ROUTINE
02080 XOR A ;CLR A FOR ZERO COMPARE
02090 DEC (HL) ;DEC TIME
02100 CP (HL) ;TEST FOR ZERO
02110 JP NZ,TOCLK ;GO IF TIME LEFT
02120 XOR A ;CLR A
02130 LD (ALMFLG),A ;CLR CONTROL WORD
02140 LD HI,BYPASS ; AND GO FOR NEW CYCLE
02150 RES 1,(HL) ;DISABLE ENTRANCE DELAY
02160 JP TOCLK ;RETURN TO CLK PROGRAM
02170 ;*****
02180 ; ALARM SCAN SECTION
02190 ;*****
02200 SECT1 CALL CLEAR ;CLR SCREEN
02210 LD HI,MESS5
02220 CALL 21BH ;PRINT ALARM STATUS MESS
02230 ACTSCN LD A,(MASK1) ;GET MASK FOR ALARMS THAT
02240 LD B,A ; HAVE BEEN DEACTIVATED
02250 CALL BUSON ;TURN ON INTERNAL BUS
02260 IN A,(2H) ;READ PORT 2 FOR ALARMS
02270 CALL BUSOFF ;TURN OFF INTERNAL BUS
02280 LD HL,MTBLE1 ;GET START OF PORT 2 MESS
02290 LD (MTBLE),HL ; TBLE & SAVE LOCATION
02300 RET
02310 SECT2 LD A,(MASK2) ;GET MASK FOR ALARMS THAT
02320 LD B,A ; HAVE BEEN DEACTIVATED
02330 CALL BUSON ;TURN ON INTERNAL BUS
02340 IN A,(3H) ;READ PORT 3 FOR ALARMS
02350 CALL BUSOFF ;TURN OFF INTERNAL BUS
02360 LD HI,MTBLE2 ;GET START OF PORT 3 MESS
02370 LD (MTBLE),HL ; TBLE & SAVE LOCATION
02380 RET
02390 CHECK XOR B ;MASK OUT DEACT. ALARMS
02400 JR Z,RETURN ;ZERO MEANS NO ALARMS
02410 LD HI,ALMFLG ;GET ALARM CONTROL WORD
02420 SET 3,(HL) ;SET TO BYPASS SECT CALLS
02430 CP 1 ;ALARM AT FRONT DOOR?
02440 JR Z,EE ;ZERO = IS YES THERE IS
02450 CP 2 ;ALARM AT GARAGE-HSE ENT?
02460 JR NZ,DD ;ZERO = IS YES THERE IS
02470 EE LD HI,BYPASS ;GET TIME DLY CNTRL BYTE
02480 BIT 0,(HL) ;IS 30 SEC TIME DLY SET?
02490 JR NZ,DD ;SKIP IF YES
02500 PUSH AF ;SAVE ALARM BITS
02510 LD HI,ALMFLG ;GET ALARM CONTROL BYTE
02520 SET 7,(HL) ;SET FOR ENTR DELY 30 SEC
02530 LD A,ENTDLY ;LOAD ENTRANCE DELAY TIME
02540 LD (TIMER),A ; TO TIME CONTROL BYT
02550 POP AF ;RESTORE ALARM BITS
02560 DD LD B,A ;SAVE BIT PATTERN
02570 C1 LD D,0 ;CLR D REGISTER
02580 BIT 0,B ;IS BIT 0 SET FOR ALARM?
02590 JR Z,SHIFT ;SKIP IF NOT AND TEST AGN
02600 LD HI,(MTBLE) ;GET CURRENT TABLE ADDRES
02610 LD A,(SHFCTR) ;GET MESSAGE CTR OR INDEX
02620 LD E,A ;STORE INDEX INTO E
02630 ADP HI,DE ;GET APPROPRIATE MESS
02640 LD E,(HL) ;GET LSB LOCATION OF MESS
02650 INC HI ;INC PTR TO MSB LOCATION
02660 LD D,(HL) ;GET MSB LOCATION OF MESS
02670 EX DE,HL ;PUT MESS LOCATION TO HL

```

Listing 2 continued

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```

02680 CALL 21BH ;PRINT ALARM MESSAGE
02690 SHIFT LD A,(SHFCTR) ;GET MESSAGE CTR AND INC
02700 ADD A,2 ; CTR FOR NEXT MESS LOC
02710 CP 16 ;ALL 8 MESS BEEN PRNTD?
02720 JR Z,PRFTRN ;RETURN IF YES
02730 LD (SHFCTR),A ;SAVE NEW INDEX #
02740 RR B ;SHIFT B RIGHT 1 BIT
02750 JR C1 ;GO TEST NEW BIT FOR ALRM
02760 PRFTRN XOR A ;PORT HAS BEEN SCANNED
02770 LD (SHFCTR),A ;CLR FOR NEXT PORT CHECK
02780 RETURN RET ;RETURN FROM CALL
02790 ;*****
02800 ; SECRPT CODE ROUTINE TO ACT. OR DEACT ALARM PROGRAM
02810 ; CODE = MOM
02820 ;*****
02830 CODE DEC B ;DEC CTR AND TRST FOR
02840 LD A,B ; ONLY THREE TRIES TO
02850 CP 0 ; GET CODE CORRECT
02860 JR Z,BAIL ;CODE ERROR...EXIT PROG
02870 CALL 49H ;SCAN KEYBD FOR CODE
02880 CP 'M' ;IS FIRST CHARCT. A 'M'
02890 JR NZ,CODE ;RE-SCAN KEYBD IF NOT
02900 CALL 49H ;SCAN KEYBD
02910 CP 'O' ;IS 2ND CHARCT. A 'O'
02920 JR NZ,CODE ;RE-SCAN KEYBD IF NOT
02930 CALL 49H ;SCAN KEYBD
02940 CP 'M' ;IS LAST CHARCT. A 'M'
02950 JR NZ,CODE ;DEC B REG AND BAIL OUT
02960 RPT
02970 ;*****
02980 ; ROUTINE TO PRINT CODE ERROR & JUMP TO BASIC
02990 ;*****
03000 BAIL CALL CLR* ;CLR SCREEN
03010 LD H*,ERROR
03020 CALL 21BH ;PRINT CODE ERROR MESS
03030 JP BASIC ;JUMP TO BASIC
03040 ;*****
03050 ; ROUTINE TO TURN INTERNAL BUS ON
03060 ;*****
03070 BUSON PUSH AF ;SAVE A REG AND FLAGS
03080 LD A,16
03090 OUT (0ECH),A ;ENABLE INTERNAL BUS
03100 POP AF ;RESTORE A REG AND FLAGS
03110 RPT
03120 ;*****
03130 ; ROUTINE TO TURN INT*RNAL BUS OFF
03140 ;*****
03150 BUSOFF PUSH AF ;SAVE A REG AND FLAGS
03160 XOR A
03170 OUT (0ECH),A ;TURN OFF INTERNAL BUS
03180 POP AF ;RETORE A REG AND FLAGS
03190 RPT
03200 ;*****
03210 ; TIME DELAY USED TO ALLOW RPLAYS TIME TO SWITCH
03220 ;*****
03230 DLY LD BC,4FFFH ;VALUE USED FOR CNT DWN
03240 CALL 60H ;CALL TIME DLY
03250 IN A,(1H) ;READ RELAYS
03260 CPL ;COMPLIMENT VALUE
03270 AND 30H ;MASK FOR ALARM RELAYS
03280 CP 0 ;ARE THEY OFF?
03290 RPT
03300 ;*****
03310 ; VARIABLES
03320 ;*****
03330 ALMPLG DEF B 0 ;ALARM SYSTEM CONTRL BYTE
03340 ALSTAT DEF B 0 ;BURGLER ALARM STATUS
03350 BYPASS DEF B 0 ;TIME DELAY CONTROL BYTE
03360 MASK1 DEF B 0 ;SAVES PORT 2 DEACT ALRMS
03370 MASK2 DEF B 0 ;SAVES PORT 3 DEACT ALRMS
03380 MTBLE DEF W 0 ;TABLE INDEX PTR.
03390 SHFCTR DEF B 0 ;USED FOR MESS TBLE INDEX
03400 SWITCH DEF B 0 ;USED TO BLINK '*'
03410 TIMER DEF B 0 ;TIME DELAY CONTROL WORD
03420 ;*****
03430 ; MAIN MESSAGE TABLE
03440 ;*****
03450 MESS1 DEF M 'THIS IS THE BURGLER ALARM PROGRAM'
03460 DEF W 0D0AH
03470 MESS2 DEF M 'THE ALARM SYSTEM IS * DEACTIVATED *'
03480 DEF B 0DH
03490 MESS3 DEF M 'THE ALARM SYSTEM IS ** ACTIVATED **'
03500 DEF B 0DH
03510 MESS4 DEF M 'ENTER (CODE WORD) TO PUT SYSTEM IN '
03520 DEF M 'OPPOSITE STATE'
03530 DEF W 0A0AH
03540 DEF M ' ** OFF-ON OR ON-OFF**'
03550 DEF B 0DH
03560 MESS5 DEF M 'THESE ITEMS ARE IN ALARM CONDITION '
03570 DEF M 'CLOSE NEEDED POINTS'
03580 DEF B 0AH
03590 DEF M 'R = TO RECHECK C = CONTINUE PROGRAM'
03600 DEF B 0DH
03610 DEF B 0DH
03620 MESS6 DEF M '**** TAKE NOTE --ITEMS ABOVE ARE DE-'
03630 DEF M 'ACTIVATED ****'
03640 DEF B 0DH
03650 MESS7 DEF M 'DO YOU NEED TIME DELAYS OF *2 MINUTES '
03660 DEF M 'LEAVING AND 30 SECONDS '
03670 DEF M 'ENTERING* ON THE ENTRANCE DOORS? Y/N'
03680 DEF B 0DH
03690 DEF B 0DH
03700 ERROR DEF B 0AH
03710 DEF M '---CODE WORD---ENTRY ERROR..PROGRAM '
03720 DEF M 'EXITED!'
03730 DEF B 0DH
03740 ALMFLT DEF M 'RELAY FAULT---SIRPN OR SONA ILLEGALLY ON'

```

Listing 2 continued

zone and time entries. When it completes this mode, the program patches the Auto mode back in for a continued time scan. The Exit command leaves the program and jumps back to Basic.

This program also checks for relay failures and uses Port 4, bit 2 to sound a buzzer if a failure occurs. Upon entry to the program, it indicates the status of the system and the zone that is currently running if applicable. It displays a message giving you the option to deactivate the system or exit back to Basic. There is a 1½-minute delay between each zone that allows time for water pressure to stabilize.

CMDTBL Program

Program Listing 4 lets you patch custom commands to the Basic command table. Presently, I include only two commands—Sprink and Alarm. When you enter either of these two commands under Basic, the specified program runs. If you add more commands to the table, insert them in order but keep them between the ENDTBL label. This label automatically computes the length of the command table for scanning purposes.

Execute this program with a /29024. The set-up section patches the main body of this program to the Basic command table. Upon execution, two more commands are added to the system. This program runs anywhere in memory by changing the ORG statement.

Conclusion

You should now have a Port I/O board with relays to control the real world, and hopefully an understanding of how to control the port board and its functions. You should have enough information to expand in regard to port I/O control. The sprinkler and burglar alarm systems provide a couple of good applications to real-world control.

The amount of control applications available are virtually unlimited. CMDTBL opens a door to custom users for designing your own Basic commands and applications. You should learn a lot about your Model III and computers in general by putting together this system, as interfacing and controlling real world applications involve many aspects of your micro.

For a 16K System

As shown, the burglar alarm and sprinkler system don't assemble on a 16K RAM system since they include so many comments and banners. I made

Listing 2 continued

```

03750      DEFB      0DH
03760 ;*****
03770 ;   PORT 2 ALARM MESSAGE TABLE
03780 ;*****
03790 MTBLE1 DEFW      A0      ;GIVES LOC FOR PORT 2
03800      DEFW      A1      ; ALARM MESSAGES
03810      DEFW      A2
03820      DEFW      A3
03830      DEFW      A4
03840      DEFW      A5
03850      DEFW      A6
03860      DEFW      A7
03870 ;*****
03880 ;   PORT 3 ALARM MESSAGE TABLE
03890 ;*****
03900 MTBLE2 DEFW      B0      ;GIVES LOC FOR PORT 3
03910      DEFW      B1      ; ALARM MESSAGES
03920      DEFW      B2
03930      DEFW      B3
03940      DEFW      B4
03950      DEFW      B5
03960      DEFW      B6
03970      DEFW      B7
03980 ;*****
03990 ;   PORT 2 ALARM MESSAGES
04000 ;*****
04010 A0      DEFM      'FRONT DOOR'      ;** NOTE **.. A0
04020      DEFB      0DH      ; AND A1 MUST BE
04030 A1      DEFM      'GARAGE DOOR'      ; USED AS ENTR
04040      DEFB      0DH      ; DLY INPUTS
04050 A2      DEFM      'FAMILY ROOM'
04060      DEFB      0DH
04070 A3      DEFM      'SLIDING DOORS'
04080      DEFB      0DH
04090 A4      DEFM      'KITCHEN WINDOW'
04100      DEFB      0DH
04110 A5      DEFM      'DINNING OR LIVING ROOM WINDOW'
04120      DEFB      0DH
04130 A6      DEFM      'SEWING ROOM'
04140      DEFB      0DH
04150 A7      DEFM      'A BATHROOM WINDOW'
04160      DEFB      0DH
04170 B0      DEFM      'MASTER BEDROOM'
04180      DEFB      0DH
04190 B1      DEFM      'BEDROOM #1 WINDOW'
04200      DEFB      0DH
04210 B2      DEFM      'BEDROOM #2 WINDOW'
04220      DEFB      0DH
04230 B3      DEFM      'BASEMENT WINDOW'
04240      DEFB      0DH
04250 B4      DEFM      'CAR #1 GARAGE DOOR' ;NOTE: I HAVE TWO
04260      DEFB      0DH
04270 B5      DEFM      'CAR #2 GARAGE DOOR'
04280      DEFB      0DH
04290 B6      DEFM      'WATER LEAK IN BASEMENT';SENSE LEAKS
04300      DEFB      0DH
04310 B7      DEFM      'PANIC BUTTON'      ;FOR EMERGENCY
04320      DEFB      0DH
04330      END      ALARM
  
```

the listings easy to follow so you can assemble them on a 16K RAM system without the comments and banners. ■

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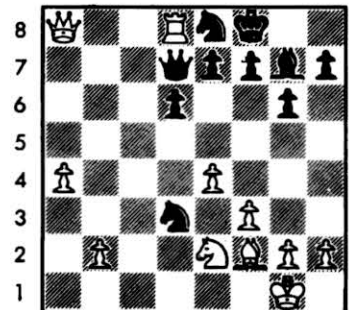
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3. d2-d4	c5-d4	19. e3-f2	b5-b4
4. f1-b5+	c8-d7	20. c2-b3	a6-a5
5. b5-d7+	d8-d7	21. d1-d4!	b7-b5
6. f3-d4	g8-f6	22. c3-b4	a5-b4
7. b1-c3	g7-g6	23. a1-c1!	c4-b6
8. e1-g1	f8-g7	24. c1-c8+	b6-c8
9. c1-e3	e8-g8	25. b3-c4	b5-d7
10. d1-d3	a7-a6	26. c4-b4	c8-a7
11. c3-d5	b7-b5?	27. b4-b8+	f6-e8
12. d5-b6	d7-b7	28. d4-c4	a7-c6
13. b6-a8	b7-a8	29. b8-a8	c6-e5
14. f2-f3	b8-d7	30. c4-c8	g8-f8
15. f1-d1	f8-c8	31. a2-a4	e5-d3
16. c2-c3	a8-b7	32. c8-d8!	resigns



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Program Listing 3. Sprinkler System.

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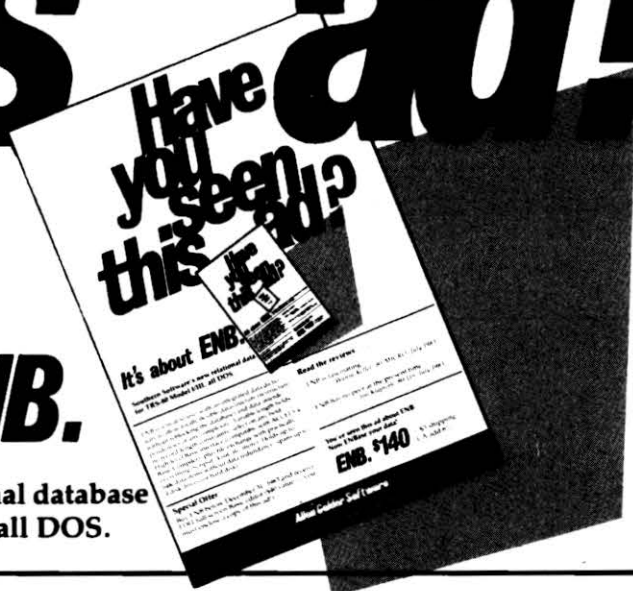
00010 ; SPRINKLE® SYSTEM PROGRAM FOR A 4 ZONE SYSTEM
00020 ; WRITTEN BY DAVE ENGELHARDT 10/82
00030 ;
00040 ; EXECUTE WITH A /29152 ....OR USE
00050 ; COMMAND 'SPRINK' FROM -CMDTBL- PROGRAM.
00060 ;
00070 ORG 71E0H
00080 AMPM EQU 7FD0H ;WORD FOR AM/PM CODE
00090 BASIC EQU 1A19H ;JUMP TO BASIC
00100 CLEAR EQU 1C9H ;CLEAR SCREEN
00110 DIGIT EQU 7FB4H ;DAY CODE FROM CLK PROGRAM
00120 DLYTME EQU 90 ;TIME BETWEEN ZONES
00130 HOURS EQU 7FC6H ;HOURS OBTAINED FROM CLK
00140 MINUTE EQU 7FC9H ;MIN OBTAINED FROM CLK
00150 RUNTME EQU 900 ;THE TIME ZONES ARE ON
00160 WATER EQU 7F96H ;PATCH SPRINK SYS TO CLK
00170 WATER1 EQU 7F97H ;PATCH TO CLK
00180 WATER2 EQU 7F98H ;PATCH TO CLK
00190 TOCLK EQU 7F99H ;JUMP BACK TO CLOCK PROG
00200 ;*****
00210 ; PROGRAM STARTS HERE
00220 ;*****
00230 SPRINK CALL CLEAR ;CLEAR SCREEN
00240 LD A,(SPRFLG) ;GET CONTROL BYTR
00250 CP 0 ;IS SYSTEM ENABLED
00260 JR Z,JJ ;GO TO SYSTEM STARTUP
00270 ;*****
00280 ; CHECK IF SYSTEM IS RUNNING
00290 ;*****
00300 AUTCHK BIT 7,A ;IS RUNNING ACT BIT SET?
00310 JR Z,MANCHK ;SKIP TO CHECK MAN OPER
00320 LD HL,MESS0
00330 CALL 21BH ;PRINT AUTO ACT MESSAGE
00340 JP ADYACT ;JUMP TO STATUS SECTION
00350 ;*****
00360 ; CHECK IF SYSTEM IS MANUEL
00370 ;*****
00380 MANCHK BIT 1,A ;IS MANUEL MODE BIT SET?
00390 JR Z,AUTOMD ;SKIP TO AUTO MODE SECT
00400 LD HL,MESS4
00410 CALL 21BH ;PRINT MAN MODE ACT MESS
00420 LD HL,MESS14
00430 CALL 21BH ;PRINT ZONE RUNNING
00440 LD HL,MESS9A
00450 CALL 21BH ;PRINT STOP SYSTEM MESS
00460 JP PP ;JUMP TO SCAN KEYBD
00470 ;*****
00480 ; AUTO MODE SECTION
00490 ;*****
00500 AUTOMD LD HL,MESS15 ;PRINT AUTO MODE ACT MESS
00510 CALL 21BH
00520 LD HL,MESS9A
00530 CALL 21BH ;PRINT STOP SYSTEM MESS
00540 JP PP ;JUMP TO SCAN KEYBD
00550 ;*****
00560 ; SYSTEM INITIALIZATION SECTION
00570 ;*****
00580 JJ CALL BUSON ;TURN ON INTERNAL BUS
00590 IN A,(1H) ;READ SPRINKLER RELAYS
00600 CPL ;COMPLIMENT VALUE
00610 AND 0FH ;MASK FOR SPRINK RELAYS
00620 CP 0 ;ARE THEY OFF?
00630 JR Z,TT ;SKIP IF YES
00640 OUT (1H),A ;TURN OFF RELAYS
00650 CALL DLY ;ALLOW RELAYS TO LATCH
00660 JR Z,TT ;SKIP IF RELAYS ARE OFF
00670 LD HL,MESS13
00680 CALL 21BH ;PRINT RELY STILL ON ERR
00690 JP BASIC ;JUMP TO BASIC
00700 TT CALL BUSOFF ;TURN OFF INTERNAL BUS
00710 LD A,0DH
00720 CALL 33H ;DO CARRIAGE RETURN
00730 LD HL,MESS1
00740 CALL 21BH ;PRINT MENU
00750 AA CALL 49H ;SCAN KEYBD FOR SELECTION
00760 CP 'M'
00770 JR Z,MAN ;GO TO MANUEL MODE
00780 CP 'A'
00790 JR Z,AUTO ;GO TO AUTO MODE
00800 CP 'G'
00810 JR Z,KICK ;GO START AUTO ON DEMAND
00820 CP 'E'
00830 JP BASIC ;JUMP TO BASIC
00840 JR A^ ;RE-SCAN KEYBD
00850 ;*****
00860 ; SET SYSTEM UP FOR AUTO MODE
00870 ;*****
00880 AUT0 CALL AUPATC ;PATCH SYS FOR AUTO MODE
00890 RR CALL SOUND ;BEEP SONA TO ACKNOW ACT
00900 CALL CLEAR ;CLEAR SCREEN
00910 LD HL,MESS0
00920 CALL 21BH ;PRINT AUTO MODE ACTIVAT
00930 JP BASIC ;JUMP BACK TO BASIC
00940 ;*****
00950 ; ROUTINE TO START AUTO ON DEMAND
00960 ;*****
00970 KICK CALL AUPATC ;PATCH AUTO MODE TO CLK
00980 LD HL,SPRFLG ;GET CONTROL WORD
00990 SET 7,(HL) ;SET SYSTEM RUNNING BIT
01000 JR RR ;MAKE SOUND & PRINT MESS
01010 ;*****
01020 ; ACTIVATE MANUEL MODE SECTION
01030 ;*****
01040 MAN LD HL,SPRFLG ;GET CONTROL WORD
01050 SET 1,(HL) ;SET MANUEL MODE ACT BIT
01060 CALL CLEAR ;CLEAR SCREEN
01070 LD HL,MESS2
01080 CALL 21BH ;PRINT MANUEL MODE
01090 CC LD HL,MESS3
01100 CALL 21BH ;PRINT ZONE MENU
01110 BB CALL 49H ;SCAN KEYBD FOR ZONE #
01120 CALL 33H ;PRINT ZONE # TO SCREEN
01130 LD (MZONE),A ;STORE VALUE TO MESS 14
01140 SUB 30H ;STRIP OFF ASCII VALUE
01150 CP 0 ;CORRECT VALUE?
01160 JR Z,ZINERR ;SKIP TO ILLEGAL ZONE #
01170 LD (ZHOLD),A ;SAVE ZONE #
01180 SUB 5 ;IS ZONE # LESS THEN 5
01190 JP M,DD ;IF NOT...SKIP TO DD
01200 ;*****
01210 ; ZONE INPUT ERROR SECTION
01220 ;*****
01230 ZINERR CALL CLEAR ;CLEAR SCREEN
01240 LD HL,MESS6
01250 CALL 21BH ;PRINT ZONE ERROR MESS
01260 JP CC ;GO AND RE-ENTER ZONE #
01270 ;*****
01280 ; IF ENTERED ZONE VALUE IS OK--ENTER M'NUTES INTO BUFFER
01290 ;*****
01300 DD LD HL,MESS5 ;GET READY TO PRINT MESS
01310 LD A,0DH
01320 CALL 33H ;DO CARRIAGE CONTROL
01330 CALL 33H ;DO CARRIAGE CONTROL
01340 CALL 21BH ;PRINT ZONE TIME MESS
01350 CALL 49H ;SCAN KEYBD FOR 1ST VALUE
01360 CALL 33H ;PRINT VALUE TO SCREEN
01370 SUB 30H ;STRIP ASCII VALUE
01380 LD (TENS),A ;SAVE TENS OF M'NUTES
01390 SUB 4 ;MUST BE LESS THAN 40 M'N
01400 JP M,FF ;CONTINUE IF LESS THEN 40
01410 CALL CLEAR ;CLEAR SCREEN
01420 LD HL,MESS8
01430 CALL 21BH ;PRINT TIME ERROR MESS
01440 JR DD ;GO AND REDUE TIME ENTRY
01450 FF CALL 49H ;SCAN KEYBD FOR TIME

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01460 CALL 33H ;PRINT VALUE TO SCREEN
01470 SUB 30H ;STRIP ASCII VALUE
01480 LD (UNITS),A ;SAVE UNITS OF MINUTES
01490 LD HI,MESS7 ;READY MESS FOR PRINT
01500 LD A,0DH
01510 CALL 33H ;DO CARRIAGE CONTROL
01520 CALL 37H ;DO CARRIAGE CONTROL
01530 CALL 21BH ;PRINT ARE YOU SATISFIED
01540 CALL 49H ;SCAN KEYBD FOR ANSWER
01550 CP 'C' ;C = TO CONTINUE PROGRAM
01560 JR Z-EE ;SKIP IF C
01570 CALL CLEAR ;CLEAR SCREEN
01580 JR CC ;GO & REDUE ZONE # & TIME
01590 ;*****
01600 ; ROUTINE TO CHANGE KYBD ENTRY TO HEX EQUIVALENT
01610 ;*****
01620 EE LD A,(TENS) ;GET TENS OF MINUTES
01630 SLA A ;SHIFT VALUE LEFT
01640 PUSH AF ;SAVE CONTENTS
01650 SLA A ;SHIFT LEFT AGAIN
01660 SLA A ;SHIFT LEFT
01670 POP BC ;TRANSFER AF TO BC
01680 ADD A,B ;ADD VALUES TOGETHER
01690 LD B,A ;STORE VALUE TO A REG
01700 LD A,(UNITS) ;GET UNITS OF TIME
01710 ADD A,B ;ADD UNITS TO TENS/MIN
01720 ;*****
01730 ; ROUTINE TO CONVERT HEX ON-TIME INTO SECONDS
01740 ;*****
01750 LD (UNITS),A ;STORE HEX TIME VALUE
01760 LD L,A ;PUT HEX VALUE TO L RFG
01770 XOR A ;CLEAR A RFG
01780 LD H,A ;CLEAR H REG
01790 SLA L ;SHIFT LEFT
01800 SLA L ;SHIFT LEFT
01810 PUSH HI ;SAVE SHIFTED VALUE
01820 SLA L ;SHIFT LEFT
01830 SLA L ;SHIFT LEFT
01840 CALL HSHIFT ;SHIFT H ACCORDING TO L
01850 SLA H ;SHIFT LEFT
01860 SLA L ;SHIFT LEFT
01870 CALL HSHIFT ;SHIFT H ACCORDING TO L
01880 SLA H ;SHIFT LEFT
01890 SLA L ;SHIFT LEFT
01900 CALL HSHIFT ;SHIFT H ACCORDING TO L
01910 POP BC ;PUT HL VALUE TO BC REG
01920 XOR A ;RESET CARRY FLAG
01930 SBC HI,BC ;CALCULATE FINAL VALUE
01940 LD (TENS),HL ;SAVE TIME IN SECONDS
01950 ;*****
01960 ; ROUTINE TO PATCH MANUAL MODE TO CLOCK
01970 ;*****
01980 SETUP CALL PORTKY ;GET MANUEL ACT BIT
01990 LD (MNPOR),A ;SAVE VALUE FOR RELAY
02000 DI ;DISABLE INTERRUPTS
02010 LD A,0C3H ;PATCH SPRINKLER
02020 LD (WATER),A ; SYSTEM TO THE
02030 LD HI,MANRT ; CLOCK
02040 LD (WATER1),HL ; PROGRAM
02050 EI ;ENABLE INTERRUPTS
02060 CALL SOUND ;BEEP SONA
02070 CALL CLEAR ;CLEAR SCREEN
02080 LD HI,MESS14
02090 CALL 21BH ;PRINT ACTIVE ZONE MESS
02100 JP BASIC ;JUMP BACK TO BASIC
02110 ;*****
02120 ; ROUTINE TO SHIFT H WITH L
02130 ;*****
02140 HSHIFT JR C,ADDBIT ;CARRY BIT SET VIA SHIFT?
02150 JR NOTSET ;SKIP IF NOT SET
02160 ADDBIT SET 0,H ;SET BIT 0
02170 NOTSET XOR A ;CLEAR CARRY BIT
02180 RET
02190 ;*****

```

```

02200 ; ROUTINE TO INDICATE ZONE NOW RUNNING
02210 ;*****
02220 ADVACT LD HI,MESS9 ;READY MESS TO PRINT
02230 LD A,(ZHDLD) ;GET RUNNING ZONE
02240 ADD A,30H ;OBTAIN ASCII VALUE
02250 LD (ZNUM),A ;STORE VALUE TO MESS
02260 CALL 21BH ;PRINT ZONE RUNNING MESS
02270 PP CALL 49H ;SCAN KEYBD
02280 CP 'N' ;N = LEAVE PROG AS IS
02290 JP Z-BASIC ;BACK TO BASIC
02300 CP 'Y' ;Y = DEACTIVATE SYSTEM
02310 JR NZ-PP ;RE-SCAN KEYBD
02320 ;*****
02330 ; ROUTINE TO SHUT OFF ZONE
02340 ;*****
02350 CALL BUSON ;TURN ON INTERNAL BUS
02360 IN A,(1H) ;READ RELAY STATUS
02370 CPL ;COMPLIMENT VALUE
02380 AND 0FH ;MASK FOR SPRINKLER RELYS
02390 CP 0 ;ARE THE RELAYS OFF?
02400 JP Z-TOTAL ;SKIP IF YES
02410 OUT (1H),A ;TURN RELAY OFF
02420 CALL DLY ;GIVE RELAY TIME TO LATCH
02430 JR NZ-ERROR ;GO TO ERROR IF STILL ON
02440 ;*****
02450 ; DEACTIVATE SPRINKLER SYSTEM
02460 ;*****
02470 TOTAL CALL CLEAR ;CLEAR SCREEN
02480 LD HI,MESS12
02490 CALL 21BH ;PRINT DEACTIVATED MESS
02500 CALL UNPATC ;UNPATCH SPRINK FROM CLK
02510 CALL SOUND ;BEEP SONA
02520 JP BASIC ;JUMP TO BASIC
02530 ;*****
02540 ; ERROR ROUTINE--ZONE ILLEGALLY ON OR FAILED TO TURN OFF
02550 ;*****
02560 ERROR PUSH AF ;SAVE CONTENTS
02570 LD A,(ZHDLD) ;GET ZONE #
02580 ADD A,30H ;OBTAIN ASCII VALUE
02590 LD (EZONE),A ; & PUT IN ERROR MESSAGE
02600 LD HI,MESS10
02610 CALL 21BH ;PRINT RELAY FAULT MESS
02620 CALL BUSON ;ENABLE INTERNAL BUS
02630 POP AF ;SAVE CONTENTS
02640 OUT (1H),A ;TRY 1 LAST SHUT-OFF
02650 LD A,2
02660 OUT (4H),A ;TURN ON SONA SOLID
02670 CALL UNPATC ;UNPATCH SPRINK FROM CLK
02680 JP BASIC ;JUMP TO BASIC
02690 ;*****
02700 ; UNPATCH SPRINKLER SYSTEM FROM CLOCK
02710 ;*****
02720 UNPATC XOR A ;CLEAR A REG
02730 DI ;DISABLE INTERRUPTS
02740 LD (SPRFLG),A ;CLEAR CONTROL BYTE
02750 LD (WATER),A ;UNPATCH
02760 LD (WATER1),A ; FROM
02770 LD (WATER2),A ; CLOCK
02780 EI ;ENABLE INTERRUPTS
02790 RRT
02800 ;*****
02810 ; AUTO PATCH ROUTINE
02820 ;*****
02830 AUPATC DI ;DISABLE INTERRUPTS
02840 XOR A ;CLEAR A REG
02850 LD (ZHDLD),A ;RESET ASCII ZONE VALUE
02860 LD A,1
02870 LD (SPRFLG),A ;SET SYSTEM ACTIVE
02880 LD (CYCLE),A ;SET CYCLE CTR
02890 LD (ZNUM),A ;RESET ASCII VALUE MESS9
02900 LD A,2
02910 LD (CYK),A ;SET CTR FOR TWO CYCLES
02920 LD A,'1'
02930 LD (ZCYK),A ;SET CYCLE VALUE MESS9

```

Listing 3 continued

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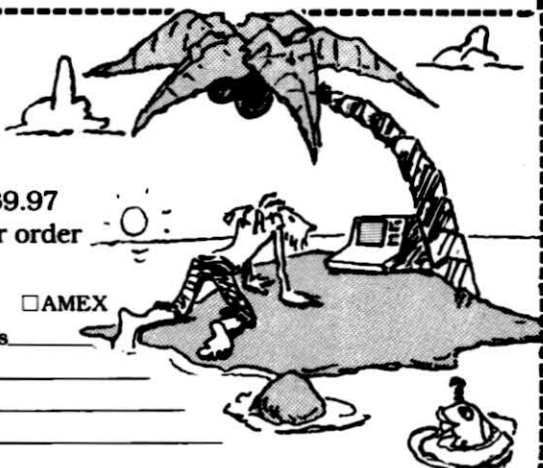
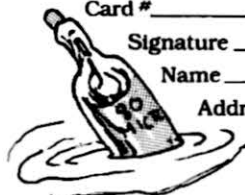
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Listing 3 continued

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02940 LD A,@C3H ;PATCH SPRINKLER
02950 LD (WATER),A ; SYSTEM TO
02960 LD HI.,AUTORT ; THE CLOCK
02970 LD (WATER1),HL ; PROGRAM
02980 EI ;ENABLE INTRRUPTS
02990 RFT
03000 ;*****
03010 ; MANUEL ROUTINE PATCHED TO CLOCK PROGRAM
03020 ;*****
03030 MANRT LD HI.,SPRFLG ;GET CONTROL WORD
03040 BIT 1,(HL) ;MAKE SURE MANUEL MODE
03050 JR Z.EXITMN ;SKIP IF NOT SET
03060 BIT 2,(HL) ;SET FOR ON-TIME COUNTDOWN
03070 JR NZ.SKIP ;SKIP UNTIL TIME IS UP
03080 CALL BUSON ;TURN ON INTERNAL BUS
03090 LD A,(MNPORT) ;LOAD ZONE ACTIVATE BIT
03100 OUT (1H),A ;TURN ON ZONE
03110 CALL BUSOFF ;TURN OFF INTERNAL BUS
03120 LD HI.,SPRFLG ;GET CONTROL WORD
03130 SET 2,(HL) ;SET TO BYPASS ACT CODE
03140 SKIP LD HI.,(TENS) ;LOAD SPRINKLER ZONE
03150 DEC HI. ; ON TIME & COUNT DWN
03160 LD (TENS),HL ;PUT TIME BACK
03170 LD A,H ;CHECK FOR
03180 OR L ; TIME EQUAL
03190 CP 0 ; TO ZERO
03200 JP NZ.TOCLK ;JUMP TO CLOCK
03210 CALL BUSON ;TURN ON INTERNAL BUS
03220 LD A,(MNPORT) ;GET ZONE ACT BIT
03230 OUT (1H),A ;TURN OFF ZONE
03240 CALL DLY ;DELAY FOR RELAY TO LATCH
03250 JR Z.EXITMN ;SKIP IF ZONE TURNED OFF
03260 JP ERROR ;ERROR...ZONE STILL ON
03270 EXITMN CALL AUPATC ;PATCH AUTO & CLR FLAGS
03280 LD HI.,MESS11
03290 CALL 21BH ;PRINT AUTO MODE MESS
03300 CALL SOUND ;ACKNOWLEDGE MODE SET
03310 JP TOCLK ;JUMP TO CLK
03320 ;*****
03330 ; AUTO SPRINKLER MODE PATCHED TO CLK PROGRAM
03340 ;*****
03350 AUTORT LD HI.,SPRFLG ;GET CONTROL WORD
03360 BIT 7,(HL) ;SET = SPRINKLER ACTIVE
03370 JR NZ.AUT ;BYPASS TIME CHECK
03380 LD A,(AMPH) ;READ A OR P FROM CLK
03390 CP 41H ;IS IT AM?
03400 JP NZ.TOCLK ;LEAVE--NOT TIME TO START
03410 LD A,(DIGIT) ;GET DAY CODE FROM CLK
03420 CP 1 ;IS IT MONDAY?
03430 JR Z.KK ;SKIP AND START IF IT IS
03440 CP 3 ;IS IT WEDNESDAY?
03450 JR Z.KK ;SKIP AND START IF IT IS
03460 CP 5 ;IS IT FRIDAY?
03470 JR Z.KK ;SKIP AND START IF IT IS
03480 CP 8 ;THIS IS A SPARE DAY
03490 JP NZ.TOCLK ;LEAVE - NOT TIME TO STRT
03500 KK XOR A ;CLR CARRY FLG
03510 LD HI.,(HOURS) ;GET ACTUAL TIME
03520 LD BC,(HRS) ;LOAD STRT TIME IN HRS
03530 SBC HL,BC ;ARE THEY EQUAL?
03540 JP NZ.TOCLK ;LEAVE AND KEEP TESTING
03550 XOR A ;CLR FLAGS
03560 LD HI.,(MINUTS) ;GET ACTUAL MINUTES
03570 LD BC,(MIN) ;LOAD STRT TIME IN MTN
03580 SBC HL,BC ;ARE THEY EQUAL?
03590 JP NZ.TOCLK ;LEAVE AND KEEP TESTING
03600 LD HI.,SPRFLG ;GET CONTROL WORD
03610 SET 7,(HL) ;SET TO BYPASS TIME CHKS
03620 AUT LD HI.,SPRFLG ;GET CONTROL WORD
03630 BIT 0,(HL) ;TEST FOR AUTO ENABLED
03640 JP Z.EXITMN ;LEAVE IF AUTO NOT SET
03650 BIT 4,(HL) ;SET FOR PAUSE DELAY
03660 JR NZ.DELAY ;SKIP FOR DELAY
03670 BIT 3,(HL) ;ON TIME DELAY...ZONE ON
03680 JR NZ.SKIP1 ;SKIP IF ZONE RUNNING

```

```

03690 HH CALL BUSON ;TURN ON INTERNAL BUS
03700 LD A,(CYCLE) ;GET ZONE ACTIVATE BIT
03710 OUT (1H),A ;TURN ON ZONE
03720 CALL BUSOFF ;TURN OFF INTERNAL BUS
03730 LD HI.,SPRFLG ;GET CONTROL WORD
03740 SET 3,(HL) ;SET TO SKIP HH SECTION
03750 LD HI.,ZHOOLD ;GET ZONE #
03760 INC (HL) ;INCREASE ZONE # BY 1
03770 SKIP1 LD HI.,(TMEWRD) ;GET ZONE ON TIME
03780 DEC HI. ;DEC ON TIME ONCE/SECOND
03790 LD (TMEWRD),HL ;STORE TIME BACK
03800 LD A,H ;CHECK FOR
03810 OR L ; TIME EQUAL
03820 CP 0 ; TO ZERO
03830 JP NZ.TOCLK ;SKIP IF NOT
03840 LD HI.,RUNTIME ;GET ZONE ON TIME VALUE
03850 LD (TMEWRD),HL ;RESTORE ON TIME PERIOD
03860 CALL BUSON ;TURN ON INTERNAL BUS
03870 LD A,(CYCLE) ;GET ZONE ACTIVATE BIT
03880 OUT (1H),A ;TURN OFF ZONE
03890 CALL DLY ;TIME FOR RELAY TO LATCH
03900 JP NZ.ERROR ;ERROR...RELAY STILL ON
03910 CALL BUSOFF ;TURN OFF INTERNAL BUS
03920 LD HI.,SPRFLG ;GET CONTROL WORD
03930 RES 3,(HL) ;RESET TO ACT NEXT ZONE
03940 SET 4,(HL) ;SET FOR PAUSE DELAY
03950 DELAY LD HI.,PAUSE ;LOAD PAUSE TIME
03960 DEC (HL) ;DECREMENT PAUSE TIME
03970 XOR A ;CLR FOR COMPARE
03980 CP (HL) ;IS TIME = 0
03990 JP NZ TOCLK ;JUMP TO CLK IF NOT
04000 LD HI.,SPRFLG ;GET CONTROL WORD
04010 RFS 4,(HL) ;RESET PAUSE DELAY
04020 LD A,DLYTME ;GET DELAY TIME VALUE
04030 LD (PAUSE),A ;RELOAD PAUSE TIME
04040 LD A,(CYCLE) ;GET ACTIVATE BIT
04050 SLA A ;SHFT LEFT = NEXT ACT BIT
04060 BIT 4,A ;IF SET = AUTO MODE DONE
04070 JR NZ.C1 ;CHECK FOR 2ND CYCLE
04080 LD (CYCLE),A ;PUT BACK SHIFTED BIT
04090 JP TOCLK ;GO FOR NEXT ZONE
04100 ;*****
04110 ; ROUTINE TO CHECK FOR 2ND CYCLE
04120 ;*****
04130 C1 LD A,(CYK) ;LOAD CYCLE COUNT
04140 DEC A ;DEC CYCLE
04150 CP 0 ;IS THIS 2ND PASS?
04160 JP Z.EXITMN ;SPRINKLER SYSTEM DONE
04170 LD (CYK),A ;LOAD DEC CYCLE # BACK
04180 LD A,1 ;RESET SYSTEM TO ZONE #1
04190 LD (CYCLE),A ; FOR SECOND PASS
04200 XOR A
04210 LD (ZHOOLD),A ;CLEAR ASCII ZONE #
04220 LD A,'2'
04230 LD (ZCYK),A ;PUT IN MESS9 FOR PRINT
04240 JP TOCLK ;JUMP TO CLOCK
04250 ;*****
04260 ; VARIABLES
04270 ;*****
04280 HRS DEFB 3530H ;5 0 = TURN ON TIME
04290 MIN DEFB 3030H ;0 0 = 05:00 AM
04300 MNPORT DEFB 0 ;Z CNTRL BIT FOR MAN
04310 SPRFLG DEFB 0 ;SPRINKLER CONTROL WORD
04320 CYCLE DEFB 1 ;SHIPPING ZONE ACT BIT
04330 TMEWRD DEFB 30 ;ZONE ON-TIME=15 MINUTES
04340 PAUSE DEFB 10 ;ZONE PAUSE TIME= 1.5 MIN
04350 ZHOOLD DEFB 0 ;ZONE VALUE FOR ASCII PRMT
04360 TENS DEFB 0 ;USED FOR MAN TIME INPUT
04370 UNITS DEFB 0 ;" " " " " TIME INPUT
04380 CYK DEFB 2 ;CYCLE CONTROL FOR SYSTEM
04390 ;*****
04400 ; THIS TABLE IS THE ACTIVATE BIT TABLE
04410 ;*****
04420 PORT DEFB 0H ;DUMMY VALUE
04430 DEFB 1H ;ZONE 1 ACTIVATE BIT
04440 DEFB 2H ;ZONE 2

```

Listing 3 continued

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- * MOUNTING HARDWARE includes power and data cables.
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- 1 Controller, Power Supply, Mounting Hardware & Instructions \$249
- 2 Controller, Power Supply, Hardware & one 40 track Tandon Drive \$429
- 3 Controller, Power Supply, Hardware, two 40 track Tandon Drives \$598
- 3a Kit 3 but with two 80 track drives (dual sided 40s) \$791
- 3b Kit three but with two 160 track drives (dual sided 80s) \$989

TCS MODEL IV DISK EXPANSION KITS

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- 12B Kit 12 but with two 160 Track Tandon Drives \$849

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TRS-80 equipment below has original 90 day Manufacturer's Limited Warranty

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- MODEL 12, 1 drive \$CALL
- MODEL 12, 2 drives \$CALL
- TCS MODEL 12 Version, 2 Tandon drives (like the original) TCS Warranty \$2995

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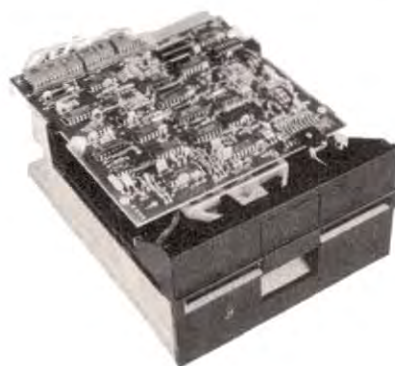
- 128K memory board (256K Max.) \$629
- 128K extra memory chips (RS) \$269
- 128K extra memory chips (TCS) \$189
- Xenix Microsoft Multi-user Basic \$269
- Xenix Accounting Software \$CALL
- Xenix Multiplan Spread Sheet Software \$263
- MII/12 to M16 multi-user upgrade kit \$1339
- DT/1 Video Terminal \$629

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- MODEL IV, 16K Cassette \$825
- MODEL IV, 64K, 2 drives, RS-232 \$CALL

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- 80 track (dual sided 40 track) \$299
- 160 track (dual sided 80 track) \$399

2 DRIVE Double Cabinet

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- 80 track (dual sided 40 tracks) \$599
- 160 track (dual sided 80 tracks) \$799

1 DRIVE Double Cabinet

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- 80 track (dual sided 40 track) \$369
- 160 track (dual sided 80 track) \$449

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- 160 track (dual sided 80 track) \$CALL
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cassette recorder/phone
Complete Documentation



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- Direct-connect Modem Cable
- System Briefcase 20x14x4"
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Listing 3 continued

```

02940 LD A,0C3H ;PATCH SPRINKLER
02950 LD (WATER),A ; SYSTEM TO
02960 LD HI,AUTORT ; THE CLOCK
02970 LD (WATER1),HL ; PROGRAM
02980 EI ;ENABLE INTERRUPTS
02990 RET
03000 ;*****
03010 ; MANUAL ROUTINE PATCHED TO CLOCK PROGRAM
03020 ;*****
03030 MANRT LD HI,SPRFLG ;GET CONTROL WORD
03040 BIT 1,(HL) ;MAKE SURE MANUAL MODE
03050 JR Z.EXITMN ;SKIP IF NOT SET
03060 BIT 2,(HL) ;SET FOR ON-TIME COUNTDWN
03070 JR NZ.SKIP ;SKIP UNTIL TIME IS UP
03080 CALL BUSON ;TURN ON INTERNAL BUS
03090 LD A,(MNPORT) ;LOAD ZONE ACTIVATE BIT
03100 OUT (1H),A ;TURN ON ZONE
03110 CALL BUSOFF ;TURN OFF INTERNAL BUS
03120 LD HI,SPRFLG ;GET CONTROL WORD
03130 SET 2,(HL) ;SET TO BYPASS ACT CODE
03140 SKIP LD HI,(TENS) ;LOAD SPRINKLER ZONE
03150 DEC HI ; ON TIME & COUNT DWN
03160 LD (TENS),HL ;PUT TIME BACK
03170 LD A,H ;CHECK FOR
03180 OR L ; TIME EQUAL
03190 CP 0 ; TO ZERO
03200 JP NZ.TOCLK ;JUMP TO CLOCK
03210 CALL BUSON ;TURN ON INTERNAL BUS
03220 LD A,(MNPORT) ;GET ZONE ACT BIT
03230 OUT (1H),A ;TURN OFF ZONE
03240 CALL DLY ;DELAY FOR RELAY TO LATCH
03250 JR Z.EXITMN ;SKIP IF ZONE TURNED OFF
03260 JP ERROR ;ERROR...ZONE STILL ON
03270 EXITMN CALL AUPATC ;PATCH AUTO & CLR FLAGS
03280 LD HI,MESS11
03290 CALL 21BH ;PRINT AUTO MODE MESS
03300 CALL SOUND ;ACKNOWLEDGE MODE SET
03310 JP TOCLK ;JUMP TO CLK
03320 ;*****
03330 ; AUTO SPRINKLER MODE PATCHED TO CLK PROGRAM
03340 ;*****
03350 AUTORT LD HI,SPRFLG ;GET CONTROL WORD
03360 BIT 7,(HL) ;SET = SPRINKLER ACTIVE
03370 JR NZ.AUT ;BYPASS TIME CHECK
03380 LD A,(AMP) ;READ A OR P FROM CLK
03390 CP 41H ;IS IT AM?
03400 JP NZ.TOCLK ;LEAVE--NOT TIME TO START
03410 LD A,(DIGIT) ;GET DAY CODE FROM CLK
03420 CP 1 ;IS IT MONDAY?
03430 JR Z.KK ;SKIP AND START IF IT IS
03440 CP 3 ;IS IT WEDNESDAY?
03450 JR Z.KK ;SKIP AND START IF IT IS
03460 CP 5 ;IS IT FRIDAY?
03470 JR Z.KK ;SKIP AND START IF IT IS
03480 CP 8 ;THIS IS A SPARE DAY
03490 JP NZ.TOCLK ;LEAVE - NOT TIME TO STRT
03500 KK XOR A ;CLR CARRY FLG
03510 LD HI,(HOURS) ;GET ACTUAL TIME
03520 LD BC,(HRS) ;LOAD STRT TIME IN HRS
03530 SBC HI,BC ;ARE THEY EQUAL?
03540 JP NZ.TOCLK ;LEAVE AND KEEP TESTING
03550 XOR A ;CLR FLAGS
03560 LD HI,(MINUTES) ;GET ACTUAL MINUTES
03570 LD BC,(MIN) ;LOAD STRT TIME IN M*IN
03580 SBC HI,BC ;ARE THEY EQUAL?
03590 JP NZ.TOCLK ;LEAVE AND KEEP TESTING
03600 LD HI,SPRFLG ;GET CONTROL WORD
03610 SET 7,(HL) ;SET TO BYPASS TIME CHKS
03620 AUT LD HI,SPRFLG ;GET CONTROL WORD
03630 BIT 0,(HL) ;TEST FOR AUTO ENABLED
03640 JP Z.EXITMN ;LEAVE IF AUTO NOT SET
03650 BIT 4,(HL) ;SET FOR PAUSE DELAY
03660 JR NZ.DELAY ;SKIP FOR DELAY
03670 BIT 3,(HL) ;ON TIME DELAY...ZONE ON
03680 JR NZ.SKIP1 ;SKIP IF ZONE RUNNING

```

```

03690 HH CALL BUSON ;TURN ON INTERNAL BUS
03700 LD A,(CYCLE) ;GET ZONE ACTIVATE BIT
03710 OUT (1H),A ;TURN ON ZONE
03720 CALL BUSOFF ;TURN OFF INTERNAL BUS
03730 LD HI,SPRFLG ;GET CONTROL WORD
03740 SET 3,(HL) ;SET TO SKIP HH SECTION
03750 LD HI,ZHOLD ;GET ZONE #
03760 INC (HL) ;INCREASE ZONE # BY 1
03770 SKIP1 LD HI,(TMEWRD) ;GET ZONE ON TIME
03780 DEC HI ;DEC ON TIME ONCE/SECOND
03790 LD (TMEWRD),HL ;STORE TIME BACK
03800 LD A,H ;CHECK FOR
03810 OR L ; TIME EQUAL
03820 CP 0 ; TO ZERO
03830 JP NZ.TOCLK ;SKIP IF NOT
03840 LD HI,RUNTIME ;GET ZONE ON TIME VALUE
03850 LD (TMEWRD),HL ;RESTORE ON TIME PERIOD
03860 CALL BUSON ;TURN ON INTERNAL BUS
03870 LD A,(CYCLE) ;GET ZONE ACTIVATE BIT
03880 OUT (1H),A ;TURN OFF ZONE
03890 CALL DLY ;TIME FOR RELAY TO LATCH
03900 JP NZ.ERROR ;ERROR...RELAY STILL ON
03910 CALL BUSOFF ;TURN OFF INTERNAL BUS
03920 LD HI,SPRFLG ;GET CONTROL WORD
03930 RES 3,(HL) ;RESET TO ACT NEXT ZONE
03940 SET 4,(HL) ;SET FOR PAUSE DELAY
03950 DELAY LD HI,PAUSE ;LOAD PAUSE TIME
03960 DEC (HL) ;DECREMENT PAUSE TIME
03970 XOR A ;CLR FOR COMPARE
03980 CP (HL) ;IS TIME = 0
03990 JP NZ.TOCLK ;JUMP TO CLK IF NOT
04000 LD HI,SPRFLG ;GET CONTROL WORD
04010 RFS 4,(HL) ;RESET PAUSE DELAY
04020 LD A,DLYTIME ;GET DELAY TIME VALUE
04030 LD (PAUSE),A ;RELOAD PAUSE TIME
04040 LD A,(CYCLE) ;GET ACTIVATE BIT
04050 SLA A ;SHFT LEFT = NEXT ACT BIT
04060 BIT 4,A ;IF SET = AUTO MODE DONE
04070 JR NZ.C1 ;CHECK FOR 2ND CYCLE
04080 LD (CYCLE),A ;PUT BACK SHIFTED BIT
04090 JP TOCLK ;GO FOR NEXT ZONE
04100 ;*****
04110 ; ROUTINE TO CHECK FOR 2ND CYCLE
04120 ;*****
04130 C1 LD A,(CYK) ;LOAD CYCLE COUNT
04140 DEC A ;DEC CYCLE
04150 CP 0 ;IS THIS 2ND PASS?
04160 JP Z.EXITMN ;SPRINKLER SYSTEM DONE
04170 LD (CYK),A ;LOAD DEC CYCLE # BACK
04180 LD A,1 ;RESET SYSTEM TO ZONE #1
04190 LD (CYCLE),A ; FOR SECOND PASS
04200 XOR A
04210 LD (ZHOLD),A ;CLEAR ASCII ZONE #
04220 LD A,'2'
04230 LD (ZCYK),A ;PUT IN MESS9 FOR PRINT
04240 JP TOCLK ;JUMP TO CLOCK
04250 ;*****
04260 ; VARIABLES
04270 ;*****
04280 HRS DEFW 3530H ;5 0 = TURN ON TIME
04290 MIN DEFW 3030H ;0 0 = 05:00 AM
04300 MNPORT DEFB 0 ;Z CNTRL BIT FOR MAN
04310 SPRFLG DEFB 0 ;SPRINKLER CONTROL WORD
04320 CYCLE DEFB 1 ;SHIFTING ZONE ACT BIT
04330 TMEWRD DEFW 30 ;ZONE ON-TIME=15 MINUTES
04340 PAUSE DEFB 10 ;ZONE PAUSE TIME= 1.5 MIN
04350 ZHOLD DEFB 0 ;ZONE VALUE FOR ASCII PRNT
04360 TENS DEFB 0 ;USED FOR MAN TIME INPUT
04370 UNITS DEFB 0 ;" " " " " " TIME INPUT
04380 CYK DEFB 2 ;CYCLE CONTROL FOR SYSTEM
04390 ;*****
04400 ; THIS TABLE IS THE ACTIVATE BIT TABLE
04410 ;*****
04420 PORT DEFB 0H ;DUMMY VALUE
04430 DEFB 1H ;ZONE 1 ACTIVATE BIT
04440 DEFB 2H ;ZONE 2

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Listing 3 continued

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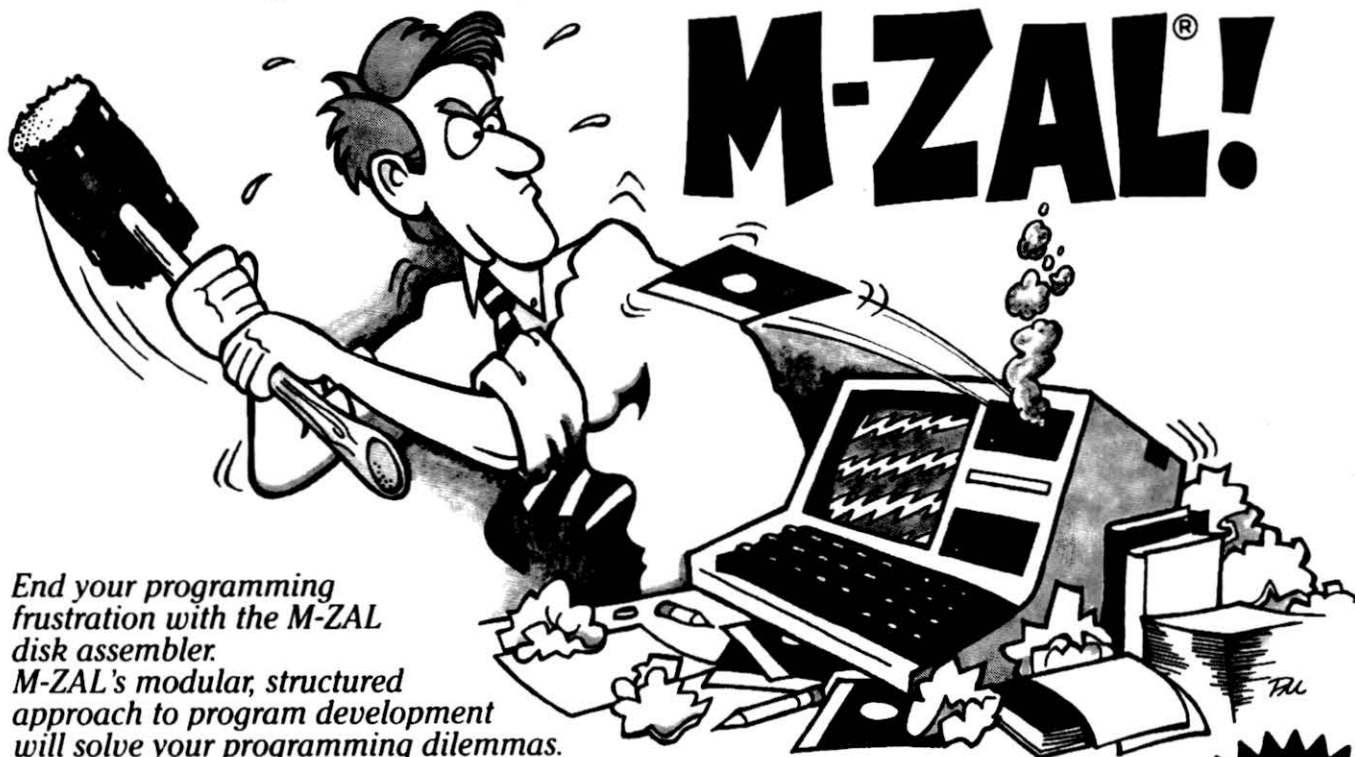
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— Bruce Douglass
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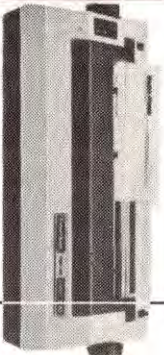
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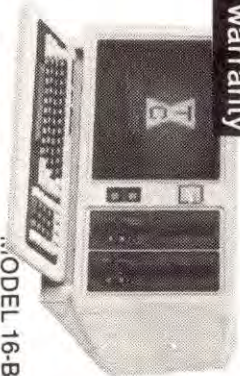
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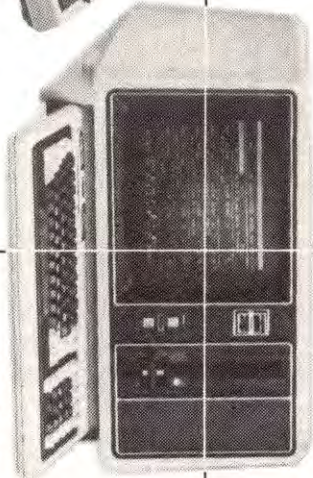
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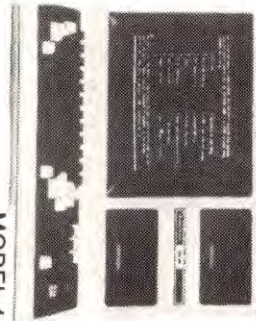
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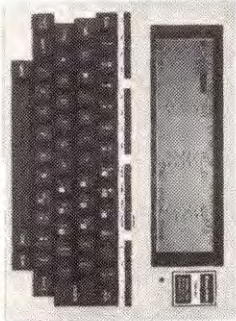
MODEL 16-B



MODEL 12



MODEL 4



MODEL 100

Listing 4 continued

```

00310      CPL                ; INVERSE VALUE FOR LENGTH
00320      DEC                A      ; DEC CMND LENGTH BY ONE
00330      LD      (CTR) ,A      ; SAVE LENGTH OF COMMAND
00340      LD      (DWNCTR) ,A    ; SAVE LENGTH OF COMMAND
00350      XOR      A            ; CLR A REGISTER
00360      LD      B,A          ; CLR B REGISTER
00370      ; *****
00380      ;  COMMAND SEARCH SECTION
00390      ; *****
00400      LD      HI, TABLE    ; GET STRT OF CUST CMD TBL
00410      LD      DE,42E6H     ; STRT OF BASIC INPUT BUFF
00420      LD      A,(ENDTBL)   ; GET LENTH OF COMMAND TBL
00430      LD      C,A          ; STORE LENGTH TO LOOP CTR
00440      GO      LD      A,(DE) ; FIRST BYTE OF BASIC CMD
00450      CP      0            ; CHECK FOR A CMD PRESENT
00460      JR      Z,RETURN     ; NO CMD...BACK TO BASIC
00470      LOOP   CPI          ; COMPARE BASIC AND TABLE
00480      JR      Z,MAYBE     ; SKIP TO MAYBE IF MATCH
00490      PUSH   AF          ; SAVE CONTENTS
00500      LD      A,(CTR)     ; LOAD LENGTH OF COMMAND
00510      LD      (DWNCTR) ,A  ; RESTORE DWN LOOP CTR
00520      LD      DE,42E6H    ; RET PTR TO BASIC CMD
00530      LD      A,(DE)     ; LOAD 1ST CHARCT & SEARCH
00540      POP    AF          ; RESTORE CONTENTS
00550      INLOOP JP      PE,LOOP ; LOOP IF CTR NOT = 0
00560      ; *****
00570      ;  RESTORE REGISTERS AND RETURN TO BASIC
00580      ; *****
00590      RETURN  POP      AF      ; RESTORE REGISTERS
00600      POP      BC
00610      POP      DE
00620      POP      HI
00630      RET                ; RET TO CALLER IN BASIC
00640      ; *****
00650      ;  MATCH WAS FOUND...CHECK NEXT CHARCT FOR MATCH
00660      ; *****
00670      MAYBE  PUSH   AF      ; SAVE CHARACTER & FLAGS
00680      PUSH   HL          ; SAVE TABLE LOCATION
00690      LD      HI, DWNCTR   ; GET DOWN COUNTER
00700      DEC      (HL)       ; DEC DOWN COUNTER
00710      XOR      A          ; CLR A FOR COMPARE
00720      CP      (HL)       ; IS DOWN COUNTER = 0?
00730      JR      NZ,GOAGN    ; SKIP AND CHK NEXT CHARCT
00740      POP      HL        ; RESTORE TABLE LOCATION
00750      LD      A,(HL)     ; FOUND MATCH...GET NEXT
00760      CP      0C3H      ; CHARACTER AND COMPARE
00770      JR      Z,DONE     ; DONE = COMMAND MATCH
00780      POP      AF        ; RESTORE CHARCT & FLAGS
00790      JR      RETURN     ; SEARCH OVER... EXIT PROG
00800      GOAGN  POP      HI   ; RESTORE TABLE LOCATION
00810      INC      DE        ; INC TO NEXT BASIC CHARCT
00820      POP      AF        ; RESTORE FLAGS
00830      LD      A,(DE)     ; GET NEW BASIC CMD CHARCT
00840      JR      INT,LOOP   ; GO TEST FOR COMPARE
00850      ;
00860      DONE   JP      (HL) ; JUMP TO COMMAND ADDRESS
00870      ;
00880      ; *****
00890      ;  VARIABLES
00900      ; *****
00910      BEGIN  DEFWM  START   ; START OF CUST CMD PROG
00920      CTR    DEFBB  0       ; LENGTH OF BASIC COMMAND
00930      DWNCTR DEFBB  0       ; USED TO DEC CMD FOR TEST
00940      ; *****
00950      ;  CUSTOM COMMAND TABLE
00960      ; *****
00970      TABLE DEFWM  'SPRINK' ; SPRINKLER SYSTEM COMMAND
00980      DEFBB  0C3H           ; JUMP ADDRESS TO
00990      DEFWM  71E8H        ; SPRINKLER SYSTEM
01000      DEFWM  'ALARM'     ; ALARM SYSTEM COMMAND
01010      DEFBB  0C3H           ; JUMP ADDRESS TO
01020      DEFWM  7910H        ; BURGLER ALARM PROGRAM
01030      ENDTBL DEFBB  $-TABLE ; CALC END OF CMD TABLE
01040      ;
01050      ;          END      START

```

Chameleon Code

by Bradley Murray

The mixture of Basic programs with Assembly-code subroutines is powerful, taking advantage of the simplicity of one and the speed of the other.

Sometimes the Assembly-code routines are loaded in Basic; other times it is better to POKE the decimal equivalents of the routine's object code into memory. It is a nuisance, though, to convert the object code to decimal, check the values and type the data lines.

I wrote a program that interprets an object file produced by an editor/assembler, converts the object code to decimal values, and writes these values to an ASCII file of data lines. These are later merged into the Basic program that POKES the values into memory.

The program gives the starting and ending POKE locations, the memory size required to protect the POKEd program, and the hexadecimal (hex) address needed for a DEFUSRn = statement.

How It Works

Program Listing 1 requests the name of the file to be converted, the name of the ASCII data file (the output file), the starting line number of the data file, and the line number increment.

The program is listed one statement per line to increase its intelligibility, but when entering the program ignore all comment lines and compress statements into single lines. The following line numbers are branch points—you must preserve 1100, 1260, 1360, 1630, 1800, 1870, 1940, 2000, 2090, and 2240.

The program begins with an error trap: The object file first opens as an I-file, closes and then reopens as an R-file. If the file does not exist, a random file with no data is created and read, giving unpredictable, incorrect output. If the file is first opened as "I", the file-not-found error can be trapped.

Tired of converting Assembly code into Basic data statements by hand? This speeds it up.

Reading the file as an Input (I) file, with an INPUT #2, A\$ would be simpler, but has one problem. A byte containing 00, valid in the object code, would be bypassed. The code D0A7 00FF would be incorrectly read into the string as D0A7FF. This does not happen when the File is read with a GET1,r (see line 1240).

Line 1090 sets HX\$ to contain all the hex codes, from which values will be extracted in line 2070 to make a decimal-to-hex conversion.

Line 1180 fields the input file buffer as two variables of 128 bytes each. No single string variable can contain the full 256 bytes. If your older version of Basic has not been modified, the second half of the buffer field contains only 127 bytes. This leads to problems if your object program occupies a full disk sector or more (256 bytes).

The first byte of an editor/assembler object file is either 01 (if created by the EDTASM in the NEWDOS package), or 05 (if created by Radio Shack's Editor/Assembler). In either case the first byte of interest to this program contains 01—the command to load.

Line 1260 extracts a byte from the string A\$(1). The first time through, it extracts the first byte and converts it to decimal. If it is not 01, the second byte

will contain a certain number of bytes to be bypassed before loading program code. Line 1310 increases the pointer by this amount, to skip over the required bytes. If the following byte is 01, it's a loading instruction.

The byte following the loading instruction gives the number of bytes to be loaded, including 2 extra bytes containing the loading address. Lines 1380-1390 decode the number of program bytes NB to be extracted from the string. Zero is interpreted as 256, and 2 is subtracted from NB to take care of the loading-address bytes.

The loading address is used to calculate the first location into which Basic will POKE the program, as well as the memory size needed to protect the program.

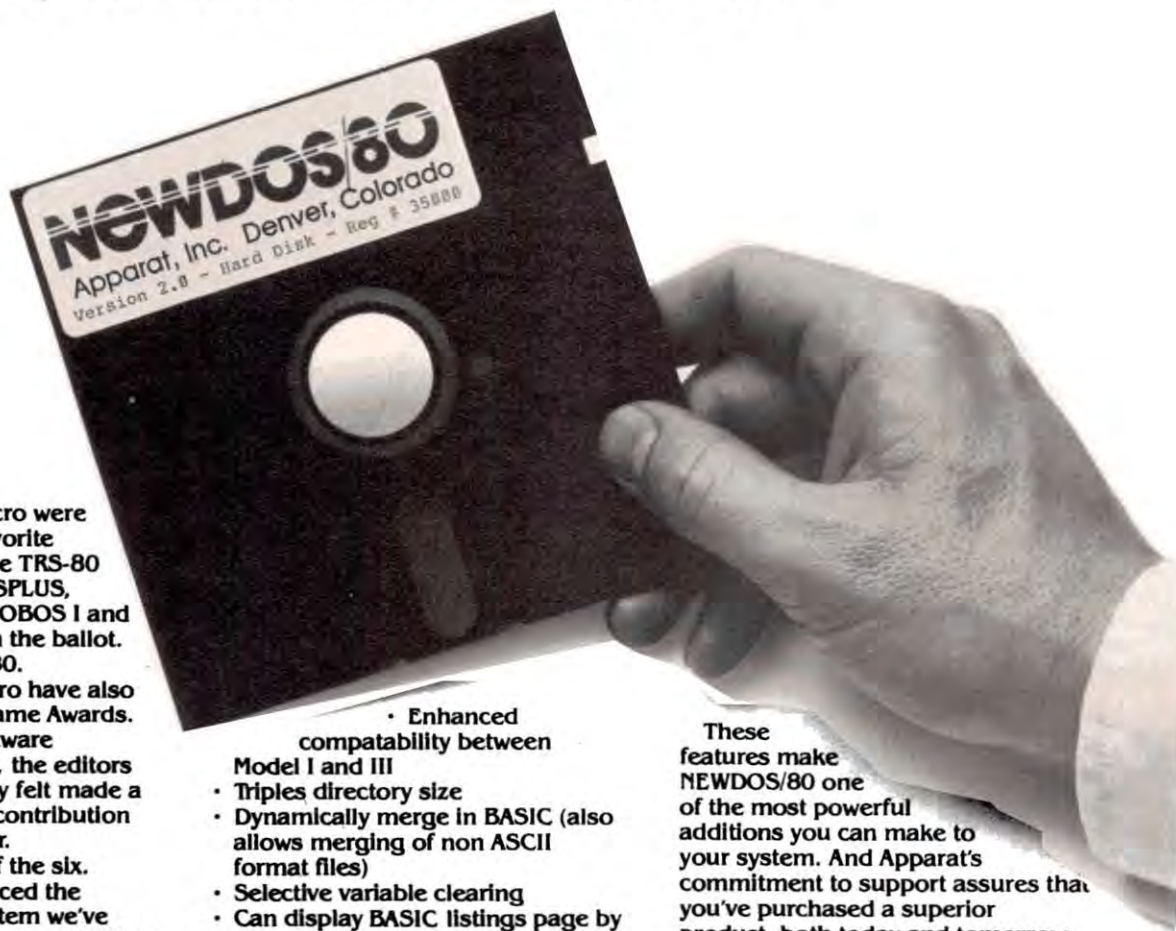
Line 1400 moves the pointer to the least significant bit (LSB) of the loading address and blanks the hex value string (ST\$) for this address. The program calls subroutine 2000 to get the decimal value of the byte, find the quotient and remainder (modulo-16), and convert each to one of the hex characters in HX\$. Upon return, it assigns ST the decimal value of LSB.

The pointer moves to the next byte, the most-significant bit (MSB) of the starting address. With a call to 2000, this is converted to decimal and to hex. The hex code is put before the LSB and linked with it to give the starting address in hex (ST\$).

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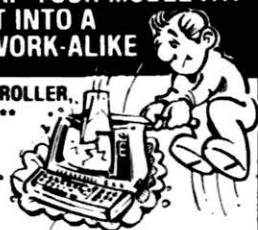
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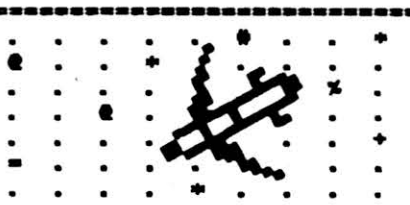
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Upon return from line 2000, the program multiplies the decimal value of this byte by 256 and adds it to the LSB to give the starting address in decimal (ST). If the decimal value is greater than 32767, line 1520 sets the sign bit so the location to POKE will be negative. Line 1510 saves the positive value in MM as the memory size value. EN in line 1570 is the ending POKE address.

N points to the byte within the string AS(K). The subscript K is either 1 or 2; each record is split into two sub-records (see line 1180). K starts with a value of 1 in line 1620, increased when 128 bytes are decoded (lines 1730-1740). If K equals 3, 256 bytes have been decoded and the next record is read from the disk (1770-1780).

NB is the number of program bytes to be converted to decimal and put on the data line. KB is the number of bytes actually converted and added. Line 1800 compares NB and KB.

NN keeps track of the number of values on a single data line. As long as this value does not exceed 14, a comma is appended to the data line 1850. When there are 14 items, the routine writes a carriage return/line feed to the file (CHR\$(13)), increases the line number, and generates a new data line (lines 1870-1890).

The decimal value of the code is not written directly to the data line, since spaces appear before and after the number. Lines 1630-1670 convert it to string format, trim it, and write it as a string. When line 1800 determines that the

number of bytes decoded and written (KB) equals the number of bytes required (NB), the program calls subroutine 2090, the ending routine. If the next byte is 01, more program bytes must be added to the data. NB is calculated as before, but the loading address is not needed.

If the next byte is not 01, the entire program has been loaded. Ordinarily this byte and the next would be 0202, followed by the program entry address (not always the loading address). In this conversion I assumed the starting address and the loading address were the same. If not, adjust them with a JP or JR to the starting address.

You can modify the program to handle a different starting address. If the next byte is not 01 (line 2180), check whether it and the next byte have a value of 02. If so, the 2 bytes following 0202 contain the entry address. Convert ST\$ to this, using the technique above. ST (the start of loading) and MM (the memory size) remain unchanged.

If the byte is not 01 the loading is finished. The program branches to produce the hex value used for the address of a USRn call, the starting and ending loop index values for the POKE, and the memory size used in Basic when running the program.

Program Listing 2 POKES the Assembly-code routine into memory and runs it. ■

Contact Bradley Murray, S.J., at Loyola College, Baltimore, MD 21210.

Program Listing 1. The Converter program.

```

1000 '      ** CONVERTER PROGRAM **
1010 '
1020 '      CONVERTS AN OBJECT CODE FILE
1030 '      TO "DATA" LINES SUITABLE FOR
1040 '      BASIC "POKE" FUNCTION
1050 '
1060 '      TRAP FILE-NOT-FOUND ERROR
-1070 ON ERROR GOTO 1940
-1080 DIM AS(2)
-1090 HXS="#0123456789ABCDEF"
-1100 LINEINPUT"OBJECT CODE FILESPEC: ";FS
1110 '      OPEN "I" TO SEE IF FILE EXISTS
-1120 OPEN "I",1,FS
-1130 CLOSE 1
1140 '      IF SO, OPEN AS A RANDOM FILE
-1150 OPEN "R",1,FS
1160 '      BE SURE YOU HAVE UPDATED VERSION OF
1170 '      OF BASIC. IF NOT: 127 AS AS(2)
1180 FIELD#1,128 AS AS(1),128 AS AS(2)
1190 LINEINPUT"ASCII DATA FILESPEC: ";FS
-1200 OPEN "O",2,FS
-1210 INPUT"ASCII DATA FILE STARTING LINE NUMBER ";LN
-1220 INPUT"LINE NUMBER INCREMENT";IN
-1230 PRINT #2,LN;"DATA ";
-1240 GET 1,1
-1250 N=1
-1260 C=ASC(MID$(AS(1),N,1))
1270 '      C = LOAD COMMAND? (01H)
1280 '      IF NOT, NEXT BYTE IS NUMBER OF BYTES
1290 '      TO SKIP OVER.
-1300 IF C=1 THEN 1360
      ELSE N=ASC(MID$(AS(1),N+1,1))
-1310 N=N+3
1320 '      CHECK WHETHER THIS BYTE IS 01H
-1330 GOTOL260
1340 '      YES: NEXT BYTE GIVES NUMBER OF BYTES TO
1350 '      LOAD, INCLUDING A TWO-BYTE LOADING ADDR
1360 N=N+1
1370 '      NB = NUMBER OF PROGRAM BYTES TO LOAD
1380 NB=ASC(MID$(AS(1),N,1))

```

Listing 1 continued

```

1390 IF NB=0 THEN NB=254
      ELSE NB=NB-2
1400 N=N+1
1410 ' ST$ = STRING FOR HEX CODE OF LOADING ADDR
1420 ST$=""
1430 GOSUB 2000
1440 ' ST WILL BE LSB OF STARTING ADDRESS
1450 ST=K
1460 N=N+1
1470 GOSUB 2000
1480 ' ST WILL BE DECIMAL VALUE OF STARTING ADDR
1490 ST=ST+K*256
1500 ' SAVE ST IN MM (MEMORY SIZE)
1510 MM=ST
1520 IF ST>32767 THEN ST=ST-65536
1530 ' EN = ENDING ADDRESS
1540 ' KB=NUMBER OF PROGRAM BYTES READ FOR THIS
1550 ' SERIES OF LOADS (UP TO NEXT 01 CODE)
1560 ' N=BYTE BEING DECODED IN A$(K)
1570 EN=ST-1
1580 KB=0
1590 N=N+1
1600 ' NN = NUMBER OF VALUES ON A "DATA" LINE
1610 NN=0
1620 K=1
1630 C=ASC(MID$(A$(K),N,1))
1640 CS=STR$(C)
1650 ' REMOVE LEADING BLANK FROM NUMBER
1660 CS=RIGHT$(CS,LEN(CS)-1)
1670 PRINT #2,CS;
1680 N=N+1
1690 KB=KB+1
1700 EN=EN+1
1710 ' HAVE 128 BYTES BEEN READ? IF SO
1720 ' START ON 2ND 128 BYTES OF RECORD
1730 IF N<129 THEN 1800
      ELSE N=1
1740 K=K+1
1750 ' IF 2ND 128 BYTES HAVE BEEN READ,
1760 ' GET NEXT RECORD
1770 IF K=2 THEN 1800
      ELSE GET 1
1780 K=1
1790 ' HAVE ALL BYTES BEEN READ?
1800 IF KB=>NB THEN GOSUB 2090
1810 NN=NN+1
1820 ' ARE THERE 14 NUMBER ON "DATA" LINE?
1830 ' IF SO, START A NEW LINE; IF NOT,
1840 ' ADD " "
1850 IF NN=14 THEN 1870
      ELSE PRINT #2," ";
1860 GOTO 1630
1870 NN=0
1880 LN=LN+IN
1890 PRINT #2,CHR$(13);LN;"DATA ";
1900 GOTO 1630
1910 '-----
1920 ' ERROR: OBJECT FILE NOT FOUND
1930 '
1940 IF ERR<>106 THEN ON ERROR GOTO 0
1950 CLS : PRINT"FILE NOT FOUND"
1960 RESUME 1100
1970 CLOSE
1980 '-----
1990 ' CONVERT 2-BYTE NUMBER TO HEX
2000 '
2010 ' GET DECIMAL VALUE FROM STRING
2020 K=ASC(MID$(A$(1),N,1))
2030 ' QUOTIENT & REMAINDER, MOD-16
2040 Q=INT(K/16)
2050 R=K-Q*16
2060 ' SELECT HEX VALUE FROM STRING HX$
2070 ST$=MID$(HX$,Q+1,1)+MID$(HX$,R+1,1)+ST$
2080 RETURN
2090 '-----
2100 ' CHECK WHETHER THERE ARE MORE BYTES TO
2110 ' BE READ--I.E. NEXT BYTE IS 01.
2120 ' IF SO, GET NUMBER OF BYTES, AND SKIP
2130 ' LOADING ADDRESS--I.E. ASSUME IT FOLLOWS
2140 ' SEQUENTIALLY. IF NO MORE BYTES, THEN
2150 ' ENDING ROUTINE: PRINT CRITICAL VALUES
2160 '
2170 C=ASC(MID$(A$(K),N,1))
2180 IF C<>1 THEN 2240
      ELSE N=N+1
2190 NB=ASC(MID$(A$(K),N,1))
2200 IF NB=0 THEN NB=254
      ELSE NB=NB-2
2210 KB=0
2220 N=N+3
2230 RETURN
2240 CLOSE
2250 CLS
2260 PRINT"FOR USR FUNCTION: DEFUSRN = 6H";ST$
2270 PRINT CHR$(13);"POKE VALUES FROM ";ST;"TO ";EN
2280 PRINT CHR$(13);"MEMORY SIZE:";MM
2290 PRINT CHR$(13);"MERGE";CHR$(34);F$;CHR$(34);CHR$(13)
2300 END

```

```

1000 ' ** THE POKE PROGRAM **
1010 '
1020 DEFINT A-Z
1030 INPUT"LINE 1000 OKAY? (ENTER) OR BREAK";Q$
1040 INPUT"START AND END ADDRESSES";S,E
1050 FOR I=S TO E
1060 READ N : POKE I,N
1070 NEXT I
1080 DEFUSR1=
1090 X=USR1(0)
1100 END

```

Program Listing 2. The POKE program.

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Basic, Faster and Readable—Part IV

by John Corbani

(The first three parts of this series appeared in June, p. 104, July, p. 200, and November, p. 228.—Eds.)

The intelligent use of variables in your programs is essential to both program speed and readability. The type and number of variables and their sequence affects execution time. Creating mnemonic variables that are easy to read, remember, and understand is essential to good programming.

In this article I look at the Model I/III version of Microsoft Basic and describe how Basic puts variables into memory and how to use variables so your computer reads them faster.

A variable name represents either a number (numeric variable) or a sequence of printable, or control, characters (string variables). Basic uses variables in program statements to represent different values. The concept is the same as that used in algebra.

The formula for adding three quantities illustrates the use of variables. $A+B+C=D$ uses A, B, and C to represent values you want added together, and specifies D to represent the answer.

If you assign A the value 2, B the value 3, and C the value 5, then D equals 10 in the above formula. If A = "B" and B = "O" and C = "Y" then D equals "BOY". You can change the number or characters represented by these variables, run the variables through a formula, and obtain general solutions to problems.

Numeric Variables

Three types of numeric variables exist: integer, single-precision, and double-precision. Integer variables describe whole numbers between -32768 and +32767. Basic processes these variables very quickly.

Using variables in a Basic program can affect execution speed. Make sure you use them efficiently.

Single-precision variables consist of any six digits and can contain a decimal point. They take longer to process than integer variables.

Double-precision variables use 16 digits with a floating decimal point and take the longest time to process, so use them only when necessary.

A numeric variable's name consists of one or two alphanumeric characters, with only two restrictions: the first character must be a letter, and you cannot use Basic reserved key words (If, To, Or, and so on).

Basic converts lowercase characters to uppercase. This allows for 26 single letter variables (A-Z), 260 alphanumeric (A0-Z9), and about 650 alpha/alpha combinations (AA-ZZ).

This total of 936 variables applies to each of the three types, bringing the total possible numeric variables to 2,808.

You have the choice of defining groups of variables as a specific numeric type, or adding an identifier (suffix) to the variable name every time you use it. If you do not specify a numeric type, Basic assumes a single-precision variable.

Use the DEFINT, DEFSNG, and DEFDBL commands to predefine groups of numeric variables as integer, single-, or double-precision.

The punctuation characters % (integer), ! (single-precision), and # (double-precision) are suffixes that you can add to variables to define their type. The listing below illustrates the use of these definitions and suffixes.

```
10 DEFINT A-C: DEFDBL X
20 A = -3: B! = 30: BA = 10: X = 1/3: X1 = 1:
   X2 = 3: X3 = X1/X2: PRINT A; B!; BA:
   PRINT X; X3
30 D = 1.666E3: X3 = 1.7563421D - 2: PRINT
   D; X3
```

Line 10 defines all simple variables (those without a suffix) starting with the letters A, B, and C as integer variables. All simple variables starting with X are double-precision. All other simple variables are, by default, single-precision.

Line 20 assigns values to four variables. It sets A to -3, an integer, and single-precision variable B to 30.0000. It also sets BA to the integer 10, and X to the double-precision value of .3333333333333333.

The computer divides constants in single-precision and converts them to double-precision or integers. If you want 1/3 to equal .3333333333333333, you have to type it in yourself or make your computer do the division with double-precision numbers.

Line 30 illustrates a shorthand method to enter data that comes in scientific notation. When you assign values to single-precision variables, you can type the number, an E, and the exponent.

In double-precision you use a D before the exponent. Basic sets the variable D to 1666.00 and the variable X3 to .017563421.

String Variables

String variables represent characters or sequences of characters. They can

represent from zero to 255 characters.

The rules for naming string variables are the same as those for numeric variables. Names can be either letters, an alphanumeric combination, or two letters that aren't reserved words.

Reserve groups of names for string variables by using the DEFSTR function (see the listing below). You can also identify a string variable by placing a \$ (read "string," not "dollar") after a variable name. Basic provides 936 string variables, bringing the total number of variables to 3,744.

```
40 DEFSTR F-H: G = "Good bye."
   : H = "Hello"
50 Y$ = "you all.": F = CHR$(191) + " "
60 PRINT F + H + Y$ + G
```

Line 40 defines all variables starting with the letters F-H as string variables, and assigns sequences of characters to G\$ and H\$.

Line 50 assigns a string to Y\$ and assigns character number 191 (a full white block) and two spaces to F\$. Line 60 uses the strings to print a block cursor and two sentences.

Arrays

Use numeric and string variables to identify arrays, or lists of values. The 3,744 possible arrays are in addition to the individual variables. Each array has as many as 255 dimensions, and 65,535 elements per dimension.

You don't need to define arrays with fewer than 11 elements per dimension. You must dimension arrays with any element number above 10 before referencing the high element.

If you define a variable as a certain type, you must dimension the variable array after that point as the same type unless otherwise specified by a suffix.

```
70 DIM A(20,2): DIM G(26)
80 FOR A=1 TO 20: FOR B=1 TO 2:
   A(A,B)=A B: NEXT B,A
90 FOR A=1 TO 20: G(A)=CHR$(A+64):
   NEXT
```

Line 70 dimensions two arrays. A(20,2) is a two-dimensional integer numeric array. G(26) is a single-dimensional string array. Remember, line 10 defines A as an integer and line 40 defines G as a string variable.

Line 80 fills the numeric array with the numbers from 1-20 in one dimension and the square of the numbers in the other dimension. Line 90 fills the string array with the code for the capital letters from A-Z.

Basic stores in memory all the variables

and arrays specified in a program, along with the information they represent. Basic stores numeric variables just after the program that defines them. The storage process occurs as the program uses each variable.

The program stores variables in memory in the order in which it encounters them. Each name takes 3 bytes: 1 for the variable type, and 2 for the name. The value assigned to numeric variables immediately follows.

Basic stores integer values in the next 2 bytes, single-precision in the next 4 bytes, and double-precision in the next 8 bytes. The length of the string in 1 byte and the address of the first character of the string in the 2 bytes follows the string variable's type and name. The program stores the data itself in high memory.

Basic stores arrays in a list following the simple variables. Three bytes identify the type of variable and the array name. Two bytes identify the total number of elements, and 1 byte identifies the number of dimensions. Basic also allocates 2 bytes for each dimension to give the number of elements allowed per dimension. The program stores the data, one element at a time, starting with the first dimension.

You can also use long names for the variables. Basic looks at the last character to determine type, and ignores all characters after the first two unless they are reserved (key) words. Microsoft gives more variables than most programs can use.

Why all the confusion about variables? Don't blame Basic, blame Fortran and the misinterpretation of books written by and for Fortran programmers. Fortran begat Basic, and contained only a few integer variables, starting at 1.

Fortran had no strings, and virtually no organized structure. It was one of the first high-level languages, and is still the language of choice in most state-of-the-art scientific applications.

Basic is an interpreter that uses much of Fortran's source code. It has greatly expanded the role and power of variables. It also includes Basic-added numeric and string types, and many of the old restrictions are gone. The literature could not keep up. Many of the current problems are due to human factors that have seldom been addressed.

Be careful not to use letters in situations that could cause confusion. Electronic connector manufacturers have noticed that people misread the letters G, I, O, and Q. G, O, and Q turn up as zero. I is a 1, and vice versa. Connector

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```
10 A% = 10: BC$ = "HELLO"
```

```
V = VARPTR(A%)
```

Memory Address	Value	Description
V-3	3	Integer type code
V-2	0	First letter of name (none)
V-1	65	Second character of name (A)
V	10	Low byte of the value
V+1	0	High byte of the value

```
V + VARPTR(BC$)
```

Memory Address	Value	Description
V-3	3	String type
V-2	66	First letter of name (B)
V-1	67	Second character of name (C)
V	6	Number of characters in string
V+1	254	Least significant byte of address of first letter of string (H)
V+2	121	Most significant byte of first letter of string (H) (H) is found at 254 + (121*256), or 30,976

Table 1. An example of integer and string storage in Basic.

```
10 DEFINT A, B, V; B = 1*0: V = 1*0: DIM A(10,2)
20 FOR A = 0 TO 10: A(A,0) = A + 1: A(A,1) = A + 21: A(A,2) = A + 41: NEXT
30 V = VARPTR(A(0,0))
40 FOR B = -10 TO 50: LPRINT PEEK(V + B):NEXT
```

Memory Address	Value	Description
V-10	2	Integer variable
V-9	0	Name
V-8	65	Name
V-7	71	Number of elements
V-6	0	Number of elements
V-5	2	Number of dimensions
V-4	3	Depth of dimension 2
V-3	0	Depth of dimension 2
V-2	11	Depth of dimension 1
V-1	0	Depth of dimension 1
V	1	First element A(0,0)
V+1	0	First element A(0,0)...
V+22	21	Element A(0,1)
V+23	0	Element A(0,1)...
V+44	41	Element A(0,2)
V+45	0	Element A(0,2)

Table 2. A two-dimensional integer array and associated values.

manufacturers use a 22-letter alphabet. That's the reason for the standard 44-pin connector.

I was the first of the few integers in Fortran, and since integers ran fast, they were used in most programming books as preferred variables. Everyone used them, and everyone had problems.

G is not too bad on screen or on fully formed character printers, but if you have a dot matrix printer, watch out. O is a disaster when used alone, and it's even worse when used as the second letter of a variable name.

Don't even consider Q unless the program context makes it unmistakable. QS for queen of spades in a poker program makes good sense, for instance.

I is just as bad. It makes a bad second letter, and can cause confusion when used alone. IN is a handy name for input data, and if the context is clear, I is a reasonable first letter.

The logical selection of variable names depends on the purpose of the program. Pick letters and combinations that form mnemonics recognizable to anyone familiar with the general subject area. X and Y are good names for variables that describe the X and Y plotting positions in a graphics package.

D or T makes sense for loop variables used for time delays. NM\$ is great for the name string in a mailing list program.

Whatever you do, keep a variables list in alphabetical order as you write a program, and put arrays in a separate list. You need to know what the variables are, what they represent, and how they're used. Never use the same name for two types of numerical variables.

Use the fewest number of variables possible to do the job. Nothing is wrong with specifying some variables as utility variables and using them repeatedly. Initialize them every time you use them and you'll never have a problem.

Variables can change function as a program executes. Just list all functions in the variables list. Variables and arrays take up valuable memory, whether used once or 1,000 times, so their efficiency is important. Remember, you can never recover memory during program execution.

Fewer variables mean higher speed. Basic interprets programs character by character. When it encounters a variable, the interpreter goes to the top of the variables list and starts searching for the name.

Variables used frequently or in time sensitive routines should be at the top of the list. If the variable is number 100 on the list, the program reads 99 variable names, compares them to the desired name, and discards them every time you reference that variable. Moving the variable up to 50 on the list doubles the speed of obtaining the quantity represented by that variable.

Assign critical values right at the start of the program. Remember to store string and numeric variables in different lists. Store string and numeric arrays in a separate list, and assign values accordingly.

Sometimes you'll want to know the location of a variable in memory. The POKE command can change the contents of strings, for example, or a machine-language routine might need access to some data in memory.

VARPTR(X) can get you to the right spot, but it's a tricky function to use. VARPTR(X) returns an error message if X is undefined in the program. If the program has not yet encountered X during the execution, VARPTR returns the memory location of the variable as part of the source code. This information is useless for determining type of value of the variable.

If all simple variables have values, and you use VARPTR to find an array, any answer you get is subject to change and may be wrong.

Assigning memory space to simple variables after arrays have been defined requires moving the array to make room for the simple variable. Table 1 shows how Basic stores an integer and a string. Table 2 shows a two-dimensional integer array.

Floating point numbers start with the least significant byte at location V. The number representation when playing with binary floating point numbers is too complex to go into here. Zilog and Intel have programming guides that can help, for those who are interested. Radio Shack information to date is superficial at best.

That's enough on variables. In my next installment, I will take a look at Basic commands that let you get right into the hardware of your computer. ■

John Corbani's hobbies include programming, radio controlled model aircraft, sailing, railroading, skiing, and windsurfing. You can reach him at 2455 Calle Linares, Santa Barbara, CA 93109.

Take It Off

by David Engelhardt

Model 4 owners may need or want more space on their TRSDOS 6.0 system disks. Killing infrequently used system utilities yields the extra space, but TRSDOS 6.0 protects these utilities with a password. Before you can rearrange your disks, you must circumvent this protection. I'll show you how.

Figure 1 shows the directory listing of an unaltered 6.0 disk. The letter P in the attribute (Attr) column identifies protected files.

The Concept

Debug on TRSDOS 6.0 is more powerful than the Model III version. It

You can gain extra space on TRSDOS 6.0 disks by killing protected utility files. Here's how.

includes a new set of features, including a disk Read/Write utility. By taking advantage of this utility in 6.0's revised Debug, you bring the system directory into memory, remove the password, and write the modified directory back to the disk.

Your TRSDOS 6.0 manual discusses this utility on pages 1-75. When you invoke a disk utility command, you must specify six parameters relevant to the operation that tell 6.0 how to proceed. You need to indicate the number of the disk drive, the cylinder number, the starting sector, the type of operation you want to perform, the memory address, and the number of sectors.

The Read/Write utility allows a possibility of four disk drives, 0-3.

TRSDOS 6.0's name for tracks is cylinders, and you must cite cylinder values in hexadecimal (hex) units. Therefore, the range of possible cylinders on a 40-track disk is 0-27 hex.

The starting sector indicates where you want to begin reading from the disk.

The Read/Write utility performs three operations: it writes to a disk (the W command), reads from a disk (R), and writes to the directory (*).

The address value tells the system where in memory to load the information read from the disk. Again, this value must be hexadecimal.

You control how much of a disk the system reads by specifying a number of sectors. If you don't specify, the program reads a whole cylinder (18 sectors). Since sectors are numbered 0-17, selecting a sector number greater than 17 tells the software to continue reading onto the next cylinder.

Removing the Protection

Begin the unprotecting process with a little insurance. Instead of altering your original disk, make a back-up copy and use that. If anything goes wrong while you're tampering with the disk directory, you won't be able to recover the working disk.

Place the back-up in drive zero. Type the command FREE :0 to determine which cylinder holds the directory. The

```

Drive :# TRSDOS60 40 Cyl, DDEN, Free = 43.50K / 180.00K, Date 18-Mar-83
Filespec MOD Attr Prot LRL #Recs EOF File Size Ext Mod Date
-----
BAR/BAS P FULL 256 0 0 0.00K 0
CLICK/FLT P EXEC 256 2 170 1.50K 1 10-Mar-83
COM/DVR P EXEC 256 4 45 1.50K 1 10-Mar-83
COM/CMD P EXEC 256 12 2 3.00K 1 10-Mar-83
CONV/CMD P EXEC 256 7 38 3.00K 1 10-Mar-83
FLOPPY/DCT P READ 256 3 35 1.50K 1 10-Mar-83
FORMS/FLT P EXEC 256 4 35 1.50K 1 10-Mar-83
HERT50/JCL P FULL 256 2 174 1.50K 1 10-Mar-83
KSM/FLT P EXEC 256 4 44 1.50K 1 10-Mar-83
LOG/CMD P EXEC 256 2 94 1.50K 1 10-Mar-83
MAILLIST P FULL 256 64 87 16.50K 1 10-Mar-83
MAILLIST/DAT ? FULL 256 1 255 1.50K 1 23-Apr-83
MEMDISK/DCT P READ 256 12 149 3.00K 1 10-Mar-83
REPAIR/CMD P EXEC 256 3 88 1.50K 1 10-Mar-83
TAPE100/CMD P EXEC 256 9 72 3.00K 1 10-Mar-83
-----
15 files out of 37 selected, Space = 42.00K

```

Figure 1. TRSDOS 6.0 directory listing.

```

6200 5E 03 53 28 00 42 4F 4F 54 20 20 20 20 53 59 53 .S(.BOOT SYS
6210 F6 37 F5 9C 0F 00 00 02 FF FF FF FF FF FF FF FF .7.....
6220 5F 03 53 89 00 53 59 53 36 20 20 20 20 53 59 53 ..S..SYS6 SYS
6230 F6 37 F5 9C 30 00 16 07 FF FF FF FF FF FF FF FF .7..0.....
6240 15 03 53 96 00 4D 45 4D 44 49 53 4B 20 44 43 54 ..S..MEMDISK DCT
6250 BF AE 96 42 0C 00 0E 01 FF FF FF FF FF FF FF FF ..B.....
6260 16 03 53 59 00 52 45 50 41 49 52 20 20 43 4D 44 ..SY.REPAIR CMD
6270 BF AE 96 42 03 00 09 40 FF FF FF FF FF FF FF FF ..B..@.....
6280 16 03 53 2E 00 43 4F 4D 20 20 20 20 20 44 56 52 ..S..COM DVR
6290 51 1F 96 42 04 00 0C 20 FF FF FF FF FF FF FF FF Q..B..@.....
62A0 16 03 53 49 00 54 41 50 45 31 30 30 20 43 4D 44 ..SI.TAPE100 CMD
62B0 BF AE 96 42 09 00 0A 01 FF FF FF FF FF FF FF FF ..B.....
62C0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..S.....
62D0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ..S.....
62E0 16 03 53 5F 00 4C 4F 47 20 20 20 20 20 43 4D 44 ..S..LOG CMD
62F0 BF AE 96 42 02 00 09 00 FF FF FF FF FF FF FF FF ..B.....

```

Figure 2. Debug display.

directory location is labelled DDD, and is usually at cylinder 20.

At the TRSDOS Ready prompt, type DEBUG (ON,EXT) and press the enter key. The Debug monitor loads, then control passes back to the Ready prompt. Press the break key to enter the Debug monitor and a three-quarters screen display of the Z80 register values appears.

Type F6000,7800,00 and press the enter key. This clears the memory you want to use.

Load the disk's directory into memory using the Disk Read/Write utility command: 0,14,0,R,6000,17 and press the enter key. The software reads disk cylinder 14 hex and places the information in memory beginning at 6000 hex. Then the utility displays the contents of memory, starting at 6000 hex—this is the disk's directory.

Pressing the semicolon key increments the display 256 bytes of memory at a time; the hyphen key decrements the display by 256 bytes. Step through memory until the starting address of 6200 hex appears on the screen.

In the far right column, the file names appear in ASCII format. As you step through memory, the names of all

the disk's files show up. Notice that some of these names don't appear when you take a directory of the disk. See your manual's explanation of the DIR command for more about these "invisible" files.

Figure 2 shows the Debug display of memory beginning at 6200 hex. This includes the directory information for the utilities Memdisk, Repair, Com, Tape-100, and Log. The line on which the ASCII file name appears represents the beginning of each directory entry.

Looking at the first byte in the first line of each utility, notice Memdisk begins with a 15; Repair, Com, Tape-100, and Log begin with 16. This byte tells the system the program's protection level. Changing this changes the program's protection. If the value is 10 hex, the program is completely accessible.

Try unprotecting Memdisk for practice. Type E6240 and press the space bar to set Debug's pointer to Memdisk's first line. Notice that the current byte value appears at the lower left of the screen.

Type 10 and press the enter key. The display reflects the change you made. The first byte of Memdisk is 10, mean-

ing that Memdisk is now unprotected.

Type E6260 and press the space bar. The pointer moves to the beginning of the Repair utility. Change its initial byte to 10. Continue making these changes until you alter all the utility programs. Remember: You've made these changes in memory only, not on the disk.

To replace the disk's directory with your modified directory, use another disk Read/Write utility command. It's almost the same as the one that puts the directory in memory. Just change the operator from R to an asterisk. Type 0,14,0,*,6000,17 and press the enter key. Type the letter O and press the enter key to return to TRSDOS Ready. Turn off Debug using the command DEBUG (OFF).

Call the directory using the DIR command and you see that the programs you changed no longer have the P attribute. You are free to copy or kill them at your discretion.

Use this technique to customize your 6.0 disks to suit your needs.

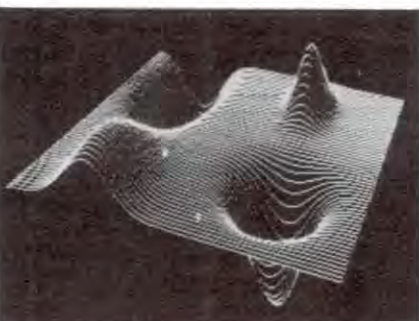
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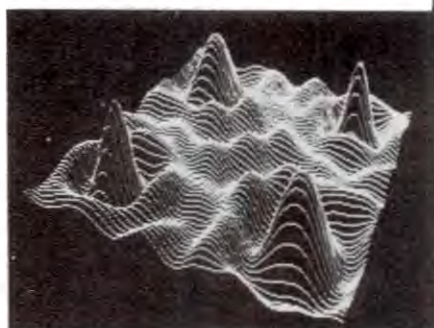
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The Password Is...

by David Lantis

At one time or another, you've probably run across a Model 4 disk file you wanted to list but couldn't because it was password-protected. One way to gain access is to remove the password protection, but that leaves the files open to anyone.

A better solution is to use this Basic program and the Memdisk utility to uncover the password. This leaves your files protected against accidents, while still giving you complete freedom.

Program Operation

PASSCRCK/BAS (see the Program Listing) searches for the password of a protected file on the disk in drive zero. The program systematically tries every possible combination of letters and numbers until it hits upon the successful one.

The On Error and Resume statements in lines 10 and 5000, respectively, are PASSCRCK/BAS's key. They keep the program running as long as it makes errors, i.e., as long as it generates an incorrect password.

Lines 30-160 loop around, testing every possible alphanumeric value for each of seven possible password characters (stored in variables C2-C8). Line 170, the loop that tests the value of the first character (C1), is different from those in the previous lines because TRSDOS 6.0 requires that a letter begin a password.

Lines 180-200 tally the values of the individual characters (C1-C8) into P\$, the variable that holds the password possibility currently being tested. Line 210 is optional; it prints P\$ on the screen. While it's helpful to know how far along the program is, this line does slow execution.

Line 220 sets the variable FILE\$ equal to the command that lists your selected program, LIST FILE NAME/EXTENSION PASSWORD, where password is the possibility the program tests.

Line 230 goes out to the system to test the password. If the program is successful, then the program listing appears on the screen. Finally, the software prints the line LIST FILE NAME/EXTENSION PASSWORD at the top of the screen. Get a pencil and write down the password.

Unfortunately, this program is slow. It tests tens of thousands of possible combinations of letters and numbers. In addition to the time it takes to test the password, the disk drives wait one second between the time they start spinning and the time they begin reading the disk. Multiply this second across the number of password possibilities tested and we're talking about hours, maybe days.

Speeding Things Up

Memdisk, a TRSDOS 6.0 utility, helps speed things by creating a pseudo-disk in memory. This circumvents the physical disk I/O that takes so much time. Your TRSDOS 6.0 manual documents the Memdisk utility on page A-116.

To run PASSCRCK/BAS with Memdisk, move the system files, Basic's error reporting overlay BASIC/OV1, and the program you want to crack into memory on Memdisk. (If BASIC/OV1 is protected on your disk, remove the protection using the method described above.)

Type SYSTEM (DRIVE=2, DRIVER="MEMDISK") and press the enter key. The Memdisk utility menu appears. Choose option D, specify a double-density Memdisk (type D again), and respond Y to the format request. If you ask for a directory (DIR), you see that drive 2 now contains Memdisk.

Type in BACKUP \$/SYS:0 :2 (SYS) to tell the computer to copy all system files onto disk 2, the disk in memory.

Typing in BACKUP BASIC/OV1:0 :2 moves the Basic overlay program onto Memdisk. This circumvents the physical disk I/O involved when PASSCRCK/BAS fails and BASIC/OV1 reports, "Access denied due to password protection."

Type in BACKUP file/ext:0 :2 (where file is the name of the program you're cracking) to move the program onto Memdisk.

Typing in SYSTEM (SYSTEM=2) installs Memdisk as drive zero. Requesting a directory now shows physical drive zero as drive 2 and Memdisk as drive zero.

Type in BASIC/CMD:2 to run Basic. Then, from Basic's READY prompt, load and run PASSCRCK/BAS. When the program asks "File you wish to list?" enter the name of the program you want to crack.

With the Memdisk method implemented, PASSCRCK/BAS tests about 100 passwords per minute. Carried to its ultimate end, the program reaches its final possibility (password ZZZZZZZZ) in approximately 1,041 years. But the chances are that the software will encounter the correct password well before then. ■

```
10 ON ERROR GOTO 5000
20 INPUT "What file to list -- must be on disk 0";P$
30 FOR C8=32 TO 90
40 IF (C8>32 AND C8<48) OR (C8>57 AND C8<65) THEN 320
50 FOR C7=32 TO 90
60 IF (C7>32 AND C7<48) OR (C7>57 AND C7<65) THEN 310
70 FOR C6=32 TO 90
80 IF (C6>32 AND C6<48) OR (C6>57 AND C6<65) THEN 300
90 FOR C5=32 TO 90
100 IF (C5>32 AND C5<48) OR (C5>57 AND C5<68) THEN 290
110 FOR C4=32 TO 90
120 IF (C4>32 AND C4<48) OR (C4>57 AND C4<68) THEN 280
130 FOR C3=32 TO 90
140 IF (C3>32 AND C3<48) OR (C3>57 AND C3<68) THEN 270
150 FOR C2=32 TO 90
160 IF (C2>32 AND C2<48) OR (C2>57 AND C2<68) THEN 260
170 FOR C1=65 TO 90
180 P1$=CHR$(C1)+CHR$(C2)+CHR$(C3)+CHR$(C4)
190 P2$=CHR$(C5)+CHR$(C6)+CHR$(C7)+CHR$(C8)
200 P$=P1$+P2$
210 PRINT P$
220 FILE$="list "+P$+"."+P$
230 SYSTEM FILE$
240 PRINT FILE$: END
250 NEXT C1
260 NEXT C2
270 NEXT C3
280 NEXT C4
290 NEXT C5
300 NEXT C6
310 NEXT C7
320 NEXT C8
330 PRINT "Couldn't find the password, I guess you'll have to fi
re me":END
5000 RESUME 250
```

Program Listing. Password Sleuth.

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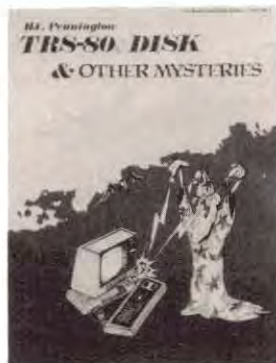
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zero) of each of the bytes in the first signature sector.

Indexing

I'll index the file in Fig. 5. First, the program reserves a 256-byte buffer in memory for the signature sector. After it opens the source and index files and writes the index file header sector, the program starts indexing.

The program sets all the bytes in the signature sector buffer to zero. The program reads the first source file record into memory. It then hashes each triplet in the source record to a number between zero and 250, and sets bit zero of the corresponding byte in the signature sector buffer to 1. In the first source record the triplets "bir" and "ird" hash to 171 and 194, respectively, so the program sets the first bits of bytes 171 and 194 of the signature sector to 1.

After the program processes the first record, it reads the second record (sector 1) into memory. Again, the program hashes each triplet in the record, but this time the program sets bit 1 of the corresponding byte equal to 1. The triplet "cat" hashes to 193 so the program sets bit 1 of byte 193 of the signature sector

to 1.

The program repeats this procedure until it indexes eight of the records. It then stores the signature sector buffer in the index file (sector 1). The program processes the next eight sectors of the source file in the same manner, and sequentially stores the signature sector in the index file. Indexing continues until the end of the source file, then the program writes the last signature sector to the index file and closes both files.

Searching

Remember that in its simplest form the search algorithm is: Match the signature of the first record to the key signature. If, for every b_i equal to 1 in the key signature, you have a corresponding b_i equal to 1 in the record signature, the screening test is positive and the program brings the record into memory and searches it for the key. Continue screening record signatures until you reach the end of the index file.

An ideal way to compare the key signature to a record signature is to have a machine with 251-bit registers and accumulators. You could compare the key and record signatures in one operation.

Search key	Jill	
Triplets	jil	ill
Hash values	212	142
Key hash buffer	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> 21 14 22 </div>	

Figure 6. Search key "Jill" for search of the source file in Fig. 5.

It would be a form of parallel processing—the same as putting multiple needles in edge-notched cards and selecting only those cards that fall out.

Eight-bit machines, however, necessitate the use of serial processing. Although a program can sequentially compare all 251 bits of the key and record signatures, it would be wasteful because the majority of bits in the key signature are set to zero and can be ignored.

Instead, the program stores the hash values of all triplets in the search key in a separate buffer called the key hash buffer (Fig. 6). If, for each hash value in the key hash buffer, the corresponding

Listing 3 continued

```

00862 ;-----
00863 ;MODII buffers
00864 ;-----
00865 PUBLIC ACCESS ;access mode of OPEN routine
00866 PUBLIC BREAK ;break enabled buffer (Y/N)
00867 PUBLIC INDCB ;Input (source) file DCB
00868 PUBLIC INDCBL ;Input file DCB Record Length
00869 PUBLIC IDCBCR ;Input file DCB Current Record
00870 PUBLIC IDCBLR ;Input file DCB Last Record
00871 PUBLIC INLNR ;true last record of source file
00872 PUBLIC IDCBSO ;Input file DCB xxxxxx
00873 PUBLIC MAPDCB ;MAP (index) file DCB
00874 PUBLIC MDCBRL ;Map file DCB Record Length
00875 PUBLIC MDCBCR ;Map file DCB Current Record
00876 PUBLIC MDCBLR ;Map file DCB Last Record
00877 PUBLIC MAPLLR ;true last record of index file
00878 PUBLIC MDCBOS ;Map file DCB xxxxxxxx
00879 PUBLIC MEMEND ;contents -> top of memory
00880 PUBLIC OUTCHR ;record buffer (1 byte) for output file
00881 PUBLIC OUTDCB ;output file DCB
00882 PUBLIC PRIBUF ;printer buffer (80 char)
00883 PUBLIC SORL ;start of record line no.
00884 PUBLIC STMAP ;start of MAP index file (always last byte
00885 ;of SEARCH program)
00886 ;-----
00887 ;MODII I/O parm
00888 ;-----
00889 PUBLIC ARROWD ;arrow down
00890 PUBLIC ARROWL ;arrow left
00891 PUBLIC ARROWR ;arrow right
00892 PUBLIC ARROWU ;arrow up
00893 PUBLIC BRKKEY ;break key
00894 PUBLIC BSPKEY ;back space key
00895 PUBLIC CYPPOS ;copyright msg position
00896 PUBLIC DELKEY ;delete key
00897 PUBLIC DFTFS ;default file size
00898 PUBLIC INSRKEY ;insert key
00899 PUBLIC LSBYTE ;col of last byte in 255 byte rec
00900 PUBLIC PENULN ;penultimate line (next to bottom)
00901 PUBLIC SWIDTH ;screen width
00902 PUBLIC SMM1 ;screen width minus 1
00903 PUBLIC TOPLN ;top line of editor screen
00904 ;-----
00905 ;external routines and buffers
00906 ;referenced by MODII
00907 ;-----
00908 EXTERN ANSWER ;general purpose 1 byte buffer
00909 EXTERN EATBNK ;bypass leading blanks
00910 EXTERN EATBNBK ;bypass leading non-blank char
00911 ;-----
00912 ;Model II equates
00913 ;-----
00914 ARROWD EQU 1FH ;arrow down
00915 ARROWL EQU 1CH ;arrow left
00916 ARROWR EQU 1DH ;arrow right
00917 ARROWU EQU 1EH ;arrow up
00918 BRKKEY EQU 3 ;break key
00919 SWIDTH EQU 80 ;screen width
00920 SMM1 EQU 79 ;screen width minus 1
00921 TOPLN EQU 19 ;top line of edit text
00922 PENULN EQU 22 ;penultimate line
00923 LSBYTE EQU 14 ;column of last byte in 255 byte rec
00924 DFTFS EQU 800 ;default file size for 3bys
00925 DELKEY EQU 2 ;delete key (F2)
00926 INSRKEY EQU 1 ;insert key (F1)
00927 BSPKEY EQU 8 ;backspace key
00928 CYPPOS EQU 52 ;copyright notice position
00929 ;-----
00930 ;HOME
00931 ;-----
00932 ;pos cursor to r1:c1
00933 ;reg altered: AF,D
00934 ;-----
00935 ;BOTTOM
00936 ;pos cursor to r24:c1
00937 ;reg altered: AF,D

```

```

00139 HOME PUSH BC ;r1:c1
00140 LD BC,8
00141 HOMES LD D,0
00142 SVC 10 ;pos cursor
00143 POP BC
00144 RET
00145 ;-----
00146 ;pos cursor to r24:c1
00147 BOTTOM PUSH BC ;r24:c1
00148 LD BC,23*256+0
00149 JR HOMES
00150 ;-----
00151 ;NEWLN
00152 ;rolls screen and positions
00153 ;cursor to next to last line
00154 ;also keeps track of first line of
00155 ;current (or last) record displayed
00156 ;reg altered: A
00157 NEWLN PUSH BC
00158 PUSH DE
00159 PUSH HL
00160 CALL BOTTOM ;pos to bottom line
00161 LD A,80H
00162 CALL VDCHAR ;roll screen by dsp EOR on bottom line
00163 LD BC,22*256+0 ;r23:c1
00164 CALL POSCUR
00165 A,(SORLN)
00166 CP 4 ;has first line reached top of screen?
00167 JR Z,NEWLNS ;if it has do not dec (SORLN)
00168 LD A,(SORLN)
00169 DEC A ;dec (SORLN)
00170 LD A,(SORLN),A
00171 NEWLNS POP HL
00172 POP DE
00173 POP BC
00174 RET
00175 ;-----
00176 ;CURPOS
00177 ;get cursor position
00178 ;value returned in BC
00179 ;B=row, C=column
00180 ;reg altered: AF,D
00181 CURPOS LD D,0
00182 SVC 11 ;get cursor pos
00183 RET
00184 ;-----
00185 ;POSCUR
00186 ;position cursor
00187 ;B=row, C=column
00188 ;reg altered: AF,D
00189 POSCUR LD D,0
00190 SVC 10 ;pos cursor
00191 RET
00192 ;-----
00193 ;KBINIT
00194 ;initialize keyboard
00195 ;-----
00196 ;KBCHAR
00197 ;get char from keyboard
00198 ;works like Model IIT KBCHAR
00199 ;value of pressed key returned
00200 ;in A reg. If no key pressed, A=8
00201 KBCHAR PUSH BC
00202 LD B,0
00203 LD A,'N'
00204 LD (BREAK),A ;set break switch to N (no break)
00205 SVC 4 ;Model IIT KBCHAR
00206 LD A,(BREAK)
00207 CP 'Y' ;was break key pressed
00208 JR Z,KBCH6
00209 LD A,B ;move entered char to A reg
00210 POP BC
00211 RET
00212

```

Listing 3 continued

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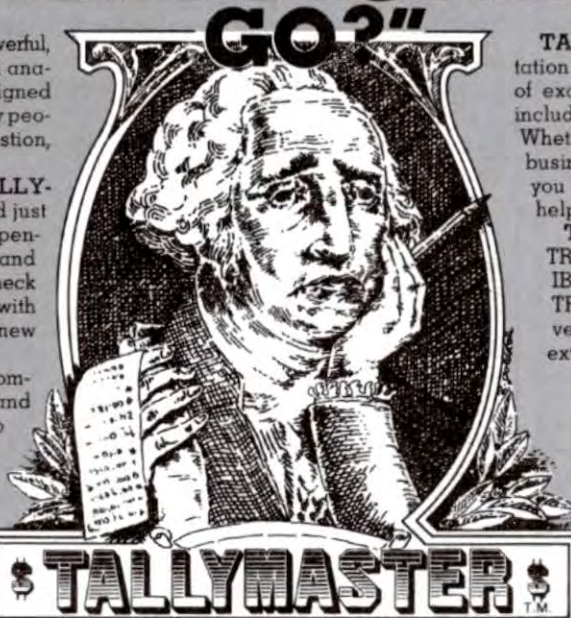
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record signature bit equals 1, the screening test is positive, and the program searches the source record for the key. Since it isn't efficient to compare 1 bit at a time on an 8-bit machine, the program processes eight record signatures at once.

To search the file in Fig. 5, you must first open the index file, then the source file specified in the index file header. The search begins when you enter a key (e.g., the name "Jill").

The program hashes each triplet of the key and stores the hash value sequentially in the key hash buffer (Fig. 6). In the example, it stores the hash values 212 (h(jil)) and 142 (h(ill)) respectively in the first and second bytes of the key hash buffer.

Then the program reads the first signature sector of the index file into the signature sector buffer in memory. It sets the accumulator (A) to 255 (1111 1111 binary). The program ANDs byte 212 (hash value of the triplet "jil") of the signature sector with A.

If A equals zero, the triplet "jil" isn't present in the first eight sectors of text and you can process the next signature sector. If A doesn't equal zero, the triplet "jil" might be present, so the program continues to process the current signature sector.

The program ANDs byte 142 (hash value of the triplet "ill") of the signature sector with A. Skip to the next signature sector if A equals zero; otherwise continue as follows. For each bit in A equal to 1 it's possible (but not certain) that the corresponding record contains the triplets "jil" and "ill".

In the example, A equals 72 (0100 1000 binary), indicating that sectors 3 and 6 might contain the key you're looking for. The program reads record 3 into memory and searches sequentially for the string "Jill". It finds the key and displays the record.

Then the program reads record 6 into memory, but the key "Jill" isn't present so it bypasses the record. The reason for the collision is simple—the triplet "goa" hashes to the same value as "jil" and the triplet "ill" appears in both records.

The program sequentially reads the index file a sector at a time and processes each signature sector similarly. After it screens the entire index file and searches the appropriate source records, you can enter another key to restart the searching process.

Searching for the joint occurrence of two or more keys is merely an extension of the above procedure (search the file for the names "Jack" and "Jill"). The

*"The program processes
eight record signatures
at once."*

program stores the hash values (123, 4, 212, and 142) of the triplets "jac", "ack", "jil", and "ill" in the key hash buffer.

The program reads the first signature sector into memory and sets the accumulator to 255. It ANDs byte 123 of the signature sector with A. Similarly, it ANDs bytes 4, 212, and 142 of the signature sector with A.

If at any time A equals zero, none of the eight source records contains both strings, and the search skips to the next signature sector. In the example, only bit 5 equals 1, so it's the only source record searched. The program finds the names "Jack" and "Jill" and displays the record.

In these simple examples only one record is present per sector. When two or more records completely fit into one sector, the program indexes the entire sector as one record. When the program searches the sector, however, it examines each record separately for the search key(s). If a record spans a sector boundary (starts in one sector and ends in another), it is considered as logically in the first sector in which it begins.

You increase the speed of searching by storing as many signature sectors as possible in memory (reducing the number of disk reads during index screening).

TRS-80 Signature Screening

Mindex and Search are Assembly-language programs that use signature screening to search text files. Mindex indexes the source file and stores the index on disk. Search uses the index created by Mindex to search large text files quickly.

These programs were written with the Radio Shack Assembly Language Development System (ALDS) on a Model II. Each program consists of several modules. The two input/output (I/O) modules include MODII/SRC for the Model II and MODIII/SRC for the Model III.

The ALDS editor, assembler, and linker work only on the Model II. If you have a Model III and want to use these programs exactly as written, you must first write, assemble, and link them on a Model II and then, using the ALTRAN

Listing 3 continued

```

00217 KBC6 LD A,3 ;<Break> pressed so A=3
00218 POP BC
00219 RET
-----
00221 ;KWAIT
00222 ;wait for char from keyboard
00223 ;works like Model II KWAIT
00224
00225 KWAIT PUSH BC
00226 LD B,0
00227 LD A,'B'
00228 LD (BREAK),A ;initialize to no break
00229 KMW4 SVC 4
00230 KWAIT LD A,(BREAK)
00231 CP 'Y' ;<Break> pressed?
00232 JR Z,KMWS ;jp to break processing section
00233 POP AF
00234 JR NZ,KMW4 ;loop until key pressed
00235 LD A,B ;move entered key to A reg
00236 POP BC
00237
00238 KMS POP AF
00239 LD A,3 ;break key entered
00240 POP BC
00241 RET
-----
00244 ;WPKMNT
00245 ;
00246 ;word processing KWAIT routine
00247 ;on the Model II this is basically
00248 ;the same as the KWAIT routine
00249 WPKMNT PUSH BC
00250 LD B,1 ;blinking cursor on
00251 SVC 8
00252 LD B,8
00253 WPKM4 CALL KWAIT
00254 LD C,A ;save keyed in char
00255 LD B,2 ;cursor off
00256 SVC 8
00257 LD A,C ;restore keyed in char
00258 POP BC
00259 RET
-----
00261 ;OPEN
00262 ;
00263 ;open file
00264 ;entry: HL-> buffer
00265 ; DE->DCB
00266 ;exit: A=TRSDOS error msg
00267 ;reg altered: AF,HL
00268 OPEN LD (BUFADR),HL
00269 LD HL,BUFADR
00270 SVC 4B ;open file SVC
00271 PUSH AF
00272 LD A,8
00273 LD (HL),A ;set record length to 256 bytes!
00274 POP AF
00275 RET
00276
00277 BUFADR DEFW 0 ;buffer address (passed by HL)
00278 RECADR DEFW 0 ;record address (not needed for 256 byte rec)
00279 EODADR DEFW 0
00280 ACCESS DEFB 'R' ;read only access
00281 HL DEFW 0 ;record length (set to B)
00282 VORP DEFB 'P' ;variable or fixed len record
00283 CREATE DEFB 0
00284 ATTRIB DEFB 0
-----
00286 ;INIT
00287 ;
00288 ;initialize (create) a file
00289 ;entry: HL->record buffer
00290 ; DE->DCB
00291 ;exit: A=TRSDOS error msg
00292 ;reg altered: AF,HL
00293 INIT LD (BUFADR),HL
00294 LD HL,BUFADR
00295 SVC 4B
00296 PUSH AF
00297 LD A,8
00298 LD (HL),A ;record length = 256
00299 POP AF
00300 RET
00301
00302 BUFADR DEFW 0 ;address of sector buffer
00303 RECADR DEFW 0 ;address of record buffer
00304 EODADR DEFW 0
00305 ACCESS DEFB 'W' ;access = (W)rite
00306 HL DEFW 0 ;record length = 256 bytes
00307 VORP DEFB 'P' ;fixed length records
00308 CREATE DEFB 2
00309 ATTRIB DEFB 0
00310
00311 ;OPINIT
00312 ;
00313 ;open a file but do not reset it
00314 ;entry: HL-> sector read buffer
00315 ; DE->DCB
00316 ;exit: A=TRSDOS error msg
00317 ;reg altered: AF,DE,HL
00318 OPINIT LD A,8
00319 LD (CREATE),A
00320 LD DE,OUTCHR
00321 LD (RECADR),DE
00322 LD (BUFADR),HL
00323 LD HL,BUFADR
00324 PUSH HL ;save DE & HL in case open fails
00325 PUSH HL
00326 LD A,(ANSWER)
00327 CP 'R'
00328 JR Z,OPIN3
00329 SVC 4B ;open
00330 JP Z,OPIN4
00331 LD A,2 ;create and reset
00332 LD (CREATE),A
00333 POP HL
00334 POP DE
00335 SVC 4B ;open
00336 RET
00337 OPIN4 POP HL ;restore stack
00338 POP DE
00339 RET
00340
00341 BUFADR DEFW 0
00342 RECADR DEFW 0
00343 EODADR DEFW 0
00344 ACCESS DEFB 'W'
00345 HL DEFW 1
00346 VORP DEFB 'P'
00347 CREATE DEFB 0
00348 ATTRIB DEFB 0
00349 OUTCHR DEFB 0 ;record buffer
00350
00351 ;CLOSE
00352 ;
00353 ;close file
00354 ;entry: DE->DCB
00355 ;exit: A=TRSDOS error msg
00356 ;close file
00357 CLOSE SVC 42
00358 RET
-----
00359 ;SETVLR
00360 ;set VAP last record to true last rec
00361 ;this routine is necessary to make programs
00362 ;compatible with Model III
00363
00364 SETVLR LD HL,(RDCBLR)
00365 LD (RAFLR),HL ;no need to dec HL on Mod II
00366 RET

```

Listing 3 continued

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programs supplied in the ALDS package, transfer them to the Model III.

Alternatively, you can write and assemble the programs using a simple editor/assembler such as Radio Shack's Series I Editor/Assembler (EDTASM). EDTASM does not contain a linker so it's necessary to combine the modules into one program for Mindex and Search.

I first developed Mindex and Search (version 1.1) on a Model III using EDTASM. However, the editor's memory was limited and the program comments were restricted.

When I switched to the Model II, I started using ALDS. Much to my chagrin, the operating systems of the two machines are quite different. For exam-

ple, to display a character on the Model III, you load the character into the accumulator and make a call to location 33 hexadecimal (hex). The routine alters the contents of the DE register pair.

On the Model II, you load the character into register B, load the supervisor call code 8 into the accumulator, and execute an RST 8 operation. The DE register pair isn't altered.

Rather than rewrite the program for the Model II, I developed separate I/O routines for the Models II and III. Since I wrote the original programs for the Model III, the parameters pass to the I/O routines in Model III format.

For example, the program stores the character you want displayed on the screen in the accumulator. A few of the

Model II routines (SVCs) aren't present in Model III TRSDOS so I added them (such as routines to position the cursor at coordinates stored in the BC register pair).

If you're using Radio Shack's ALDS, type in the program modules in Program Listings 1-3 and 7-12 for the Model II, and Listings 4-12 for the Model III. After the ALDS writes each module, you must assemble them to relocatable code by using ALASM, the ALDS assembler.

After ALASM assembles all modules, you're ready to link them. For the Model II, type ALLINK MINDEX2 MINDEX \$=4000 to link the Mindex program and ALLINK SEARCH2 SEARCH \$=4000 to link the Search

Listing 3 continued

```

00367 -----
00368 ;SETILR
00369 ;set input last rec to true last rec
00370 SETILR LD HL,(IDCBLR)
00371 LD (IMLRL),HL ;true value regardless of whether
00372 ;sector is full or not!!
00373 RET
00374
00375 -----
00376 ;POSN
00377 ;not used for Model II
00378 ;but present for Mod III compatibility
00379 POSN RET
00380
00381 -----
00382 ;POSEOF
00383 ;position to end of file
00384 ;entry: DE->DCB
00385 POSEOF LD BC,$FFFFH
00386 SVC 35
00387
00388 LD DE,OUTDCB ;LOCATE
00389 SVC 33 ;must have this!!
00390 DEC BC
00391 LD DE,OUTDCB
00392 SVC 35 ;sets file cursor to last char
00393
00394 RET
00395
00396 -----
00397 ;READR
00398 ;read direct
00399 ;entry: DE->DCB,BC=rec no.
00400 READR SVC 35
00401 RET
00402
00403 -----
00404 ;READNX
00405 ;read next record
00406 ;entry: DE->DCB
00407 READNX SVC 34
00408 RET
00409
00410 -----
00411 ;WRITE
00412 ;write direct
00413 ;DE->DCB, BC=rec no.
00414 WRITE SVC 44
00415 RET
00416
00417 -----
00418 ;WRITNX
00419 ;write next record
00420 ;entry: DE->DCB
00421 WRITNX SVC 43
00422 RET
00423
00424 -----
00425 ;KBLINE and KBLIN3
00426 ;KBLINE: EOR=#DH, KBLIN3: EOR=#3
00427 ;entry: HL->buf
00428 ;B = max length
00429 ;EOR=#DH or #3
00430 ;returns with last char entered in A
00431 ;EOR=#3
00432 KBLIN3 LD A,3
00433 JR KBL#3
00434 KBLINE LD A,#DH
00435 KBL#3 LD (EORCHR),A
00436 LD A,1
00437 CALL VDCRHR ;blinking cursor
00438 LD C,#
00439 KBL#5 CALL KWAIT
00440 LD D,A
00441 CP #DH ;<enter> key?
00442 JR Z,KBL#DH
00443 CP #B ;<backspace> key?
00444 JR Z,KBL#BSP
00445 CP #BKREY ;<break> key?
00446 JR Z,KBL#BK
00447 CP ZBH
00448 JF W,KBL#5
00449 LD A,B
00450 CP C
00451 LD A,Z,KBL#5 ;reload since A used for calc
00452 INC C ;store in buf
00453 INC HL
00454 CALL VDCRHR
00455 JR KBL#5
00456 KBL#BSP LD A,# ;back space routine
00457 CP C
00458 LD A,Z,KBL#5 ;do nothing if start of buf
00459 LD A,B
00460 CALL VDCRHR ;dps backspace
00461 DEC HL
00462 DEC C
00463 JR KBL#5
00464
00465 ;KBRK
00466 LD A,(EORCHR) ;break routine
00467 LD (HL),A
00468 CALL VDCRHR ;display EOR
00469 LD A,BKREY ;return with A=break
00470 LD (EORCHR),A ;save for ret
00471 JR KBL#01
00472 KBL#DH LD A,(EORCHR) ;place EOR (#3 or #DH)
00473 LD (HL),A
00474 CALL VDCRHR ;display EOR
00475 KBL#D1 INC HL ;HL->byte past EOR
00476 LD A,2
00477 CALL VDCRHR ;cursor off
00478
00479 LD A,(EORCHR) ;A returns with last char (#DH or #3)
00480 LD B,C ;char count
00481 RET
00482 EORCHR DEFB #DH ;EOR character
00483
00484 -----
00485 ;PRINIT
00486 ;initialize printer
00487 PRINIT PUSH BC
00488 PUSE DE
00489 SVC 17 ;printer init
00490 POP DE
00491 POP BC
00492 RET
00493
00494 -----
00495 ;SCRPRO
00496 ;scroll protect
00497 ;A contains line no.
00498 SCRPRO PUSH BC
00499 LD B,A
00500 SVC 27
00501 POP BC
00502 RET
00503
00504 -----
00505 ;ERASES
00506 ;erase to end of screen code
00507 ERASES LD A,18H
00508 CALL VDCRHR
00509 RET
00510
00511 -----
00512 ;ERASEL
00513 ;erase to end of line
00514 ERASEL LD A,17H
00515 CALL VDCRHR
00516 RET
00517
00518 -----
00519 ;VDCRHR
00520 ;display char
00521 VDCRHR PUSH BC
00522 PUSE AF
00523 LD B,A
00524 SVC #
00525 POP AF
00526 POP BC
00527 RET
00528
00529 -----
00530 ;VDINIT
00531 ;clear screen and initialize
00532 VDINIT PUSH BC
00533 LD BC,257
00534 SVC 7
00535 POP BC
00536 RET
00537
00538 -----
00539 ;VDLINE
00540 ;entry: HL->string
00541 ;#DH or #3 stop display
00542 ;exit: HL->next char
00543 VDLINE PUSH BC
00544 VDL#5 LD B,(HL)
00545 SVC #
00546 INC HL ;vdcchr
00547 LD A,B
00548 CP #DH
00549 JP Z,VDL#12
00550 CP #3
00551 JP Z,VDL#12
00552 VDL#12 JP VDL#5 ;cursor off
00553 CALL VDCRHR
00554 POP BC
00555 RET
00556
00557 -----
00558 ;VDLIN3
00559 ;display line but no carriage return
00560 ;entry: HL->string
00561 ;#DH or #3 stop display
00562 ;DOES NOT PRINT #DH!!
00563 ;exit: HL->next char
00564 VDLIN3 PUSH BC
00565 VDL#95 LD B,(HL)
00566 LD A,#DH
00567 CP #
00568 JR Z,VDL#98
00569 SVC # ;vdcchr
00570 VDL#98 INC HL
00571 LD A,B
00572 CP #DH
00573 JR Z,VDL#12
00574 CP #3
00575 JR Z,VDL#12
00576 VDL#12 LD VDL#95 ;cursor off
00577 CALL VDCRHR
00578 POP BC
00579 RET
00580
00581 -----
00582 ;VDCLS
00583 ;clear screen below cursor code
00584 ;VDCRHR
00585 VDCLS LD B,18H
00586 SVC #
00587 RET
00588
00589 ;KEYIN
00590
00591

```

Listing 3 continued

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File Name:

Enter name of file to be indexed, or ? for help

Figure 7. The Mindex screen.

program. Do the same for the Model III, but use the file names MINDEX3 and SEARCH3 and set \$ = 5200 (the program's starting location).

To transfer the programs from the Model II to a Model III, you must use the ALTRAN transfer programs supplied with ALDS. On the Model III, Mindex and Search must have the ex-

tension CMD; on the Model II, no extension is necessary.

Using Mindex and Search

After you assemble and link both programs, you're ready to begin indexing and searching. The first requirement is an ASCII text file. You can create the text with Scripsit and convert it to

ASCII file format by using the Scripsit convert utility.

If you don't have Scripsit or some other word processor/text editor, you can create text files by using the editor that comes with Basic. Instead of typing in a line of code, type in a record. You must save text files created with the Basic editor in ASCII format.

Mindex indexes text or data source files. It stores the index in the separate MAP index file. The program segments records longer than 255 characters into blocks of 255 characters and indexes them until it finds a block of characters less than 255 characters long terminating in an end-of-record (EOR) message. The index file that Mindex creates has the same name as your source file (unless you specify otherwise) and the extension MAP.

To run Mindex, type MINDEX and press the enter key. Mindex displays the screen in Fig. 7 and waits for you to enter the file specifications of the source and index files. The syntax is: SOURCE

Listing 3 continued

```

00572          ;routine to input search key
00573          ;entry: HL -> input buffer
00574          ;B = max no. of char
00575          ;exit: HL -> EOR
00576          ;B=no. char, A= EOR
00577  KEYIN  LD  A,1
00578        CALL VDCCHAR
00579        LD  A,17
00580        CALL VDCCHAR
00581        LD  C,8
00582  GETCHR NOP
00583        CALL KWAIT
00584        CP  1
00585        JP  1,ENTAND
00586        CP  2
00587        JP  2,ENTOR
00588        CP  28H
00589        JP  N,CTRL
00590        LD  ALPHA
00591  ENTAND LD  A,C
00592        CP  B
00593        JP  1,GETCHR
00594        INC C
00595        LD  A,'+'
00596        JP  ALPHA5
00597  ENTOR  LD  A,C
00598        CP  B
00599        JP  1,GETCHR
00600        INC C
00601        LD  A,124
00602        JP  ALPHA5
00603        LD  A,253
00604  CNDAND LD  (HL),A
00605        CALL 80H
00606        LD  A,'+'
00607        CALL VDCCHAR
00608        CALL 80FF
00609        INC HL
00610  CNDOR  JP  GETCHR
00611        LD  A,254
00612        LD  (HL),A
00613        CALL 80H
00614        LD  A,124
00615        CALL VDCCHAR
00616        CALL 80FF
00617        INC HL
00618        JP  GETCHR
00619  :
00620  ALPHA  LD  D,A
00621        LD  A,C
00622        CP  B
00623        JP  1,GETCHR
00624        ;loop until CTRL or CMD
00625        ;char ok so process
00626        INC C
00627        LD  A,D
00628        CP  '+'
00629        JP  1,CNDAND
00630        CP  124
00631        JP  1,CNDOR
00632  ALPHA5 LD  (HL),A
00633  ALPHA7 LD  (HL),A
00634        CALL VDCCHAR
00635        JP  GETCHR
00636  CTRL  NOP
00637        CP  80H
00638        JP  1,CTRL8D
00639        CP  88
00640        JP  1,CTRL88
00641        CP  BRKKEY
00642        JP  1,CTRL81
00643        JP  GETCHR
00644  CTRL81 NOP
00645        LD  A,C
00646        CP  B
00647        JP  NE,CTRL82
00648        LD  A,82H
00649        CALL VDCCHAR
00650        LD  A,BRKKEY
00651        LD  B,8
00652        RET
00653  CTRL82 LD  A,BRKKEY
00654  CTRL8D NOP
00655        LD  (HL),A
00656        JP  EREND
00657  CTRL88 NOP
00658        LD  D,A

```

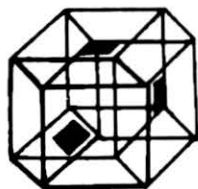
```

00659        LD  A,C
00660        CP  8
00661        JP  1,GETCHR
00662        DEC C
00663        DEC HL
00664        LD  A,88
00665        CALL VDCCHAR
00666        JP  GETCHR
00667  KBEND LD  B,C
00668        PUSH AF
00669        LD  A,2
00670        CALL VDCCHAR
00671        POP AF
00672        RET
00673  :-----
00674  :NON
00675  :-----
00676  NON   LD  A,19H
00677        CALL VDCCHAR
00678        RET
00679  :-----
00680  :HOFF
00681  :-----
00682  HOFF  LD  A,19H
00683        CALL VDCCHAR
00684        RET
00685  :-----
00686  :PRSCR
00687  :-----
00688  PRSCR NOP
00689        LD  BC,8
00690        LD  E,8
00691        PUSH BC
00692  PRSCRNP NOP
00693        LD  HL,PRTBUF
00694        LD  D,88
00695        POP BC
00696        PUSH BC
00697        SVC 11
00698        POP BC
00699        INC B
00700        PUSH BC
00701        LD  HL,PRTBUF
00702        LD  B,88
00703        LD  C,80H
00704        SVC 19
00705        INC E
00706        LD  A,24
00707        CP  E
00708        JP  NZ,PRSCRNP
00709        POP BC
00710        RET
00711  :-----
00712  PRTBUF DEFS 88
00713        DEFB 80H
00714  :-----
00715  :MOVELN
00716  :-----
00717  MOVELN NOP
00718        ;HL->buffer,D=no. char
00719        ;BC=cursor coordinates
00720        SVC 11
00721        RET
00722  :-----
00723  :PRLINE
00724  :-----
00725  :print line
00726  ;HL->buffer,C=ending char
00727  ;B=no. char, C=ending char
00728  PRLINE SVC 19
00729        RET
00730  :-----
00731  :PRTBLN
00732  :-----
00733  :print penultimate line
00734  PRTBLN PUSH BC
00735        PUSH DE
00736        PUSH HL
00737        LD  B,PENULN
00738        LD  C,8
00739        LD  D,88
00740        LD  HL,PRTBUF
00741        CALL MOVELN
00742  :
00743        LD  HL,PRTBUF
00744        LD  B,88
00745        LD  C,80H
00746        CALL PRLINE

```

Listing 3 continued

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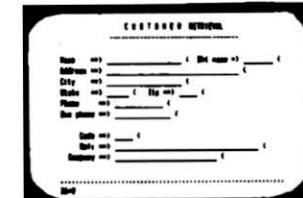
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Figure 8. Initial Search screen.

FILE,INDEX FILE;OPTIONS.

You can also enter the file specifications and options on the TRSDOS command line (MINDEX REF:0,:1;P). Only the source file specification is necessary; the program assigns the index file the same name, password, and disk drive as the source file unless you specify otherwise.

For example, typing REF/TXT.SECRET:1 and pressing the enter key opens the source file "REF/TXT.SECRET:1" and creates the index file "REF/MAP.SECRET:1", while typing REF/TXT.SECRET:1,.CODEWORD:2 and pressing the enter key opens the source file "FILE1/TXT.SECRET:1" and creates the index file "FILE1/MAP.CODEWORD:2".

In this case the index file has a different password from the source file and is on drive 2 rather than drive 1. You don't need to specify the disk drive for your source file unless you have two files with the same specification on two separate drives. The program places the index file on the same disk as the source file unless you specify another drive.

Indicate the paragraph format option by appending a semicolon and the letter P to the file specifications. In the paragraph format, the program treats each sentence as a string. You should use the paragraph format for text files composed of sentences arranged in paragraphs and that don't have an EOR at the end of each line or sentence.

MAP uses the period as a pseudo EOR and treats each sentence as a record. If you don't specify the indexing format, the program defaults to the record format. Typing TEXTFILE,:1;P and pressing the enter key opens the source file TEXTFILE from whatever drive it's on, creates the index file TEXTFILE/MAP on drive 1, and indexes the source file in paragraph format.

Minindex displays the name, extension, password, and drive of the source and

data files, indicates that it's opened each file successfully (or gives a self-explanatory error message), and begins indexing. The program displays the number of the source file sector it indexes.

When the program finishes indexing, it saves the index file on disk and returns you to TRSDOS. You don't need to re-index the source file unless you modify the file or you delete the index file from the disk.

To run Search, type SEARCH and press the enter key. The screen in Fig. 8 appears. Type in the name of the file you want to search. Alternatively, you can enter the file specifications on the TRSDOS command line (SEARCH REF:1). The complete syntax is SOURCE FILE, INDEX FILE, OUTPUT FILE.

It's only necessary to type in the name of the source file. The program assigns the same specification to the index file (except for the extension MAP) and output file (except for the extension OUT) unless you specify otherwise.

For example, typing TESTFILE/TXT assigns the specification TESTFILE/MAP to the index file and TESTFILE/OUT to the output file. The MAP index file contains the source file name, extension, and password so you don't have to type in that information.

The appropriate files will open, the index will load into memory, and you can begin your search. If an error occurs in opening the files, the program informs you of the type of error so you can correct it.

After Search opens the MAP index file and its associated source file, the name of the source file appears at the top of the screen. The blinking cursor on the second line under the letter E is a prompt for you to enter the key or keys you want to locate. Type the key(s) you're searching for and tap the enter key.

Each key must be three or more char-


```

00747      LD      B,PENULN
00748      LD      C,0
00749      CALL   POSCUR      ;reposition cursor to next to last line
00751      POP    DE
00752      POP    BC
00753      RET
00754
-----
00756      ;PRTREC
00757      ;print record from screen
00758
PRTREC LD      C,0
00759      LD      A,(SORLN)
00761      CP      4
00762      JP      Z,PTR2
00763      LD      A,(SORLN)
00764      DEC    A
00765      LD      B,A
00766      LD      HL,PRTBUF
00767      LD      D,00
00768      PUSH   BC
00769      SVC    11          ;move screen line to buffer
00770      LD      HL,PRTBUF
00771      LD      B,00
00772      LD      C,0DH
00773      SVC    19          ;PRLINE
00774      POP    BC
00775      LD      A,22
00776      CP      B          ;has last line been reached?
00777      JP      Z,PTR5
00778      JP      M,PTR5
00779      INC    B
00780      JP      PTRLPL
00781      PTR5  RET
-----
00782      ;JPDOS
00783      ;jp to TRSDOS
00784
00785      JPDOS  SVC    36    ;jp to TRSDOS without cmd
00786
-----
00788      ;DOSCMD
00789      ;jp to TRSDOS with cmd
00790      ;execute CMD file then DOS
00791      ;HL->name of CMD file
00792
DOSCMD PUSH   HL
00793      LD      B,0
00794      LD      A,(HL)
00795      CP      0DH
00796      JP      Z,DOSEXC
00797      INC    HL
00798      INC    B
00799      JP      DOSLPL
00800      DOSEXC POP    HL
00801      SVC    37          ;exc prog, then DOS
00802      DOSLPL NOP
00803      JP      DOSLPL    ;just in case
00804
-----
00806      ;DISBRK
00807      ;disable break
00808      LD      HL,0
00809      LD      HL,DSBRK
00810      LD      HL,DSBRK
00811      SVC    3          ;whenever break is pressed
00812      RET              ;program will jp to DSBRK
00813
-----
00815      ;DSBRK
00816      ;break routine
00817      DSBRK  PUSH   AF
00818      LD      A,'Y'
00819      LD      A,(BREAK),A
00820      POP    AF
00821      RET
00822      BREAK  DEFB  'N'  ;break = Y, no break = N
00823
-----
00824      ;DIVIDE
00825      ;divide A into HL
00826
DIVIDE PUSH   BC
00827      LD      B,1
00828      LD      C,A
00829      SVC    23
00830      LD      A,C
00831      POP    BC
00832      RET
-----
00833      ;MULT
00834
00835      MULT  PUSH   BC
00836      LD      B,0
00837      LD      C,A
00838      LD      D,23
00839      LD      A,C
00840      POP    BC
00841      RET
00842
-----
00844      ;PTFS
00845      ;point to file spec
00846      ;bypass char count
00847      ;bypass cmd
00848      ;bypass trailing blanks
00849      ;BL -> first char of file spec
00850
PTFS  INC      HL,EATBNK
00851      CALL   EATBNK
00852      RET
-----
00853      ;ERRDSP
00854      ;error dsp for Mod II TRSDOS
00855
ERRDSP NOP
00856      PUSH   BC
00857      LD      B,A
00858      LD      HL,MSGAREA
00859      SVC    52
00860      LD      HL,MSGAREA
00861      CALL   VDLINE
00862      POP    BC
00863      RET
00864      MSGAREA DEFB  00  ;error message area
00865      DEFB  03
00866
-----
00867      ;STREND
00868      ;store end of memory
00869      ;must be called before DE changed!!!!
00870      ;stores top address of mem available
00871
MEMEND LD      (MEMEND),DE
00872      RET
-----
00873      INDCB  DEFB  0  ;input (source) file DCB
00874      INDC1  DEFB  0
00875      DEFB  0
00876      DEFB  0
00877      INCBRL DEFB  0  ;record length
00878      DEFB  0
00879      DEFB  0
00880      INDCBR DEFB  0  ;current record
00881      DEFB  0
00882      DEFB  0
00883      INDCBL DEFB  0  ;last record
00884      DEFB  0
00885      INCBOS DEFB  0
00886      DEFB  50
00887      INLLR  DEFB  0  ;true last sector
00888
-----
00889      MAPDCB DEFB  0  ;MAP file DCB
00890      MDCB1  DEFB  0
00891      DEFB  0
00892      DEFB  0
00893      WDCBRL DEFB  0  ;record length
00894      DEFB  0
00895      DEFB  0

```

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acters long, and no key or combination of keys can be longer than 60 characters. Search ignores capitalized letters and lets you search for partial keys. For example, the key "cdonal" locates records containing the names McDonald and MacDonald.

You can search for combinations of keys within records or sentences. You find combinations by using the logical operators AND or OR. AND is represented by the + symbol (hold the shift key and press +). OR is represented by the | symbol (hold the control key and press zero on the Model II; hold the shift key and press @ on the Model III).

On the Model II the operators + and | appear in inverse video to distinguish them from characters in a key. On the Model III a small, solid white rectangle appears under the operator to indicate that it isn't a character in a key. For example, the search key Jack + Jill|Jack +

"You can search for combinations of keys within records or sentences."

nimble finds records that contain the names Jack and Jill or records containing the name Jack and the word nimble.

On the Model II, enter the + character as part of a key by pressing F1 and enter the | character as part of a key by pressing F2. On the Model III the @ key enters special characters from the keyboard.

If the key you're searching for has the symbol + or |, you can enter it in the following manner: press the @ key (unshifted) and the cursor becomes larger. Then enter either + or |. You enter

the @ character into a key in the same manner.

After you enter a valid key, the program starts its search and the message "Searching" appears in the upper left corner of the screen. The number of each sector searched appears next to the word Searching.

When the program locates the first record in the file with the appropriate key (or keys), it displays the record at the bottom of the screen. One record appears at a time and the program waits for your instructions to continue the search, abort the search, or display text around the located record.

To continue the search, press the down-arrow key after each line of text appears. Pressing and holding the down-arrow key (and the repeat key on the Model II) lets you continuously scroll through records as the program finds them. When the program has

Listing 3 continued

```

00096 NDCBCR DEFB 0 ;current record
00097 DEFB 0
00098 DEFB 0
00099 NDCBLR DEFB 0 ;last record
00100 DEFB 0
00101 NDCBOS DEFB 0
00102 MAPLLR DEFB 50
00103 MAPLLR DEFB 0 ;true last sector
00104
00105 OUTDCB DEFB 68 ;output file DCB
00106
00107 SORLNL DEFB 0 ;start of record line number
00108 ;for each line of rec displayed
00109 ;(SORLNL) is decremented
-----
00110
00111 STNAP DEFB 0
00112 END

```

Program Listing 6. Assembly-language listing of MODIII/SRC.

```

Ln # Source Line
00001 ;MODIII/SRC VERSION 1.2
00002 ;Jun 26, 1983
-----
00004 ;MAP MODEL III I/O ROUTINES, BUFFERS AND PARAMETERS
00005 ;COPYRIGHT 1983, SOFTWARE CORPORATION ALL RIGHTS RESERVED
00006
00007 MODIII PSECT ;begin relocatable program section
00008
00009 ;public routines
00010
00011 PUBLIC BOTTOM ;position cursor to last line of screen
00012 PUBLIC CLOSE ;close file (DE-DCB)
00013 PUBLIC CURPOS ;determine cursor pos (coor:BC)
00014 PUBLIC DISBRK ;disable break (for Model II)
00015 PUBLIC DIVIDE ;divide A into HL
00016 PUBLIC DORSND ;public DORSND and execute command
00017 PUBLIC ERASEL ;erase to end of line
00018 PUBLIC ERASES ;erase to end of screen
00019 PUBLIC ERDRSP ;MAP error display routine
00020 PUBLIC HOME ;position cursor to top line of screen
00021 PUBLIC INIT ;initialize file (create/open, pos to last rec)
00022 ; (DE->DCB, HL->rec buf)
00023
00024 PUBLIC JF2DOS ;jp to TRSDOS
00025 PUBLIC KBCBAR ;set char (or null) from keyboard
00026 PUBLIC KBINIT ;initialize keyboard (Mod II)
00027 PUBLIC KBLIN3 ;get line from keyboard and end with #3
00028 PUBLIC KBLINE ;get line from keyboard and end with #0H
00029 PUBLIC KBWAIT ;wait for char from keyboard
00030 PUBLIC KEYIN ;get search key(s) from keyboard
00031 PUBLIC NOVELN ;move line from screen to buffer
00032 ;HL->buf, B=no. char, BC=cursor coor
00033 PUBLIC MULT ;multiply routine
00034 PUBLIC NEMLN ;role screen and pos cur to next to last line
00035 PUBLIC OPEN ;open file (DE->DCB, HL->record buffer)
00036 PUBLIC OPENI ;open and initialize file
00037 ; (DE->DCB, HL->record buffer)
00038 PUBLIC POSCUR ;position cursor (coordinates in BC)
00039 PUBLIC POSROW ;position to end of file
00040 PUBLIC POSH ;position to record in file
00041 PUBLIC PRINT ;initialize printer
00042 PUBLIC PRLINE ;print line (HL->buf, B=no. char, C=end char)
00043 PUBLIC PRSCR ;print entire screen
00044 PUBLIC PRTRLN ;print last line of text
00045 PUBLIC PRTRC ;print current record
00046 PUBLIC PTF5 ;point to file spec in cmd line
00047 PUBLIC READER ;read file: direct access
00048 PUBLIC READLN ;read next record in file
00049 PUBLIC SCRFRO ;set scroll protect line (A=line no.)
00050 PUBLIC SETLH ;set INHRR to true last record
00051 PUBLIC SETLRL ;set MAPLLR to true last record
00052 PUBLIC STREND ;store top of memory in MEMEND
00053 PUBLIC VDCBAR ;display char in A register
00054 PUBLIC VDCLS ;clear screen
00055 PUBLIC VDMIT ;initialize video I/O (for Model II)
00056 PUBLIC VDLIN3 ;display line (HL->msg; don't print #0H)
00057 PUBLIC VDLINE ;display line (HL->msg)
00058 PUBLIC WPKBMT ;word processor kbwait routine
00059 PUBLIC WRITE ;direct write routine
00060 PUBLIC WRITK ;write next record to file
-----
00061
00062 ;MODIII buffers
00063
00064 PUBLIC ACCESS ;dummy for MODII compatibility
00065 PUBLIC INDCB ;input (source) file DCB
00066 PUBLIC INDCBL ;input file DCB Record Length
00067 PUBLIC INDCBCL ;input file DCB Current Record
00068 PUBLIC INDCBLR ;input file DCB Last Record
00069 PUBLIC INDCBOS ;true last record of source file
00070 PUBLIC INDCBOSL ;input file DCB xxxxxxx
00071 PUBLIC INDCBOSR ;MAP (index) file DCB
00072 PUBLIC INDCBRL ;Map file DCB Record Length
00073 PUBLIC INDCBRLR ;Map file DCB Current Record
00074 PUBLIC INDCBRLS ;Map file DCB Last Record
00075 PUBLIC INDCBRLR ;true last record of index file
00076 PUBLIC INDCBOSL ;Map file DCB xxxxxxx
00077 PUBLIC INDCBOSR ;contents -> top of memory
00078 PUBLIC INDCBOSL ;record buffer (1 byte) for output file
00079 PUBLIC INDCBOSR ;output file DCB
00080 PUBLIC INDCBOSL ;printer buffer (80 char)
00081 PUBLIC INDCBOSR ;start of record line no.
00082 PUBLIC INDCBOSL ;start of MAP index file (always last byte
00083 ; of SEARCH program)
-----
00084
00085 ;MODIII I/O para
00086
00087 PUBLIC ARROWD ;arrow down
00088 PUBLIC ARROWL ;arrow left
00089 PUBLIC ARROWR ;arrow right
00090 PUBLIC ARROWU ;arrow up

```

Listing 6 continued

Program Listing 4. Assembly-language listing of Mindex3/SRC.

```

Ln # Source Line
00001 ;MINDX3/SRC...1.2
00002 ;Mar 85, 1983
-----
00004 ;MINDX INDEXING PROGRAM FOR MODEL III
00005 ;MASTER SECTION: links main program with Model III I/O routines
00006 ;and general purpose routines
00007 ;COPYRIGHT 1983, SOFTWARE CORPORATION ALL RIGHTS RESERVED
00008
00009 PROGII PSECT ;begin relocatable program section
00010
00011 EXTERN BEGIN ;BEGIN = start of M3
00012 START JP BEGIN
00013 LINK 'M3/REL' ;main program
00014 ;note: the program is called M3 because it
00015 ;was originally developed on Model III
00016 ;in its current form it will work with
00017 ;Model II or III given the proper I/O
00018 ;module
00019 LINK 'GR/REL' ;general programs
00020 LINK 'MODIII/REL' ;Model III I/O routines
00021 END START

```

Program Listing 5. Assembly-language listing of Search3/SRC:1.

```

Ln # Source Line
00001 ;SEARCH3/SRC...1.2
00002 ;Mar 85, 1983
-----
00004 ;SEARCH PROGRAM FOR MODEL III
00005 ;MASTER SECTION: links S3, GR, S3OPEN, S3DSP, S3OPT and MODIII
00006 ;COPYRIGHT 1983, SOFTWARE CORPORATION ALL RIGHTS RESERVED
00007
00008 PROGII PSECT ;begin relocatable program section
00009
00010 EXTERN BEGIN ;BEGIN = start of S3
00011 START JP BEGIN
00012 LINK 'S3/REL' ;SEARCH program proper
00013 ;note: the program is called
00014 ;S3 because it was originally
00015 ;developed on the Model III
00016 ;in its current form it will
00017 ;work with Model II or III
00018 ;given the proper I/O module
00019 LINK 'GR/REL' ;general routines
00020 LINK 'S3OPEN/REL' ;SEARCH open files routine
00021 LINK 'S3DSP/REL' ;SEARCH display
00022 LINK 'S3OPT/REL' ;SEARCH options
00023 LINK 'MODIII/REL' ;Model III I/O routines
00024 END START

```

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(C)hange File, (M)AP, (O)ptions or (T)RSDOS

```
xxxxxxx Format
Inset from Left Margin:      x
Search Display Mode: (C/R/L) x
Print Mode: (C/M)           x
Output File Name:           xxxxxxx/OUT
Output File Status: (C/R/A) x
Output Mode: (C/M)         x
```

Figure 9. Search options screen.

searched the entire file, the message "Enter Key" appears again. You can now search for another key or combination of keys.

Search Options and Commands

While the "Enter Key" message is present and the cursor is in column 1,

you can jump to the Search minimenu by pressing the break key. The following message appears on the top line: "(C)hange File, (M)AP, (O)ptions or (T)RSDOS".

Typing O gives you the Options screen shown in Fig. 9. You can bypass any question in the options menu by

pressing the enter key. The program displays the meaning of abbreviations used in the current prompt at the bottom of the screen.

The first line informs you of the format used to index the file and you can't change it while searching a file.

The inset number (X) ranges from zero to 9. Insetting is similar to indenting except that the first line of a record is flush with the left margin, and subsequent lines are inset from the left margin. The number displayed across from the word inset is the value currently used to inset records. You can change it by typing any number from zero to nine and then pressing the enter key. The default inset is two.

While searching for a key or combination of keys, you can display the information continuously, or a record or line at a time. Type C and press the enter key to have records continuously displayed as the program finds them. Type R and press the enter key for

Listing 6 continued.

```
00090 PUBLIC BKKEY      ;break key
00091 PUBLIC BSKEY     ;back space key
00092 PUBLIC CYPPOS    ;copyright msg position
00093 PUBLIC DELETE    ;delete key
00094 PUBLIC DPTFS     ;default file size
00095 PUBLIC INKEY     ;insert key
00096 PUBLIC LBYTTE   ;col of last byte in 255 byte rec
00097 PUBLIC PENULN   ;penultimate line (next to bottom)
00098 PUBLIC SWIDTH   ;screen width
00099 PUBLIC SWM1     ;screen width minus 1
00100 PUBLIC TOPLN    ;top line of editor screen
-----
00102 ;external routines and buffers
00103 ;referenced by MODII
-----
00104
00105 EXTERN ANSWER    ;general purpose 1 byte buffer
00106 EXTERN APPEND    ;append one string to another
00107 EXTERN EATBHK   ;bypass leading blanks
00108 EXTERN EATBNK   ;bypass leading non-blank char
-----
00109 ;
00110 ;Model III equates
00111
00112 ARROWD EQU 0AH   ;arrow down
00113 ARROWL EQU 08H   ;arrow left
00114 ARROWR EQU 09H   ;arrow right
00115 ARROWU EQU 0BH   ;arrow up
00116 BKKEY EQU 1     ;BREAK
00117 SWIDTH EQU 64   ;screen width
00118 SWM1 EQU 63    ;screen width minus 1
00119 TOPLN EQU 11   ;top line of edit display
00120 LBYTTE EQU 62   ;last col of record byte 255
00121 PENULN EQU 14  ;penultimate line (next to last line)
00122 DPTFS EQU 400  ;default 3by5 data file size
00123 DELKEY EQU 4   ;delete key (shift, down arrow, D)
00124 INKEY EQU 1FH  ;insert key (CLEAR)
00125 BSKEY EQU 2   ;backsp key (shift, down arrow, B)
00126 CYPPOS EQU 36 ;tab pos for copyright notice
00127 ;
00128 KBWAIT EQU 0049H
00129 EBCHAR EQU 0028H
00130 VDCBAR EQU 0033H
00131 VDCLS EQU 01C9H
00132 INITIO EQU 0069H
00133 PRCHAR EQU 003BH ;print char
00134 PRSCR EQU 01D5H ;print screen
00135 DINIT EQU 4420H ;initialise file
00136 DOPEN EQU 4424H ;open file
00137 DPOSH EQU 4442H ;position to rec in file
00138 DREAD EQU 4436H ;direct read
00139 DWRITE EQU 4438H ;direct write
00140 DBSPC EQU 4445H ;TRSDOS backspace routine
00141 DPEOF EQU 4448H ;position to EOF
00142 DCLOSE EQU 4428H ;close file
00143 JF2DOS EQU 4020H
00144 CONDOS EQU 429CH
00145 CHDXTX EQU 4225H
00146 ;
00147 DELAY EQU 0060H
00148 CURSOR EQU 4020H ;cursor is at this position
00149 CURCHR EQU 4023H ;cursor character
00150 CURBLK EQU 401CH ;# = blink, non# = no blink
00151 VIDEO EQU 3C00H ;start of video memory map
00152 DCBPR EQU 4214H ;scroll protect
00153 DERDSP EQU 4409H ;TRSDOS error display routine
00154 DIVIDE EQU 4451H ;TRSDOS divide routine
00155 DMULT EQU 444EH ;TRSDOS multiple routine
00156 EORSH EQU 4411H ;end of memory
-----
00157 ;
00158 ;HOME
00159 ;pos cursor to r1:c1
00160 ;reg altered: HL
00161 HOME LD HL,VIDEO
00162 LD (CURSOR),HL
00163 RET
00164
00165 ;BOTTOM
00166 ;pos cursor to bottom line, col 1
00167 ;reg altered: HL
00168 BOTTOM LD HL,VIDEO+3C0H
00169 LD (CURSOR),HL
00170 RET
00171
00172 ;NEMLN
00173 NEMLN PUSH BC
00174 ;rolls screen and positions
```

```
00177 PUSH DE ;cursor to next to last line
00178 PUSH HL
00179 CALL BOTTOM ;position to bottom line
00180 LD A,8DH
00181 CALL VDCBAR ;roll screen
00182 LD BC,256*14
00183 CALL POSCUR ;position to next to last line
00184 LD A,(SORLN)
00185 CP J,(SORLN) ;has first line reached top of screen?
00186 JP Z,NEMLN5 ;if it has do not dec (SORLN)
00187 LD A,(SORLN)
00188 DEC A ;dec (SORLN)
00189 LD (SORLN),A
00190 NEMLN5 POP HL
00191 POP DE
00192 POP BC
00193 RET
-----
00194 ;CURPOS
00195 ;set cursor position
00196 ;exit B=row-1, C=col-1
00197 ;reg altered: AF,BC
00198 CURPOS PUSH DE
00199 PUSH HL
00200 LD BC,0
00201 LD HL,(CURSOR)
00202 LD DE,VIDEO
00203 OR A
00204 SBC HL,DE
00205 JP Z,CUR8
00206 CURLP PUSH HL
00207 LD DE,64
00208 OR A
00209 SBC HL,DE
00210 JP Z,CUR5
00211 JP C,CUR6
00212 CUR5 INC B
00213 POP DE
00214 JP CURLP
00215 CUR6 POP DE
00216 POP BC
00217 CUR8 POP HL
00218 INC B
00219 JP CUR8
00220 CUR5 POP HL
00221 LD C,L
00222 POP HL
00223 POP DE
00224 PUSH BC
00225 POP HL
00226 RET
-----
00227 ;POSCUR
00228 ;position cursor
00229 ;entry: B=row-1, C=col-1
00230 POSCUR PUSH DE
00231 LD A,15 ;bottom line
00232 CP B ;exit if B > bottom line
00233 LD A,63 ;last col on screen
00234 CP C
00235 JP C,POSH ;exit if C > last col
00236 LD HL,VIDEO ;HL=HL+64 (repeat as needed)
00237 LD B,0
00238 POSLP LD C,POSH
00239 LD DE,64
00240 LD A,B
00241 CP B
00242 LD Z,POSH
00243 LD DE,64
00244 LD HL,DE
00245 ADD B,HL
00246 DEC B
00247 JP POBSP ;loop until B=#
00248 POS5 LD E,C ;now set col value
00249 LD D,B
00250 ADD HL,DE
00251 LD (CURSOR),HL ;store new value in CURSOR
00252 POP HL
00253 POP DE
00254 RET
-----
00255 ;KBINIT
00256 ;no MODII equivalent
00257 KBINIT RET
00258 ;OPEN
00259 ;open file
00260 ;entry: HL->buffer
00261 ; DE->DCB
```

Listing 6 continued

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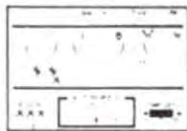


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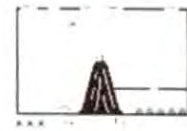


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Listing 6 continued

```

00265 ;exit: A=TRSDOS error code
00266 OPEN CALL DOPEN
00267 PUSH AF
00268 LD A,8
00269 LD (IDCBRL),A ;RL=256
00270 LD A,32
00271 LD (IDCB1),A ;RL=256??
00272 POP AF
00273 RET
-----
00275 ;IRIT
00276 ;initialize file
00277 ;DE->DCB
00278 INIT CALL DINIT
00279 RET
-----
00281 ;OPINIT
00282 ;open file if present, else init file
00283 ;entry: HL->buffer
00284 ; DE->DCB
00285 ;exit: A=TRSDOS error code
00286 OPINIT PUSH BC
00287 PUSH DE
00288 CALL DOPEN
00289 ;try to open file first
00290 ;keeps present record no.
00291 JP 2,OPIT4
00292 POP HL
00293 POP DE
00294 POP BC
00295 CALL DINIT ;sets last rec no. = 8
00296 RET
00297 OPIT4 POP HL ;open attempt successful
00298 POP DE
00299 POP BC
00300 RET
00301 OUTCHR DEFB 8 ;output record buffer for Mod II
00302 ;
00303 ;CLOSE
00304 ;close file
00305 ;entry: DE->DCB
00306 CLOSE CALL DCLOSE
00307 RET
-----
00309 ;SETMLR
00310 ;set MAPLLR to true last rec
00311 ;MODIII adjustment
00312 LD HL,(MDCBLR)
00313 DEC HL
00314 LD (MAPLLR),HL
00315 RET
-----
00316 ;SETILR
00317 ;set INLLR to true last record
00318 LD HL,(IDCBLR)
00319 LD A,(IDCBOS)
00320 CP 8
00321 JP NZ,SETI4
00322 DEC HL ;file ends at end of sector
00323 ;therefore on Mod III, must dec (IDCBLR)
00324 ;for true last record no.
00325 LD (INLLR),HL
00326 RET
-----
00327 ;POSN
00328 ;position to rec in file
00329 ;entry: DE->DCB
00330 ; BC=rec no.
00331 ;exit: A=TRSDOS error code
00332 POSN CALL DPOSN
00333 RET

```

```

00335 ;position to rec in file
00336 ;entry: DE->DCB
00337 ; BC=rec no.
00338 ;exit: A=TRSDOS error code
00339 POSN CALL DPOSN
00340 RET
-----
00342 ;POSEOF
00343 ;position to end of file
00344 ;entry: DE->DCB
00345 ;exit: TRSDOS error code
00346 POEOF CALL DPOSEOF
00347 DREAD
00348 RET
-----
00351 ;READDR
00352 ;direct read
00353 ;entry: DE->DCB
00354 ; BC=rec. no.
00355 ;exit: A=TRSDOS error msg
00356 READDR PUSH BC
00357 CALL DREAD
00358 JP NZ,RDDR5
00359 CALL DREAD
00360 POP BC
00361 POP AF
00362 CALL DPOSN
00363 ;position to rec BC
00364 ;JP if error
00365 ;direct read
00366 ;temp store any error msg code
00367 ;reposition to rec=BC
00368 ;needed for Model II compatibility
00369 POP AF
00370 POP BC
00371 RET
-----
00372 ;READNX
00373 ;read next record
00374 ;entry: DE->DCB
00375 ;exit: A=TRSDOS error code
00376 READNX CALL DREAD
00377 RET
-----
00378 ;WRITE
00379 ;direct write
00380 ;entry: DE->DCB
00381 ; BC=rec. no.
00382 WRITE PUSH BC
00383 PUSH DE
00384 CALL DPOSN
00385 ;position to record
00386 POP DE
00387 PUSH DE
00388 CALL DWRITE
00389 ;write
00390 POP DE
00391 POP BC
00392 CALL DPOSN
00393 ;reposition to BC
00394 RET
-----
00394 ;WRITNX
00395 ;sequential write
00396 ;entry: DE->DCB
00397 ;exit: A=TRSDOS error code
00398 WRITNX CALL DWRITE
00399 RET
-----
00401 ;WPRBWT
00402 ;word processing KWAIT routine
00403 ;cursor alternates with character
00404 WPRBWT
00405

```

Listing 6 continued

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record scroll.

As it locates and displays each record containing the keys, the program waits for your instruction to continue, abort the search, print the record, or output the record to another disk file. Type L and press the enter key for line scroll to have Search pause after displaying each line. The default search display mode is record scroll.

You can print records found during a search continuously or manually. Type C and press the enter key to have each line printed as it appears on the screen. Type M and press the enter key to let you selectively print records or lines of text as they appear on the screen. The Search Display Mode determines whether a line or the entire record is printed. The default print mode is manual.

The output file name is the name of the file to which you want to transfer records. Enter the file name using standard TRSDOS notation to designate the name, extension, disk drive, and password. If you don't specify an output file name, the output file has the same specifications as the source file except for the extension OUT.

You can close, reset, or open the out-

put file. Type C and press the enter key to close an output file. Type R and press the enter key to reset the output file to the first sector. If the file is closed, this opens the file and sets it to the first sector.

Type A and press the enter key to append additional records to a file. The program retains previously written records. If the program finds the file closed, it opens it and sets the file pointer to the end-of-file marker. Using append on a newly created file is equivalent to resetting the file. The default output file status is closed.

You can write records found during a search to the output file continuously or manually. Type C and press the enter key to have each record written to the file as it's found. Type M and press the enter key to manually select records to be written to the output file. The default output file mode is manual.

While searching you might wish to display the text around a particular record. Tap L to call the list routine. A dotted line indicates that you changed from the search to the list mode. The message on the top line reads "Listing XXXXX", where XXXXX is the sector number. In the list mode, the program

sets the inset to zero while word wrap-around remains in effect.

Press the down-arrow key to display a line at a time. If you hold the down-arrow key (and the repeat key on the Model II), the file scrolls forward.

To backspace through the source file, press the up-arrow key and the text jumps back three sectors. The message "**Backspace Three Sectors*" appears. You can backspace to the beginning of the file in this manner.

While listing, you can continue your search where you left off by pressing the S key. A dotted line indicates that you've changed from listing to searching the source file. The message on the top line of the screen reads "Searching XXXXX".

You can write records found during searching or listing to a separate output file. Three of the options deal with the output file.

The default output file specification is the same as the index file but has the extension OUT. If you don't want to change the name, tap the enter key in response to the Output File Name prompt.

Typing R and pressing the enter key opens the output file and sets the output

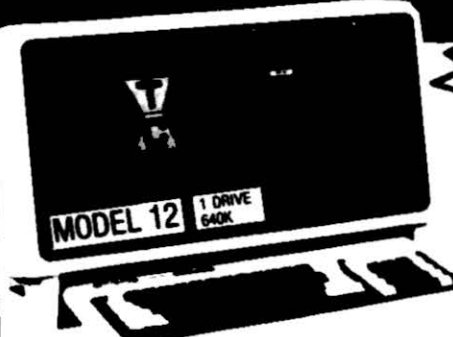
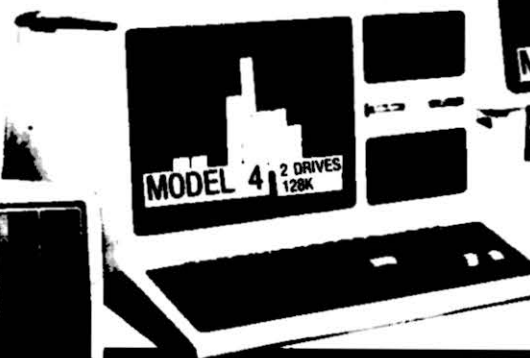
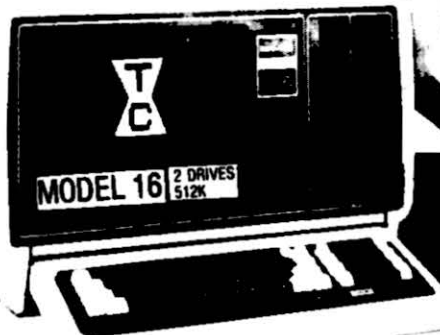
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file pointer to the first record. Typing A and pressing the enter key opens the output file and sets the file pointer to the end of the file so that you can append records to the file.

To close an open file, type C and press the enter key in response to the prompt. If the file is already closed, the program ignores the command. To bypass the output file status prompt, press the enter key and the status won't change.

You can write records to the output file as they appear by typing C and

pressing the enter key in response to the output mode prompt. Alternatively, you can select which records you want to copy to the output file by typing M and pressing the enter key in response to the output mode prompt.

As each record appears, you can copy it to the output file by pressing O before going on to the next record. Records are written to the output file in the same format they have in the source file.

With MAP, you can edit or index and search the output file. At the end of the search, either close the file (using the

options menu) or exit from the search program (the output file is closed whenever you exit Search).

You can print the entire contents of the screen by pressing W any time the program searches or lists lines of the source file on the screen. If the Search Display mode is set for record display, you can print the last record displayed any time while searching by pressing P.

If the Search Display mode is set for line display, you can print the display's bottom line at any time while searching by pressing the P key. If you do so and

Listing 6 continued

```

00406 WPKBWT PUSH BC ;BC used as counter
00407 LD A,1
00408 LD (CURBLK),A ;non blinking cursor
00409 LD A,141
00410 LD (CURCHR),A ;large cursor over character
00411 WPKB3 LD BC,48H
00412 LD A,8EH ;cursor on
00413 CALL VDCCHAR
00414 WPKB6 CALL KBCHAR
00415 CP B
00416 JP NZ,WPKB20 ;jp if char entered
00417 DEC BC
00418 LD A,B
00419 OR C
00420 CP B
00421 JP NZ,WPKB6
00422 ..... ;cursor off
00423 LD A,8FH
00424 CALL VDCCHAR
00425 LD BC,50H
00426 WPKB12 CALL KBCHAR
00427 CP B
00428 JP NZ,WPKB20 ;jp if char entered
00429 DEC BC
00430 LD A,B
00431 OR C
00432 CP B
00433 JP NZ,WPKB12
00434 WPKB3 JP WPKB3
00435 WPKB20 PUSH AF
00437 LD A,8FH
00438 CALL VDCCHAR
00439 LD A,8
00440 LD (CURBLK),A ;blinking cursor
00441 LD A,176
00442 LD (CURCHR),A
00443 POP AF
00444 POP BC
00445 RET
00446 .....
00447 ;KBLIN3 and KBLINE
00448 KBLIN3 NOP
00449 LD A,83
00450 JR KBL83
00451 KBLINE NOP
00452 ;entry: HL->buf, B= max length
00453 ;exit: B=length not including EOR char
00454 ;EOR=8DH or 83
00455 ;returns with last char entered in A
00456 KBL83 LD A,8DH
00457 LD (EORCHR),A
00458 LD A,8EH
00459 CALL VDCCHAR ;cursor on
00460 LD C,8
00461 KBL85 CALL KBWAIT
00462 LD D,A
00463 ;key entered
00464 ;enter?
00465 CP B
00466 JP Z,KBL8DH
00467 CP B
00468 ;backspace?
00469 JP Z,KBL8SP
00470 CP B
00471 ;break?
00472 JP Z,BRKKEY
00473 CP B
00474 ;' '?
00475 JP Z,KBL85
00476 ;jp if control char
00477 LD A,B
00478 CP C
00479 ;have max char's been entered?
00480 JP Z,KBL85
00481 LD A,D
00482 ;reload since A used for calc
00483 LD (BL),A
00484 ;store in buf
00485 INC C
00486 ;inc char count
00487 HL
00488 CALL VDCCHAR ;display char
00489 JP KBL85 ;loop until EOR
00490 KBL8SP NOP
00491 LD A,9
00492 CP C
00493 ;do nothing if start of buf
00494 LD A,8
00495 CALL VDCCHAR ;backspace
00496 HL
00497 ;dec buf pointer
00498 DEC C
00499 ;dec char count
00500 JP KBL85
00501 KBRK LD A,(EORCHR) ;break key entered
00502 LD (HL),A
00503 CALL VDCCHAR
00504 LD A,BRKKEY
00505 LD (EORCHR),A
00506 KBL8DI NOP
00507 ;place EOR (83 or 8DH)
00508 LD A,(EORCHR)
00509 LD (HL),A
00510 ;display EOR VOID VOID VOID VOID VOID
00511 KBL8DI INC HL ;HL->byte past EOR
00512 LD A,8FH
00513 CALL VDCCHAR ;cursor off
00514 LD A,(EORCHR)
00515 LD B,C
00516 RET
00517 EORCHR DEFB 8DH ;EOR character
00518 .....
00519 ;PRINT
00520 PRINT RET ;PRINT
00521 ;initialize printer (MOD II only)
00522 .....
00523 ;SCRPRO
00524 LD (DSCRPR),A
00525 SCRPRO RET ;scroll protect
00526 .....
00527 ;ERASES
00528 ERASES LD A,1FH ;erase to end of screen

```

```

00521 CALL VDCCHAR
00522 RET
00523 .....
00524 ;ERASEL
00525 ERASEL LD A,1EH
00526 ;erase to end of line
00527 CALL VDCCHAR
00528 LD A,1EH
00529 RET
00530 .....
00531 ;VDINIT
00532 VDINIT LD A,8
00533 ;clear screen and initialize
00534 CALL SCRPRO
00535 CALL ERASES
00536 RET
00537 .....
00538 ;VDLINE
00539 VDLINE NOP ;display line
00540 ;entry: HL->string
00541 ;8DH or 83 stop display
00542 ;exit: HL->next char
00543 ;get char
00544 VDL85 LD A,(HL)
00545 CP B
00546 ;EOR?
00547 JR Z,VDL12
00548 CP B
00549 ;EOR?
00550 JR Z,VDL12
00551 CALL VDCCHAR ;display char
00552 HL
00553 VDL85 ;loop until EOR
00554 VDL12 CALL VDCCHAR ;display EOR char
00555 ;-> next char
00556 RET
00557 .....
00558 ;VDLIN3
00559 VDLIN3 NOP ;display line, but not 8DH
00560 ;entry: HL->string
00561 ;8DH or 83 stop display
00562 ;DOES NOT PRINT 8DH!
00563 ;exit: HL->next char
00564 VDL385 LD A,(HL)
00565 CP B
00566 ;EOR?
00567 JR Z,VDL312
00568 CP B
00569 ;EOR?
00570 JR Z,VDL312
00571 CALL VDCCHAR ;display char
00572 HL
00573 VDL385 ;loop until EOR
00574 VDL312 CALL VDCCHAR ;display EOR char
00575 ;-> next char
00576 RET
00577 .....
00578 ;KEYIN
00579 KEYIN LD A,8EH
00580 CALL VDCCHAR ;turn cursor on
00581 CALL ERASEL ;erase to end of line
00582 LD C,8 ;char counter
00583 GETCHR NOP
00584 CALL KBWAIT ;get char from keyboard
00585 CP B ;char or control?
00586 JP M,CTRL ;control if less 28H
00587 CP B
00588 ;'e'?
00589 JP Z,KBCHD ;jp KBCHD if cmd (i.e. 'e' pressed)
00590 ALPHANUM
00591 ;alphanumeric entered
00592 LD A,C
00593 ENTAND LD A,C
00594 CP B
00595 ;I,GETCHR
00596 LD A,1
00597 ENTOR LD A,C
00598 CP B
00599 ;I,GETCHR
00600 INC C
00601 LD A,124
00602 CHDAND LD A,253 ;and code
00603 LD (HL),A ;store and cmd
00604 LD A,1
00605 ;and char
00606 CALL VDCCHAR
00607 CALL MARK ;mark as operator
00608 INC HL
00609 GETCHR
00610 LD A,254
00611 CHDOR LD (HL),A ;or code
00612 LD A,1
00613 ;or char
00614 CALL VDCCHAR
00615 HL
00616 ;mark as operator
00617 CALL VDCCHAR
00618 HL
00619 ;loop
00620 GETCHR
00621 LD A,D
00622 ALPHA LD D,A ;alpha numeric char
00623 LD A,C ;A now = char count
00624 CP B ;op to max char
00625 ;loop until CTR or CHD
00626 ;char ok so process
00627 ;bump counter
00628 LD A,D
00629 ;restore A
00630 CP B
00631 ;'e'?
00632 LD A,1
00633 ;I,CHDAND
00634 CP B
00635 ;reverse
00636 LD A,1
00637 ALPHAS LD (HL),A
00638 ALPHAS LD (HL),A
00639 INC HL ;bump HL
00640 CALL VDCCHAR ;display char
00641 JP GETCHR ;loop
00642 .....

```

Listing 6 continued

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the printer isn't ready, the program pauses until you press the break key.

You can exit from the Search program by pressing the break key while it lists or searches text, or by pressing the break key in response to the "Enter Key" message. The minimenu appears again on the top line. Press T to return to TRSDOS.

Possible Applications

Entering reference collections in disk files and searching with Search eliminates extensive cross-indexed card files

or specially coded computer files. You can enter titles, authors, or journal names in any order. You can also add key words to the record.

Search's output option is helpful when composing the reference section of any research or technical paper. Search your reference files for the appropriate references and copy them to an output file. You can incorporate the output file into a manuscript or edit it as an independent file.

You can keep information about clients or club members in text format

and retrieve it rapidly with Search. A realtor could keep a record of each client, type of property required, geographic location, and price range. When a new property becomes available, he could search for the appropriate keys and locate the clients who might be interested. He could also use the program to select properties a new client might want to purchase.

You can search parts listings rapidly. Each record of a file could store information on automobile parts, and contain a description of part, stock num-

Listing 6 continued

```

00635 CTRL NOP ;control char entered
00636 CP B ;? CR
00637 JP I,CTRL8D ;? backspace
00638 CP B ;? backspace
00639 JP I,CTRL8S
00640 CP I ;was break hit?
00641 JP I,CTRL81
00642 JP GETCHR ;other CTRL not allowed
00643 CTRL81 NOP ;break key routine
00644 LD A,C
00645 CP B ;was break hit on ct = B?
00646 JP NE,CTRL82 ;start over
00647 LD A,8FH
00648 CALL VDCRHR ;turn off cursor
00649 LD A,BKKEY ;A=1 => break hit
00650 LD B,B
00651 RET
00652 CTRL82 LD A,BKKEY
00653 CTRL8D NOP ;EOR
00654 LD (HL),A
00655 JP KBEND
00656 CTRL8S NOP ;backspace routine
00657 LD D,A ;temp save A in D
00658 LD A,C
00659 CP B ;if zero cannot backspace
00660 JP I,GETCHR
00661 DEC C ;dec counter
00662 DEC HL ;dec buffer pointer
00663 LD A,BB
00664 CALL VDCRHR ;erase one char
00665
00666
00667 LD HL,(CURSOR)
00668 LD DE,64
00669 OR A
00670 ADD HL,DE
00671 LD A," "
00672 LD (HL),A
00673 POP HL
00674 JP GETCHR
00675
00676 KBEND NOP ;keyboard command routine
00677 LD A,143
00678 LD (CURCHR),A ;large cursor
00679 CALL KBWAIT ;get char
00680 CP B
00681 JP I,RSTCUR
00682 LD D,A
00683 LD A,C
00684 CP B
00685 JP I,RSTCUR ;restore A
00686 LD A,D
00687 CP '+'
00688 JP I,EBAND
00689 CP 6BH ;reverse '
00690 JP I,KBOR
00691 CP ' '
00692 JP I,CHDCHR
00693 CHDCHR NOP
00694 LD (HL),A
00695 CALL VDCRHR
00696 JP CHDOK
00697 EBAND LD A," "
00698 LD (HL),A
00699 CALL VDCRHR
00700 JP CHDOK
00701 EBOR LD A," "
00702 LD (HL),A
00703 CALL VDCRHR
00704 CHDOK NOP
00705 INC C
00706 INC HL
00707 RSTCUR LD A,176
00708 LD (CURCHR),A
00709 JP GETCHR
00710
00711 KBEND LD B,C
00712 PUSH AF
00713 LD A,8FH
00714 CALL VDCRHR ;turn off cursor
00715 POP AF ;A = EOR character
00716 RET
00717
00718 MARK PUSH HL ;place mark on line under char
00719 LD DE,63
00720 OR A
00721 ADD HL,DE
00722 LD A,13B
00723 LD (HL),A
00724 POP HL
00725 RET
00726
00727 ;NOVELN
00728
00729 ;move char from screen to buffer
00730 ;entry: HL->buffer, D= no. char
00731 ; BC=cursor coordinates
00732 NOVELN LD A,D
00733 CP B
00734 RET B ;no transfer if char count = B
00735 LD (COORD),BC ;store cursor coordinates
00736 CALL CURPOS ;position cursor
00737 PUSH BC
00738 LD BC,(COORD)
00739 CALL POSCUR
00740 LD B,B
00741 LD C,D
00742 PUSH BC
00743 LD D,H
00744 LD E,L
00745 LD HL,(CURSOR)
00746 POP BC
00747 LD DE,PRTRUF ;transfer to PRTRUF
00748 LDIR
00749 POP BC
00750 CALL RET ;reposition cursor
00751 RET
00752
00753 COOR DEFB B ;coordinate storage
00754
00755 ;PRLINE
00756
00757 PRLINE NOP ;print line
00758 ;HL->buffer
00759 ;B=no. char, C=ending control char
00760 PRLLP LD A,(HL)
00761 CALL PRCHAR ;print char
00762 CALL KBCHAR ;see if break pressed
00763 CP B1
00764 RET Z
00765 INC BL ;pt to next char
00766 LD A,B
00767 CP B
00768 JP I,PRLMED
00769 DEC B ;dec char count
00770 JP PRLLP
00771 PRLMED LD A,C
00772 CALL PRCHAR
00773 RET
00774
00775 ;PRSCR
00776
00777 ;print screen
00778 PRSCR CALL PRTRSCR
00779 RET
00780
00781 PRTRUF DEFB BB ;printer buffer
00782 DEFB 8BH
00783
00784 ;PRTRLN
00785
00786 PRTRLN PUSH BC ;print next to bottom line
00787 PUSH DE
00788 LD B,PENULN
00789 LD C,B
00790 LD D,SMIDTH
00791 LD HL,PRTRUF
00792 CALL NOVELN
00793 LD HL,PRTRUF
00794 LD B,SMIDTH
00795 LD C,8BH
00796 LD HL,PRTRUF
00797 CALL PRLINE
00798 LD B,PENULN
00799 LD C,B
00800 CALL POSCUR ;reposition cursor to next to last line
00801 POP HL
00802 POP DE
00803 POP BC
00804 RET
00805
00806 ;PRTRC
00807
00808 PRTRC NOP ;print record from screen
00809 LD C,B
00810 LD A,(SORLN)
00811 CP 3
00812 JP I,PRTR2
00813 LD A,(SORLN)
00814 DEC A
00815 PRTR2 LD B,A
00816 PRTRLP LD HL,PRTRUF
00817 LD D,SMIDTH
00818 PUSH BC
00819 CALL NOVELN
00820 LD HL,PRTRUF
00821 LD B,SMIDTH
00822 LD C,8BH
00823 CALL PRLINE
00824 POP BC
00825 LD A,PENULN
00826 CP B ;has last line been reached?
00827 JP I,PRTR5
00828 JP H,PRTR5
00829 INC B
00830 JR PRTRLP
00831 PRTR5 RET
00832
00833 ;MULT
00834
00835 ;entry: HL=multiplcand
00836 ; A=multiplier
00837 ;exit: HL=product, A=overflow byte
00838 MULT CALL DMULT
00839 PUSH HL
00840 LD B,L
00841 LD L,A
00842 POP AF
00843 ;A now has over flow byte
00844
00845 ;PTFS
00846
00847 PTFS LD HL,CHDXT ;point (HL) to cmd line
00848 CALL EATBHK ;bypass cmd
00849 CALL EATBHK ;bypass trailing blanks
00850 RET ;HL-> first char of file spec
00851
00852 ;DOSCMD
00853
00854 ;execute CMD file then DOS
00855 ;HL->name of CMD file
00856 DOSCMD PUSH HL
00857 LD DE,CHDXT ;DE->TRSDOS cmd line buffer
00858 CALL APPEND ;move cmd to cmd line buffer
00859 ;needed to pass parameters to program
00860 POP HL
00861 JP CONDOS

```

Listing 6 continued

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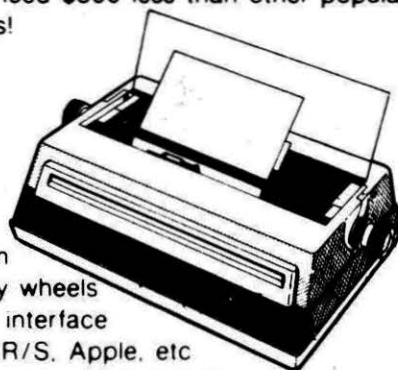


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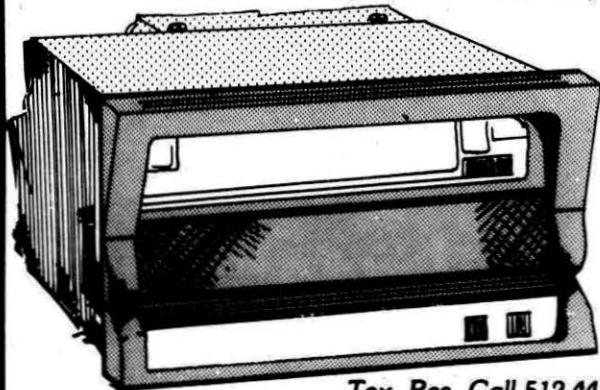
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ber, manufacturer, model number, and equivalent products from other manufacturers. A customer needs a water pump for a 1970, 250-cubic-inch Chevrolet. Type in Chevro+1970+250ci and the appropriate records appear with the model number, your stock number, and price.

Limitations

The Mindex and Search programs have several limitations. First, you must reindex the source file whenever you modify it, and you can't modify the source file directly from the search program.

The major limitation on modifying a record-compressed text file is that if the modified record is longer than the original, you can't modify it in place. You can overcome this problem by deleting the old record (overwriting it with O's or some other character) and appending the modification to the end of the file.

One disadvantage of this method is that with extensive use the file size quickly becomes too large and you must use a reformatting utility to reorganize the file (eliminating the deleted records). A minor disadvantage is that the position of a record within a file changes every time you modify it.

My solution to this problem (a program called 3by5) is to assign one record per sector. Although this method doesn't optimize disk space, it's simple to implement and doesn't require pe-

riodic file maintenance with a reformatting utility.

Another problem with Mindex and Search is that they are designed for systems with disk drives. Random access is slow on disk drives, and Search bypasses this problem by storing as much of the index file in RAM as possible. Large hard disk files can have indexes one or two orders of magnitude greater than available memory.

The solution is simple: 251 random access records are set aside for the index file. The n^{th} bits of all the signature strings are stored in the n^{th} logical record of the file. Only the index records corresponding to the hash values of the search key are read from the disk. You don't need to sequentially read the entire index file.

This file access method, however, requires multiple, nonsequential disk reads from the index file, and a floppy disk based system is too slow. I am in the process of modifying Mindex and Search for TRSDOS, TRS-XENIX, and LDOS hard-disk systems.

Future of Text Storage

Several publishing companies have plans to distribute textual material on laser video discs. These discs hold large amounts of information (text, numerical, program, and pictorial), can be interfaced to microcomputers, and can be mass produced.

The tremendous amount of information stored on the video disc creates a

problem. How can you rapidly search large text files (reference works such as encyclopedias, thesauruses, and so on)? Sequential access methods are too slow for these huge files. Tree-searching algorithms aren't appropriate for text.

Signature screening is a partial answer to this problem. You must make substantial modifications to apply this method to extremely large files stored on machines with relatively slow direct access times. The goal is to devise hashing algorithms that maximize the specificity of the screening test (reduce collisions).

The application of signature screening isn't limited to text files. With modification, you can apply it to records with fixed fields. Indexed sequential and signature screening methods can access a data file. You can extend the concept of signature screening in Mindex and Search to include many sophisticated applications. ■

Joseph E. Trojak is the president of Softshell Corporation, P.O. Box 18522, Baltimore, MD 21237. Softshell sells 3by5, an enhanced information retrieval system that incorporates Mindex and Search.

Mindex and Search are available from the author at \$12.50 for a TRSDOS 1.3 Model III/4 disk and \$14 for a TRSDOS 2.A Model II/12/16 disk. Specify source code or the assembled version. The price includes U.S. postage; Maryland residents must add 5 percent sales tax.

Listing 6 continued

```

00062      JP      DOSCMD      ;just in case
00063      )-----
00064      )ERRDSP
00065      )error display
00066      )set bit 6 (detailed error msg) and
00067      ERRDSP OR      #CWH      ;set bit 7 (return to caller)
00068      )call error display message
00069      CALL      DERDSP
00070      RET
00071      )-----
00072      DISBRK RET      ;for Mod II compatibility
00073      )-----
00074      STMBND LD      DE,(ROMEM) ;store end of memory
00075      LD      (MEMEND),DE      ;must be called before DE changed!!!!
00076      RET
00077      MEMEND DEFB      0      ;end of memory storage
00078      )-----
00079      )MODIII buffers
00080      )-----
00081      INDCB  DEFB      0      ;input file DCB
00082      IDCRI  DEFB      0
00083      DEFB      0
00084      DEFB      0
00085      DEFB      0
00086      DEFB      0
00087      DEFB      0
00088      DEFB      0
00089      )BOF offset
00090      IDCBS  DEFB      0      ;logical record length
00091      IDCBCR DEFB      0      ;current record (actually next record)
00092      IDCBLR DEFB      0      ;last record
00093      )textents
00094      INLRL  DEFB      40
00095      )true last sector
00096      )MAP file DCB
00097      MAPDCB DEFB      0
00098      DEFB      0
00099      DEFB      0
00100      DEFB      0
00101      DEFB      0
00102      DEFB      0
00103      DEFB      0
00104      )BOF offset
00105      MDCBS  DEFB      0      ;logical record length
00106      MDCBCR DEFB      0      ;current record (actually next record)
00107      MDCBLR DEFB      0      ;last record
00108      )textents
00109      MAPLRL DEFB      40
00110      )true last sector
00111      )output file DCB
00112      SORLN  DEFB      0      ;start of record line number
00113      )for each line of rec displayed
00114      );(SORLN) is decremented
00115      )-----
00116      ACCESS DEFB      0      ;dummy for Mod II compatibility
00117      )-----
00118      STMAP  DEFB      0
00119      END

```

Program Listing 7. Assembly-language listing of S3OPT/SRC:1.

```

00001      ;S3OPT/SRC:1.2
00002      ;Jun 21, 1983
00003      )-----
00004      )SEARCH OPTIONS ROUTINE
00005      )COPYRIGHT 1983 SOFTSHELL CORPORATION ALL RIGHTS RESERVED
00006      )-----
00007      S3OPT PSECT      ;start of relocatable program section
00008      )-----
00009      PUBLIC OPT
00010      )-----
00011      EXTERN KBLINE,KBLIN3,KRCHAR,KDWAIT
00012      EXTERN KBRK
00013      EXTERN VDCLS,VOLINE,VDCHAR
00014      EXTERN HOME,BOTTOM,NEWLN
00015      EXTERN CURPOS,POSCUR
00016      EXTERN ERASEL,ERASES
00017      EXTERN OPEN,CLOSE,POSEOF,POSN
00018      EXTERN OUTDCB
00019      EXTERN ARROW,ARROWL,ARROWR,ARROWW,BRKEY,SWIDTH,PENULN
00020      )-----
00021      EXTERN MINSET,SINSET,SDMODE,PRMODE,OMODE,ANSWER
00022      EXTERN PSEOF,OPSTAT,OPCOND,OPNOUT
00023      EXTERN OPNAME,KEYBUF
00024      EXTERN APPEND
00025      )-----
00026      OPTCOL EQU      42      ;Column for option answers
00027      )-----
00028      )OPT
00029      )options routine
00030      )entry: no parameters passed
00031      )exit: no parameters returned
00032      ) one exit point: OPTEND
00033      )calls: OPTPCB,OPTPC
00034      )req altered: AF,BC,DE,HL
00035      ;r5:c1
00036      OPT      LD      BC,4*256
00037      CALL      POSCUR
00038      CALL      ERASES
00039      OPTB      LD      A,(PSEOF) ;erase to end of screen
00040      CP      0DH              ;is it standard EOR (0DH)?
00041      JR      Z,OPTB0         ;jp OPTB0 if record format
00042      LD      HL,MSGPF        ;Paragraph Format'83
00043      CALL      VOLINE
00044      JR      OPTB0
00045      OPTB      LD      HL,MSGRF ;'Record Format'83
00046      CALL      VOLINE
00047      )end of OPTB section
00048      )-----
00049      LD      BC,5*256      ;r6:c1
00050      CALL      POSCUR
00051      LD      HL,OPMGL        ;'Inset from Left Margin'83
00052      CALL      VOLINE
00053      LD      A,(MINSET)     ;get inset value
00054      ADD      A,48          ;convert to ASCII
00055      CALL      VDCHAR      ;display inset value
00056      )-----

```

Listing 7 continued

Listing 7 continued

```

00057 LD BC,6*256 ;r7:c1
00058 CALL POSCUR
00059 LD HL,OPMSG2 ;'Search Display Mode: C/R/L'#3
00060 CALL VDLINL
00061 LD A,(SDMODE) ;get search display mode
00062 CALL VDCNAR ;display search display mode
00063
00064 LD BC,7*256 ;r8:c1
00065 CALL POSCUR
00066 LD HL,OPMSG3 ;'Print Mode: C/R'#3
00067 CALL VDLINL
00068 LD A,(PRMODE) ;get print mode
00069 CALL VDCNAR ;dsp print mode
00070
00071 LD BC,8*256 ;r9:c1
00072 CALL POSCUR
00073 LD HL,OPMSG4 ;'Output File: R/A/C'#3
00074 CALL VDLINL
00075 LD HL,OPNAME ;HL->output file name
00076 CALL VDCNAR ;dsp output file name
00077
00078 LD BC,9*256 ;r10:c1
00079 CALL POSCUR
00080 LD HL,OPMSG5 ;'Output File: R/A/C'#3
00081 CALL VDLINL
00082 LD A,(OPCOND) ;get output file status
00083 CALL VDCNAR ;dsp output file status
00084
00085 LD BC,10*256 ;r11:c1
00086 CALL POSCUR
00087 LD HL,OPMSG6 ;'Output Mode: C/R'#3
00088 CALL VDLINL
00089 LD A,(OMODE) ;get output mode
00090 CALL VDCNAR ;dsp output mode
00091
00092 OPT01 CALL OPTPCB ;inset from left margin
00093 LD B,5
00094 CALL OPTPC ;r6:c(OPTCOL+1)
00095 LD HL,ANSWER
00096 LD B,1
00097 CALL KBLIN3
00098 LD A,B
00099 CP B
00100 JR I,OPT01E ;jp OPT01E if null entry
00101 LD A,(ANSWER)
00102 CP 50
00103 JP P,OPT01 ;loop if not no.
00104 CP 48
00105 JP N,OPT01 ;loop if not no.
00106 SUB 48 ;convert to binary no.
00107 LD (INSET),A ;save in inset buffer
00108 OPT01E LD B,5 ;display inset value
00109 CALL OPTPC ;r6:c(OPTCOL+1)
00110 LD A,(INSET)
00111 ADD A,48 ;convert to ASCII
00112 CALL VDCNAR ;dsp inset
00113
00114 .....
00115 ;OPT02
00116 .....
00117 OPT02 CALL OPTPCB ;search display mode (C/R/L)
00118 LD HL,OPMG2A ;r(PENULN):c1
00119 CALL VDLINL ;'(C)ontinuous, (R)ecord or (L)ine'#3
00120 LD B,6
00121 CALL OPTPC ;r7:c(OPTCOL+1)
00122 LD HL,ANSWER
00123 LD B,1
00124 CALL KBLIN3
00125 LD A,B
00126 CP B
00127 JR I,OPT02E ;jp OPT02E if null entry
00128 LD A,(ANSWER)
00129 RES 5,A ;convert to upper case
00130 CP 'C'
00131 JP I,OPT02D ;'
00132 CP 'H'
00133 JP I,OPT02D ;'L'
00134 CP 'L'
00135 JR NE,OPT02 ;loop until valid input
00136 OPT02D LD (SDMODE),A ;save new search display mode
00137 OPT02E LD B,6 ;dsp search display mode
00138 CALL OPTPC ;r7:c(OPTCOL+1)
00139 LD A,(SDMODE)
00140 CALL VDCNAR
00141
00142 .....
00143 ;OPT03
00144 .....
00145 OPT03 CALL OPTPCB ;print mode (C/R)
00146 LD HL,OPMG3A ;r(PENULN):c1
00147 CALL VDLINL ;'(C)ontinuous or (M)annual'#3
00148 LD B,7
00149 CALL OPTPC ;r8:c(OPTCOL+1)
00150 LD HL,ANSWER
00151 LD B,1
00152 CALL KBLIN3
00153 LD A,B
00154 CP B
00155 JR I,OPT03E ;jp OPT03E if null entry
00156 LD A,(ANSWER)
00157 RES 5,A ;convert to upper case
00158 CP 'C'
00159 JP I,OPT03D ;'
00160 CP 'H'
00161 JP I,OPT03D ;'L'
00162 OPT03D LD (PRMODE),A ;loop until valid answer
00163 OPT03E LD B,7 ;store new print mode
00164 CALL OPTPC ;r8:c(OPTCOL+1)
00165 LD A,(PRMODE)
00166 CALL VDCNAR ;display print mode
00167
00168 .....
00169 ;OPT04
00170 .....
00171 OPT04 CALL OPTPCB ;output file name
00172 LD B,8 ;r(PENULN):c1
00173 LD C,42
00174 CALL POSCUR ;r9:c43
00175 CALL ERASEL ;erase to end of line
00176 LD HL,OPNAME ;temp store file name in KEYBUF
00177 DE,KEYBUF
00178 OPT04B CALL APPEND ;move OPNAME to KEYBUF
00179 LD HL,OPNAME
00180 LD B,24
00181 CALL KBLIN3 ;get new file name
00182 DEC HL ;(HL),SDH
00183 LD (HL),SDH ;SDH needed for file open
00184 LD A,B
00185 CP B
00186 JP I,OPT04H ;jp OPT04H if null entry
00187 LD DE,OUTDCB ;DE->output file DCB
00188 CALL CLOSE ;close output file
00189 LD A,'C'
00190 LD (OFSTAT),A ;output file status = (C)losed
00191 LD HL,OPNAME ;HL->output file name
00192 DE,OUTDCB ;DE->output file DCB
00193 OPT04L CALL APPEND ;move output file name to OUTDCB
00194 CALL OPWOUT ;open output file
00195 LD A,(OFSTAT)
00196 CP 'C'
00197 JP I,OPT04A
00198 JP OPT04E
00199
00200 OPT04H LD HL,KEYBUF ;default name
00201 LD DE,OPNAME
00202 OPT04Q CALL APPEND ;move output file name from KEYBUF to OPNAME
00203 LD (HL),#3 ;avoid new line feed
00204 LD B,8
00205 LD C,42
00206 CALL POSCUR ;r9:c43

```

Listing 7 continued



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Listing 7 continued

```

00207 LD HL,KEYBUF
00208 CALL VDLINE ;display output file name
00209 LD A,(OFSTAT)
00210 CP 'C'
00211 JP NZ,OPT#4E
00212 HL,OP#NAME
00213 LD DE,OUTDCB
00214 CALL APPEND ;move file spec to OUTDCB
00215 OPT#4E NOP
00216 ;-----
00217 ;OPT#5
00218 ;
00219 ;output file status (R/A/C)
00220 OPT#5 CALL OPT#CB ;(R)eset, (A)ppend or (C)lose'
00221 LD HL,OP#G5A
00222 CALL VDLINE
00223 LD B,9
00224 CALL OPT#CB ;r18:(OPTCOL+1)
00225 LD HL,ANSWER
00226 LD B,1
00227 CALL KBLIN3
00228 LD A,8
00229 CP B
00230 JP Z,OPT#5E ;jp OPT#5E if null entry
00231 LD A,(ANSWER)
00232 RES 5,A ; convert to upper case
00233 LD (ANSWER),A
00234 CP 'C'
00235 JP Z,OPT#5C
00236 CP 'R'
00237 JP Z,OPT#5R
00238 CP 'A'
00239 JP Z,OPT#5A
00240 OPT#5C LD A,(OFSTAT) ;loop until valid entry
00241 LD A,(OFSTAT)
00242 CP 'C'
00243 JP Z,OPT#5D ;file already closed
00244 LD DE,OUTDCB ;DE->output file DCB
00245 CALL CLOSE ;close output file
00246 LD A,OPT#5D
00247 ;-----
00248 ;OPT#5R
00249 ;
00250 ;open output file and reset
00251 ;file cursor to start of file
00252 OPT#5R CALL OP#OUT ;open output file
00253 LD A,(OFSTAT)
00254 CP 'C'
00255 JP Z,OPT#5E ;loop if error in opening file
00256 LD DE,OUTDCB ;DE->output file DCB
00257 LD BC,8
00258 CALL POSN ;position file cursor to first record
00259 JP OPT#5D
00260 ;-----
00261 ;OPT#5A
00262 ;
00263 ;open output file and set file
00264 ;file cursor to EOF
00265 OPT#5A CALL OP#OUT ;open output file
00266 LD A,(OFSTAT)
00267 CP 'C'
00268 JP Z,OPT#5E ;loop if error in opening file
00269 LD DE,OUTDCB
00270 CALL POSN ;position to end of file
00271 ;-----
00272 ;OPT#5D
00273 ;
00274 ;end of OPT#5 section
00275 OPT#5D LD A,(ANSWER)
00276 LD (OFCOND),A
00277 OPT#5E LD B,9
00278 CALL OPT#CB ;r18:(OPTCOL+1)
00279 LD A,(OFCOND)

```

```

00280 CALL VDC#AR ;display output file status
00281 ;-----
00282 ;OPT#6
00283 ;
00284 OPT#6 CALL OPT#CB ;output mode (C/M)
00285 LD HL,OP#G3A ;(C)ontinuous or (M)annual'
00286 LD VDLIN
00287 LD B,18
00288 CALL OPT#CB ;r18:(OPTCOL+1)
00289 LD HL,ANSWER
00290 LD B,1
00291 CALL KBLIN3
00292 LD A,8
00293 CP B
00294 JP Z,OPT#6E
00295 LD A,(ANSWER)
00296 RES 5,A ;convert to upper case
00297 CP 'C'
00298 JP Z,OPT#6D
00299 CP 'M'
00300 OPT#6D LD (OMODE),A
00301 OPT#6E LD B,18
00302 CALL OPT#CB ;r18:(OPTCOL+1)
00303 LD A,(OMODE)
00304 CALL VDC#AR
00305 LD BC,3*256 ;r4:c1
00306 CALL POSCUR
00307 CALL ERASES ;erase to end of screen
00308 OPTEND RET ;end of options
00309 ;-----
00310 ;OPT#CB
00311 ;
00312 ;position cursor to col = OPTCOL
00313 ;B=line number
00314 ;B passed as parameter
00315 OPT#CB LD B,PENULN ;next to bottom line
00316 LD C,8 ;col 1
00317 CALL OPT#CB ;jp to position section
00318 ;-----
00319 ;OPT#CB
00320 ;
00321 ;position cursor to col = OPTCOL
00322 ;B=line number
00323 ;B passed as parameter
00324 OPT#CB LD C,OPTCOL
00325 CALL POSCUR
00326 CALL ERASES ;erase to end of line
00327 RET
00328 ;-----
00329 ;OPT MESSAGES
00330 ;
00331 OPMSG1 DEFB 'Inset from Left Margin'
00332 DEFB 83
00333 OPMSG2 DEFB 'Search Display Mode: C/R/L'
00334 DEFB 83
00335 OPMSG3 DEFB 'Print Mode: C/M'
00336 DEFB 83
00337 OPMSG4 DEFB 'Output File Name:'
00338 DEFB 83
00339 OPMSG5 DEFB 'Output File: R/A/C'
00340 DEFB 83
00341 OPMSG6 DEFB 'Output Mode: C/M'
00342 DEFB 83
00343 OP#G2A DEFB '(C)ontinuous, (R)ecord or (L)ine'
00344 DEFB 83
00345 OP#G3A DEFB '(C)ontinuous or (M)annual'
00346 DEFB 83
00347 OP#G5A DEFB '(R)eset, (A)ppend or (C)lose'
00348 DEFB 83
00349 MSG#FF DEFB 'Paragraph Format'
00350 DEFB 83
00351 MSG#RF DEFB 'Record Format'
00352 DEFB 83
00353 ;-----
00354 END

```

Program Listing 8. Assembly-language listing of M3/SRC.

```

00001 ;M3/SRC VERSION 1.2
00002 ;Jun 26, 1983
00003 ;-----
00004 ;MINDEX INDEXING PROGRAM
00005 ;MAIN MODULE
00006 ;COPYRIGHT 1983, SOFTSHELL CORPORATION ALL RIGHTS RESERVED
00007 ;-----
00008 MINDEX PSECT ;begin relocatable program section
00009 ;-----
00010 ;public variables
00011 ;1 byte switch
00012 PUBLIC ANSWER
00013 PUBLIC BEGIN
00014 PUBLIC CMDLFS
00015 ;indicates whether file spec also entered
00016 ;along with MINDEX cmd
00017 PUBLIC KEYBUF ;keybuf used to enter MINDEX file spec
00018 ;-----
00019 ;calls to MODII or MODIII
00020 ;-----
00021 EXTERN BOTTOM ;position cursor to last line of screen
00022 EXTERN CLOSE ;close file (DE->DCB)
00023 EXTERN CURPOS ;determine cursor pos (coord:BC)
00024 EXTERN DISBRK ;disable break (for Model II)
00025 EXTERN DIVIDE ;divide A into HL
00026 EXTERN DOSCMD ;jp to TRSDOS and execute command
00027 EXTERN ERASEL ;erase to end of line
00028 EXTERN ERASES ;erase to end of screen
00029 EXTERN ERRDSP ;MAP error display routine
00030 EXTERN ERROR ;TRSDOS error msg routine
00031 EXTERN HOME ;position cursor to top line of screen
00032 EXTERN INIT ;initialize file (create/open, pos to 1st rec)
00033 ; (DE->DCB, HL->rec buf)
00034 ;jp to TRSDOS
00035 EXTERN KBCHAR ;get char (or null) from keyboard
00036 EXTERN KBLINE ;display line pointed to by HL
00037 EXTERN KWAIT ;wait for char from keyboard
00038 EXTERN OPEN ;open file (DE->DCB, HL->record buffer)
00039 EXTERN POSCUR ;position cursor (coordinates in BC)
00040 EXTERN READR ;read file: direct access
00041 EXTERN READNX ;read next record in file
00042 EXTERN VDC#AR ;display char in A register
00043 EXTERN VDCLS ;clear screen
00044 EXTERN VDLIN ;initialize video I/O (for Model III)
00045 EXTERN VDLIN ;display line (HL->msg)
00046 EXTERN WRITNX ;write next record to file
00047 ;-----
00048 ;MODII/III buffers and I/O parameters
00049 ;-----
00050 EXTERN INDCB ;input (source) file DCB
00051 EXTERN INDCBL ;input file DCB Record Length
00052 EXTERN INDCBR ;input file DCB Current Record
00053 EXTERN INDLR ;true last record of source file
00054 EXTERN INDBOS ;input file DCB xxxxxxxx
00055 EXTERN MAPDCB ;MAP (index) file DCB
00056 EXTERN MDCBRL ;Map file DCB Record Length
00057 EXTERN MDCBCR ;Map file DCB Current Record
00058 EXTERN MDCBLR ;Map file DCB Last Record
00059 EXTERN MAPLLR ;true last record of index file
00060 EXTERN MDCBOS ;Map file DCB xxxxxxxx
00061 ;I/O parameters:
00062 EXTERN BRKEY ;break key value
00063 EXTERN CPYPOS ;copyright notice position (52 or 36)
00064

```

```

00065 EXTERN PENULN ;next to last line on screen (23 or 15)
00066 EXTERN SWIDTH ;screen width (88 or 64)
00067 ;-----
00068 ;calls to GR (general routines)
00069 ;-----
00070 EXTERN BXDEC ;binary to decimal conversion
00071 EXTERN DECB ;decimal to binary conversion
00072 EXTERN DLIN ;display dotted line (e.g. ....)
00073 EXTERN DSP#NR ;display 5-digit decimal no. (right justified)
00074 EXTERN DSP#NRL ;display 5-digit decimal no. (left justified)
00075 EXTERN EATBNK ;remove leading blanks
00076 EXTERN F#SEC ;move cmd line file spec to KEYBUF
00077 EXTERN GET#WR ;get MAP file names
00078 EXTERN LINE ;display line (from char in A reg)
00079 EXTERN PACKFS ;pack (compress) file spec in fixed table
00080 EXTERN PARSEF ;parse one file spec
00081 EXTERN RECD ;zero-out 256-byte record
00082 EXTERN RECLB ;blank-out 256-byte record
00083 EXTERN TAPENT ;'Tap enter to continue'
00084 ;-----
00085 ;GR buffers
00086 ;-----
00087 EXTERN SNAM,SEXT,SPSW,SDDR ;source file table
00088 EXTERN INAM,IEXT,IPSW,IDDR ;index file table
00089 ;-----
00090 ;MINDEX MAIN SEGMENT
00091 ;syntax for loading program:
00092 ;MINDEX source file,index file,options
00093 ;options:
00094 ;R=record format or P=paragraph format
00095 ;=return to TRSDOS or M=return to MAP
00096 ;R and M are default values
00097 ;-----
00098 ;-----
00099 ;-----
00100 BEGIN PUSH HL ;HL->cmd line buffer
00101 ;save while break is disabled
00102 CALL DISBRK ;HL->cmd line buffer
00103 POP HL
00104 CALL F#SEC ;get cmd line file spec if any
00105 CALL VDCLS ;clear screen
00106 CALL HL,TITLE ;point to title
00107 CALL VDLIN ;display title
00108 LD BC,CPYPOS ;copyright notice coordinates (Mod II/III)
00109 CALL POSCUR ;r18: Model II, r18: Model III
00110 LD HL,CPYMSG ;point to copyright notice
00111 CALL VDLIN ;display copyright notice
00112 LD A,'-' ;select '-' char for LINE routine
00113 CALL LINE ;draw dashed line under title
00114 ;-----
00115 ;FN#1
00116 ;-----
00117 ;set default values
00118 LD A,'R' ;default indexing format = record
00119 LD (FORMAT),A
00120 LD A,'M' ;default return to MAP when done
00121 LD (ENDCMD),A
00122 LD BC,3*256
00123 CALL POSCUR ;r4:c1
00124 CALL ERASES ;erase to end of screen
00125 LD HL,FN#MSG ;point to file name msg ('File Name:')
00126 CALL VDLIN ;display file name message
00127 LD B,PENULN ;point to next to last line
00128 LD C,8
00129 CALL POSCUR ;r23:c1 Mod II, r15:c1 Mod III
00130 LD HL,FN#MSG2 ;point to following message
00131 ;'Enter name of File to be indexed or

```

Listing 8 continued

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- Smith Corona Daisy Wheel TP-1
- Brother Daisy Wheel
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Continued on page 211

Listing 8 continued

```

00132          ;? for help'
00133 CALL      VDLNLE      ;display message
00134
00135 LD        A,(CMDLFS)   ;CMDLFS indicates whether file spec
00136          ;was entered after MINDEX on TRSDOS cmd line
00137 CP        'Y'         ;was file spec entered on TRSDOS cmd line?
00138 JR        NZ,FN02     ;jp if file name not entered
00139
00140          ;file spec entered on cmd line so dsp
00141 LD        BC,3*256+11
00142 CALL      POSCUR      ;r4:c12
00143 LD        A,'N'       ;reset CMDLFS
00144 LD        (CMDLFS),A
00145 LD        HL,KEYBUF   ;point to cmd line file spec
00146 CALL      VDLNLE      ;display file spec
00147 LD        A,00H
00148 CP        A           ;I (set)
00149 LD        B,1        ;(so len > 8)
00150 JR        FN04
00151
00152 FN02 LD      BC,3*256+11 ;get file spec
00153 CALL      POSCUR      ;r4:c12
00154 CALL      ERASEL      ;erase to end of line
00155 LD        HL,KEYBUF   ;point to KEYBUF to hold file spec
00156 CALL      B,51        ;max file spec = 51 characters
00157 CALL      KBLNLE      ;enter file spec
00158
00159 FN04 PUSH    AF        ;now process file spec
00160 PUSH    HL
00161 LD        BC,5*256
00162 CALL      POSCUR      ;r5:c1
00163 CALL      ERASES      ;erase to end of screen
00164 POP     HL
00165 POP     AF
00166
00167 CP        BRKKEY      ;was <break> entered?
00168 JF        Z,MNENU1    ;if so jp to mini-menu 1
00169 LD        A,(KEYBUF)  ;get first char entered
00170 CP        00H         ;was first char 00H (i.e. null entry)?
00171 JF        Z,FN01     ;loop if null entry
00172 LD        HL,KEYBUF   ;point to file spec buffer
00173 CALL      EATBNK     ;bypass leading blanks
00174 LD        A,(HL)      ;load A with first non-blank char
00175 CP        ' '        ;was ' ' entered?
00176 JF        Z,MHELP    ;if so jp to help screen
00177
00178 LD        HL,KEYBUF   ;point to file spec buffer
00179 CALL      GETMFM      ;get file names
00180 LD        Z,FNOK      ;jp to FNOK if file spec syntax OK
00181 LD        BC,8*256   ;file spec syntax incorrect
00182 CALL      POSCUR      ;r9:c8
00183 LD        HL,FNMMSG   ;point to file name error msg
00184 CALL      VDLNLE      ;display file name error msg
00185 CALL      TAPENT      ;Tap enter key to continue
00186 JP        FN02       ;loop back and get file spec again
00187
00188 FNOK NOP          ;file names ok
00189 CALL      CLOPT      ;call command interpreter options routine
00190 JP        NZ,OPTERR   ;jp to options error routine if error
00191
00192 LD        HL,SNAM      ;HL->source file name
00193 LD        DE,INDCB    ;DE->source file DCB
00194 CALL      PACKFS      ;space compress source file spec
00195 ;and move to source file DCB
00196
00197 LD        HL,INAM      ;HL-> index file table
00198 LD        DE,MAPDCB   ;DE-> index file DCB
00199 CALL      PACKFS      ;space compress index file spec
00200 ;and move to index file DCB
00201
00202 LD        BC,7*256
00203 CALL      POSCUR      ;r8:c8
00204 LD        HL,MSG09    ;pt to msg 'source file name:'
00205 CALL      VDLNLE      ;dsp msg
00206 LD        HL,INDCB    ;HL->source file DCB
00207 CALL      VDLNLE      ;display source file spec
00208
00209 LD        BC,8*256
00210 CALL      POSCUR      ;r9:c1
00211 LD        HL,MSG10    ;map index file name:'
00212 CALL      VDLNLE      ;dsp above msg
00213 LD        HL,MAPDCB   ;HL->index file DCB
00214 CALL      VDLNLE      ;display index file spec
00215 LD        JF        OFFILE ;jp to section to open files
00216
00217 OPTERR LD      HL,OPMSG ;HL->options error message
00218 CALL      VDLNLE      ;dsp options error msg
00219 CALL      TAPENT      ;Tap enter key to continue
00220 JP        FN01       ;loop back and get file spec
00221
00222          ;OFFILE
00223 LD        HL,INAM      ;open files
00224 LD        BC,11*256
00225 LD        HL,MSG11    ;r12:c1
00226 CALL      POSCUR      ;HL->source file DCB
00227 LD        HL,INDCB    ;DE->index file DCB
00228 LD        DE,MAPDCB
00229 LD        A,(DE)      ;check if file spec's different
00230 CP        (HL)
00231 JR        NZ,DIFFIL  ;not equal so dif names
00232 CP        00H         ;00H => same file names
00233 JR        Z,SAMPFL    ;same file names error msg
00234 INC     HL
00235 INC     DE
00236 JR        CF,NLPL    ;same file names error msg
00237 SAMPFL LD      HL,MSGSFN ;same file names error msg
00238 CALL      VDLNLE      ;dsp error msg
00239 CALL      TAPENT      ;Tap enter to continue
00240 JP        FN01       ;loop back and get file spec again
00241
00242          ;DIFFIL
00243 LD        HL,INAM      ;different file spec for source and index
00244 LD        BC,3*256    ;now print msg regarding indexing format
00245 LD        HL,MSG12    ;paragraph or record format
00246 CP        'P'
00247 CALL      Z,PERIOD   ;paragraph format?
00248 LD        BC,3*256    ;paragraph format so set program for 'P'
00249 CALL      POSCUR      ;r18:c1
00250 LD        A,(FORMAT)
00251 CP        'P'
00252 JF        Z,FTDSP4   ;paragraph format?
00253 LD        HL,RECMMSG  ;if para format jp to appropriate dsp
00254 LD        HL,MSG13    ;if para format msg
00255 CALL      VDLNLE      ;display record format msg
00256 LD        HL,FTDSP4   ;bypass paragraph format msg
00257 LD        HL,PARMSG   ;pt to paragraph format msg
00258 CALL      VDLNLE      ;display paragraph format msg
00259
00260          ;PREIN
00261 LD        A,00H       ;prepare input (source) file
00262 CALL      VCHAR      ;ask to next line
00263 LD        HL,INBUF    ;HL->input buffer
00264 LD        DE,INDCB    ;DE->source file DCB
00265 LD        B,8         ;record length = 256
00266 CALL      OPEN       ;open source file
00267 JP        Z,PREIN8   ;jp to PREIN8 if open OK
00268 PUSH    AF           ;save error code
00269 LD        BC,12*256
00270 CALL      POSCUR      ;r13:c1
00271 LD        HL,MSGSRF   ;source file open error msg
00272 CALL      VDLNLE      ;dsp source file open error msg
00273 LD        BC,13*256
00274 CALL      POSCUR      ;r14:c1
00275 LD        HL,MSGSRF   ;restore error code
00276 CALL      ERSDSP     ;display TRSDOS error msg
00277 LD        BC,14*256
00278 CALL      POSCUR      ;r15:c1
00279 CALL      TAPENT      ;Tap enter to continue
00280 CALL      FN01       ;loop and get file spec again
00281

```

```

00282 PREIN LD      A,8
00283 LD        (IDCBRL),A ;set record len = 256
00284 LD        BC,7*256+37 ;r8:c38
00285 CALL      POSCUR
00286 LD        HL,OOKMSG
00287 CALL      VDLNLE      ;'Opened' msg
00288
00289          ;PREMAP
00290          ;prepare MAP index file
00291 LD        HL,MAPBUF   ;HL->index file buffer
00292 LD        DE,MAPDCB   ;DE->index file DCB
00293 LD        B,8         ;record length = 256
00294 CALL      INIT       ;initialize (create or open) file
00295 JP        Z,CMSGOP   ;jp to CMSGOP if index file init OK
00296 PUSH    AF           ;save error code
00297 LD        BC,12*256
00298 LD        HL,MSGSRF   ;r13:c1
00299 CALL      POSCUR
00300 LD        HL,MSGSRF   ;'Error in opening index file'
00301 CALL      VDLNLE      ;dsp error msg
00302 LD        BC,13*256
00303 CALL      POSCUR      ;r14:c1
00304 LD        HL,MSGSRF   ;restore error code
00305 CALL      ERSDSP     ;dsp TRSDOS error msg
00306 LD        BC,14*256
00307 CALL      POSCUR      ;r15:c1
00308 CALL      TAPENT      ;Tap enter key to continue
00309 LD        HL,MSGSRF   ;loop back and get file spec
00310 CMSGOP LD      BC,8*256+37 ;index file open OK
00311 CALL      POSCUR      ;r9:c38
00312 LD        HL,OOKMSG
00313 CALL      VDLNLE      ;'Opened' msg
00314
00315          ;add header to MAP index file
00316 LD        HL,MSGSRF   ;header format:
00317 LD        A,19H       ;bytes 0-19: MINDEX1.2..
00318 LD        HL,MSGSRF   ;bytes 40-41: file spec.
00319
00320 LD        A,00H       ;set source file drive no. to 00H (null)
00321 LD        (SDDR),A   ;since header never specifies disk drive
00322 LD        HL,SNAM      ;of source file
00323 LD        HL,SNAM      ;HL->source file spec table
00324 LD        DE,HPN      ;DE->header file name buffer
00325 CALL      PACKFS      ;rpack header with source file spec
00326 LD        HL,MSGSRF   ;space compress file spec in process
00327 LD        HL,MAPBUF   ;HL->index file buffer
00328 LD        HL,MSGSRF   ;zero out index file buffer
00329 CALL      RECB       ;header sector
00330 LD        HL,HSEC     ;HL->header sector
00331 LD        DE,MAPBUF   ;DE,MAPBUF
00332 LD        BC,50
00333 LD        HL,DIR      ;move header to MAPBUF
00334 LD        DE,MAPDCB
00335 CALL      WRITX      ;write index header sector (sector 8)
00336 JP        NZ,ERROR   ;jp to error routine if error
00337 LD        HL,MAPBUF   ;HL->index buffer
00338 CALL      RECB       ;initialize index buffer to 0's
00339 LD        BC,256*10
00340 CALL      POSCUR      ;r11:c1
00341 LD        HL,IDXSEC   ;'Indexing Sector:'
00342 CALL      VDLNLE      ;dsp msg
00343
00344          ;files open and ready to
00345          ;start indexing process
00346
00347          ;main loop, repeat until file indexed
00348 LOOP CALL      READIN ;get next sector from source file
00349 LD        A,(RDERR)   ;RDERR = error code during read
00350 CP        Z           ;is end of file?
00351 JF        Z,ENDIN    ;jp to ENDIN if end of source file
00352 LD        A,(SCROSS) ;this is the only EXIT from this loop
00353 LD        C,255      ;IO buffer length
00354 LD        A,(SCROSS) ;no. of bytes in current record
00355 LD        HL,MSGSRF   ;scared over from previous sector
00356 LD        HL,MSGSRF   ;if SCROSS=0 then record did not span sector
00357 LD        HL,MSGSRF   ;SCROSS never > 255
00358 LD        B,A         ;B now has number of bytes in record
00359 LD        HL,MSGSRF   ;from previous sector
00360 CALL      HASHWD     ;hash all the words in current sector
00361 LD        HL,MSGSRF   ;on return from HASHWD IX->byte after
00362 LD        HL,MSGSRF   ;source file record buffer
00363 LD        IX,IX+8     ;IX now -> last byte in src file rec buf
00364 LD        HL,MSGSRF   ;get last char in SFRB
00365 LD        HL,MSGSRF   ;'.'?
00366 LD        HL,MSGSRF   ;if file indexed in paragraph format,
00367 LD        HL,MSGSRF   ;the above 00H is converted to '.'
00368 LD        HL,MSGSRF   ;if record does not span sector
00369 LD        HL,MSGSRF   ;EOR ?
00370 LD        HL,MSGSRF   ;jp if record does not span sector
00371 LD        HL,MSGSRF   ;store in SCROSS no. of bytes in record
00372 LD        HL,MSGSRF   ;before sector boundary crossed
00373 LD        HL,MSGSRF   ;loop until end of source file
00374 LD        HL,MSGSRF   ;SCROSS=0 means record does not
00375 LD        HL,MSGSRF   ;span sector boundary
00376 LD        HL,MSGSRF   ;00H at end of source file rec buf
00377 LD        HL,MSGSRF   ;increment BICT
00378 LD        HL,MSGSRF   ;loop until end of source file
00379 LD        HL,MSGSRF   ;HASHWD
00380 LD        HL,MSGSRF   ;hash word subroutine
00381 LD        HL,MSGSRF   ;hashes all valid triplets in record
00382 LD        HL,MSGSRF   ;hash algorithm for three chars cl,c2,c3
00383 LD        HL,MSGSRF   ;h(c1,c2,c3)=
00384 LD        HL,MSGSRF   ; (100ac1+10ac2+ac3) mod 251
00385 LD        HL,MSGSRF   ;where: cl,c2,c3 represent the 1st,2nd and
00386 LD        HL,MSGSRF   ;3rd char of the triplet
00387 LD        HL,MSGSRF   ;a is the ASCII value of the char c
00388 LD        HL,MSGSRF   ;and upper case is converted to l.c.
00389 LD        HL,MSGSRF   ;three 2-byte buffers are used:
00390 LD        HL,MSGSRF   ;MBYTE=10ac2
00391 LD        HL,MSGSRF   ;LBYTE=ac3
00392 LD        HL,MSGSRF   ;during hash loop reg B is used to store
00393 LD        HL,MSGSRF   ;no. of bytes in current logical record
00394 LD        HL,MSGSRF   ;value in B is transferred to SCROSS
00395 LD        HL,MSGSRF   ;only when a record spans a sector
00396 LD        HL,MSGSRF   ;and a new sector must be read from the
00397 LD        HL,MSGSRF   ;source file
00398 LD        HL,MSGSRF   ;during hash loop reg C is used to store
00399 LD        HL,MSGSRF   ;no. of bytes remaining if sfrb
00400 LD        HL,MSGSRF   ;IX->source file record buffer (sfrb)
00401 LD        HL,MSGSRF   ;move MBYTE to HL
00402 LD        HL,MSGSRF   ;multiply MBYTE by 10
00403 LD        HL,MSGSRF   ;move HL to FBYTE
00404 LD        HL,MSGSRF   ;move LBYTE to HL
00405 LD        HL,MSGSRF   ;multiply HL by 10
00406 LD        HL,MSGSRF   ;move HL to MBYTE
00407 LD        HL,MSGSRF   ;get c3 from sfrb
00408 LD        HL,MSGSRF   ;'.'?
00409 LD        HL,MSGSRF   ;if file is indexed in paragraph format,
00410 LD        HL,MSGSRF   ;the above 00H is converted to '.'
00411 LD        HL,MSGSRF   ;if char = EOR, then A = 0
00412 LD        HL,MSGSRF   ;jp if lower case - no conversion needed
00413 LD        HL,MSGSRF   ;jp to UPCASE to convert u.c. to l.c.
00414 LD        HL,MSGSRF   ;jp
00415 LD        HL,MSGSRF   ;jp if value <33 (i.e. control or ' ')
00416 LD        HL,MSGSRF   ;char with ASCII value from 33 to 64
00417 LD        HL,MSGSRF   ;
00418 LD        HL,MSGSRF   ;
00419 LD        HL,MSGSRF   ;
00420 LD        HL,MSGSRF   ;
00421 LD        HL,MSGSRF   ;
00422 LD        HL,MSGSRF   ;
00423 LD        HL,MSGSRF   ;
00424 LD        HL,MSGSRF   ;
00425 LD        HL,MSGSRF   ;
00426 LD        HL,MSGSRF   ;
00427 LD        HL,MSGSRF   ;
00428 LD        HL,MSGSRF   ;
00429 LD        HL,MSGSRF   ;
00430 LD        HL,MSGSRF   ;
00431 LD        HL,MSGSRF   ;
00432 LD        HL,MSGSRF   ;

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Listing 8 continued

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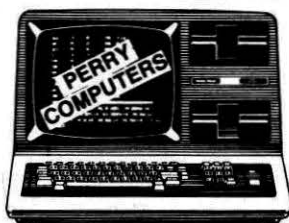
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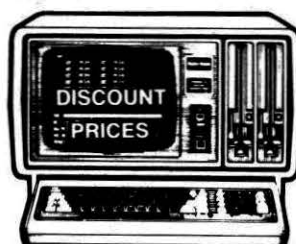
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26-1067 Model 4 16K Computer	\$ 999.00	\$ 685.00
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26-1069 Model 4 64K 2 Drive Computer	\$1999.00	\$1585.00
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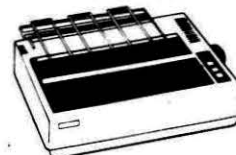
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26-6005 Model 16B 256K 2 Drive Computer	\$5798.00	\$4510.00
26-6006 Model 16B 256K 15Meg HD Computer	\$6999.00	\$5950.00
26-6010 Model 12 To Model 16 Upgrade	\$1499.00	\$1275.00
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Listing 8 continued

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00433          jdo not convert to l.c.
00434          jconvert u.c. to l.c.
00435          ZERO LD A,#
00436          LCASE LD L,A
00437          LCASE LD L,A
00438          LD H,#
00439          jload HL with value of character
00440          ;-----
00441          jstart sector cross routine
00442          LD A,(SCROSS)
00443          CP #
00444          JP Z,BUFLP3
00445          jcheck SCROSS
00446          jlp BUFLP3 if SCROSS=#
00447          ;-----
00448          jget c3 from sfrb again
00449          jif file indexed in paragraph format,
00450          jconvert above 0DH to ','
00451          JP Z,BUFLP2
00452          CP #DH
00453          JP NZ,BUFLP5
00454          jBOR while SCROSS = 1
00455          jshift sector ct
00456          BUFLP2 CALL NEWSEC
00457          LD A,#
00458          LD (SCROSS),A
00459          LD B,#
00460          JP BUFLP5
00461          ;-----
00462          jget c3 from sfrb again
00463          BUFLP3 LD A,(IX+0)
00464          POINT4 CP #DH
00465          jif file indexed in paragraph format,
00466          jconvert above 0DH to ','
00467          JP Z,BUFL3B
00468          CP #DH
00469          JP NZ,BUFLP4
00470          jBOR while SCROSS = 0
00471          BUFL3B LD B,#
00472          JP BUFLP7
00473          BUFLP4 CP B
00474          LD A,254
00475          jcheck rec len
00476          jif BUFLP7 if <255
00477          jset record len = #
00478          jSCROSS=# so no need to
00479          jcall NEWSEC routine
00480          ;-----
00481          BUFLP5 LD A,254
00482          CP B
00483          JP NZ,BUFLP7
00484          jcheck for rec >255 bytes
00485          jREC >255 bytes
00486          jBump sector ct
00487          jreset rec len = #
00488          BUFLP7 INC B
00489          LD (SCROSS),A
00490          jreset SCROSS = #
00491          BUFLP8 INC IX
00492          LD B,#
00493          jincrement record len
00494          jIX now -> next byte
00495          jcall NEWSEC routine
00496          ;-----
00497          jcheck triplet for # val
00498          BUFLP8 LD (LBYTE),HL
00499          CALL CHECK8
00500          jchar in triplet has # value
00501          CP #
00502          JP Z,CHECKC
00503          HL,(LBYTE)
00504          LD DE,(MBYTE)
00505          ADD HL,DE
00506          LD DE,(FBYTE)
00507          ADD HL,DE
00508          LD A,251
00509          CALL DIVIDE
00510          CALL STORE
00511          jcheck if end of record reached
00512          CHECKC LD A,#
00513          CP C
00514          RET Z
00515          DEC C
00516          JP BUFLP
00517          jreturn if end of record
00518          jcontinue to hash record until
00519          jend of record (i.e. C=#)
00520          jBUFLP end
00521          ;-----
00522          jmult # in A by 10
00523          MUAL# NOP
00524          jBC and DE used
00525          jvalue returned in HL
00526          LD H,#
00527          LD L,A
00528          MULL# ADD HL,HL
00529          LD HL,HL
00530          LD HL,HL
00531          LD HL,HL
00532          ADD HL,HL
00533          ADD HL,HL
00534          ADD HL,HL
00535          ADD HL,HL
00536          RET
00537          jHL contains 4*no.
00538          jHL contains 8*no.
00539          jHL contains 10*no.
00540          ;-----
00541          jSTORE
00542          jstore bit in appro byte
00543          STORE LD IX,MAPBUF
00544          LD D,#
00545          ADD IX,DE
00546          LD A,(BICT)
00547          OR (IX+0),A
00548          LD (IX+0),A
00549          RET
00550          jset IX to point to index file buffer
00551          jmove hash value to DE
00552          jadd hash value (DE) to index file buffer
00553          jsector pointer
00554          ;-----
00555          jNEWSEC
00556          jnew source file sector so
00557          jrotate BICT bit
00558          NEWSEC LD A,(BICT)
00559          RLCA
00560          LD (BICT),A
00561          CALL C,WRITER
00562          RET
00563          jwrite rec if new sector
00564          ;-----
00565          jCHECK8
00566          jcheck triplet for 0's
00567          jif any char in triplet has # value,
00568          jthen triplet is not hashed
00569          jblanks, 0DH, control char give # value
00570          jreturn A=# -> # value
00571          CHECK8 LD DE,#
00572          OR A
00573          LD HL,(LBYTE)
00574          SBC HL,DE
00575          JP Z,VAL#
00576          LD HL,(MBYTE)
00577          OR A
00578          SBC HL,DE
00579          JP Z,VAL#
00580          LD HL,(FBYTE)
00581          OR A
00582          SBC HL,DE
00583          JP Z,VAL#
00584          LD A,1
00585          RET
00586          jcarry = #
00587          jcarry = #
00588          jcarry = #
00589          VAL# LD A,#
00590          RET
00591          jzero value for triplet, do not hash
00592          ;-----
00593          READIN BOP
00594          CALL DE,INDCB
00595          READNX LD DE,READNX
00596          JP Z,READOK
00597          CP Z
00598          JP NZ,ERROR
00599          LD (RDERR),A
00600          READOR NOP
00601          jread input record
00602          jDE-source file DCB
00603          jread next sector
00604          jlp if read OK
00605          jend of file?
00606          jtp to error routine if not BOR
00607          jstore EOF code in RDERR
00608          ;-----
00609          jDPSNR

```

Listing 8 continued

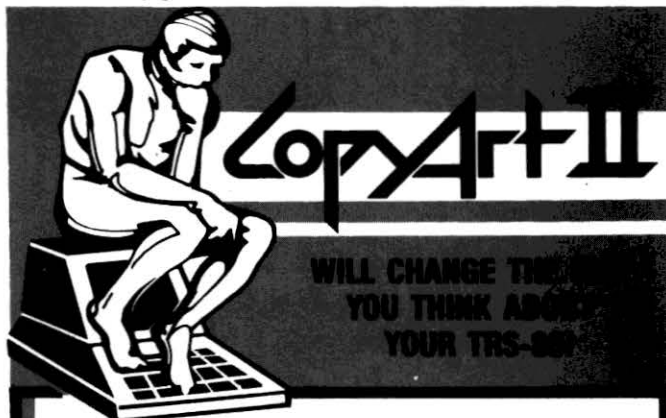
```

00583 ;-----
00584 ;display current source file sector no.
00585 DPFNR PUSH BC
00586 PUSH DE
00587 PUSH HL
00588 PUSH IX
00589 PUSH IY
00590 LD BC,10*256+18 ;r11:c18
00591 CALL POSCUR
00592 LD HL,(DPCBCR) ;load current source sector no. into HL
00593 CALL BKDECB ;convert binary to ASCII
00594 ;on return HL->buf with 5 digit ASCII value
00595 CALL VDLINE ;display ASCII value
00596 POP IY
00597 POP IX
00598 POP HL
00599 POP DE
00600 POP BC
00601 RET
;-----
00602 ;PERIOD
00603 ;sets '.' for paragraph format
00604 ;BDH is replaced with '.' to indicate
00605 ;end of record
00606 PERIOD LD HL,POINT1
00607 INC HL ;bypass CP instruction
00608 LD (HL), '.' ;convert BDH to '.'
00609 LD HL,POINT2
00610 INC HL ;bypass CP instruction
00611 LD (HL), '.' ;convert BDH to '.'
00612 LD HL,POINT3
00613 INC HL ;bypass CP instruction
00614 LD (HL), '.' ;convert BDH to '.'
00615 LD HL,POINT4
00616 INC HL ;bypass CP instruction
00617 LD (HL), '.' ;convert BDH to '.'
00618 INC HL ;bypass CP instruction
00619 LD (HL), '.' ;convert BDH to '.'
00620 LD HL,HESECFP
00621 LD (HL),2EH ;mark header at byte 12
00622 RET
;-----
00623 ;WRITER
00624 ;write output rec
00625 ;DE->index file DCB
00626 WRITER LD DE,MAPDCB
00627 PUSH BC ;save BC
00628 CALL WRITBK ;write next sector
00629 JP NZ,ERROR ;jp if error
00630 LD HL,MAPBUF ;pt to index file buffer
00631 CALL RECB ;set index file buffer to #'s
00632 POP BC ;restore BC
00633 RET
;-----
00634 ;CIOPT
00635 ;command interpreter options routine
00636 ;HL -> first NB char after file spec
00637 ;bypass blanks before semicolon
00638 CIOPT CALL EATBKN
00639 LD A,(HL)
00640 CP ';'
00641 JR NZ,CPT2 ;semicolon entered to mark options?
00642 INC HL ;point to next char
00643 CALL EATBKN ;bypass any blanks after semicolon
00644 LD A,(HL) ;remove any leading blanks
00645 CP BDH ;? BOR
00646 JR Z,CPTOK
00647 CP ' '
00648 JR Z,CPTOK
00649 CP '!'
00650 JR Z,CPT4
00651 RES 5,A ;convert to upper case
00652 CP 'R'
00653 JR Z,CPTFMT
00654 CP 'P'
00655 JR Z,CPTFMT
00656 CP 'M'
00657 JR Z,CPTFMT
00658 CP 'T'
00659 JR Z,CPTFMT
00660 CP 'M'
00661 JR Z,CPTFMT
00662 CPT4 INC HL
00663 JR Z,CPT2 ;loop and continue to process options
00664 ;until end of cmd line reached
00665 CPTFMT LD (FORMAT),A ;load format parameter
00666 JR CPT4 ;load end command parameter
00667 CPTFMT LD (ENDCMD),A
00668 JR CPT4
00669 ;
00670 CPTBAD LD A,8 ;bad options syntax
00671 CP 1 ;NZ (reset)
00672 RET
00673 CPTOK CP A ;Z (set) options syntax OK
00674 RET
;-----
00675 ;MMENU1
00676 ;mini-menu 1
00677 ;used to abort program before indexing started
00678 ;r3:c1
00679 MMENU1 NOP
00680 LD BC,2*256
00681 CALL POSCUR ;erase to bottom of screen
00682 ERASES LD HL,MM1MSG ;'(I)NDEX File, (M)AP or (T)RSDOS'
00683 LD HL,MM1MSG
00684 CALL VDLINE
00685 MMU1 CALL KBWAIT ;wait for key to be pressed
00686 RES 5,A ;convert l.c. to u.c.
00687 CP 'I' ;'I' entered?
00688 JP Z,FNB1 ;start again and get file spec
00689 CP 'M' ;'M' entered?
00690 JP Z,ENDINS ;jp to TRSDOS and load MAP
00691 CP 'T' ;'T' entered?
00692 JP Z,TRSDOS ;jp to TRSDOS
00693 JP Z,JP2DOS ;loop until I,M or T entered
00694 MM1MSG DEFB '(I)NDEX File, (M)AP or (T)RSDOS'
00695 DEFB 3
00696 ;-----
00697 ;MHELP
00698 ;mini-help screen
00699 ;r7:c1
00700 LD HL,HMSG2 ;display help msg's
00701 CALL VDLINE ;msg's are at end of this routine
00702 LD A,BDH
00703 CALL VDCHAR ;skip line
00704 LD HL,HMSG4
00705 CALL VDLINE ;skip line
00706 LD A,BDH
00707 CALL VDCHAR ;skip line
00708 LD A,BDH
00709 CALL VDCHAR ;skip line
00710 LD HL,HMSG6
00711 CALL VDLINE ;skip line
00712 LD HL,HMSG8
00713 CALL VDLINE ;skip line
00714 LD 8,PENULN ;next to bottom line
00715 LD C,8
00716 CALL POSCUR ;r23:c1 Mod II, r15:c1 Mod III
00717 CALL TAPENT ;Tap enter to continue
00718 JP FNB2 ;jp back and get file spec
00719 HMSG2 DEFB 'Format: SOURCE FILE,INDEX FILE,OPTIONS'
00720 DEFB BDH
00721 HMSG4 DEFB 'Only the source file specification is required'
00722 DEFB BDH
00723 HMSG6 DEFB 'Options: R = record format; P = paragraph format'
00724 DEFB BDH
00725 HMSG8 DEFB ' N= return to MAP Master Menu; T = return to TRSDOS'
00726 DEFB BDH
00727 ;-----
00728 ;ENDIN
00729 ;end input file
00730 ;store last signature sector
00731 ENDIN CALL WRITER

```

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Continued from page 207



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Listing 8 continued

```

00732 LD DE,INDCB ;DE->source file DCB
00733 CALL CLOSE ;close source file
00734 MZ ERROR ;jp if error
00735 LD DE,MAPDCB ;DE->index file DCB
00736 CALL CLOSE ;close index file
00737 JP MZ.ERROR ;jp if error
00738
00739 LD A,(ENDCMD) ;get end cmd
00740 CP 'T' ;return to TRSDOS?
00741 JP Z,JP2DOS ;jp to TRSDOS if true
00742 ENDINS LD HL,MAPCMD ;return to MAP Master Menu
00743 JP ;jp to TRSDOS and execute cmd
00744 MAPCMD DEFM 'MAP'
00745 DEFB 0DH
00746 ;-----
00747 ;
00748 ;buffers used by M3
00749 ;
00750 ;general purpose variables
00751 ANSWER DEFB 0 ;one byte key variable (Y/N etc)
00752 ;not used by MINDEX but must be
00753 ;present in public or there will
00754 ;be a link error
00755 CHDLFS DEFB 0 ;cmd line file spec [Y/N]
00756 ;indicates whether file spec
00757 ;was entered along with MINDEX cmd
00758 ENDCMD DEFB 0 ;end cmd (M=MAP, T=TRSDOS)
00759 FORMAT DEFB ;indexing format (R=record, P=para)
00760 KEYBUF DEFS 80 ;used by MINDEX for file spec buffer
00761 DEFB 0DH ;precautionary EOR
00762 ;-----
00763 ;hash routine variables
00764 FBYTE DEFW 0 ;hash value of first byte of triplet
00765 MBYTE DEFW 0 ;hash value of middle byte of triplet
00766 LBYTE DEFW 0 ;hash value of last byte of triplet
00767 SCROSS DEFB 0 ;sector cross variable
00768 ;if 0 then sector boundary is not
00769 ;crossed by a record
00770 ;if >0 then the value in SCROSS
00771 ;is equal to the no of bytes in record
00772 ;prior to end of sector
00773 BICT DEFB 1 ;bit points to sector (0 to 7)
00774 ;
00775 ;disk I/O buffers
00776 RDERR DEFB 0 ;read error storage
00777 INBUF DEFS 256 ;source file buffer
00778 DEFB 0DH ;precautionary EOR for INBUF
00779 MAPBUF DEFS 256 ;index file buffer
00780 DEFB 0DH ;precautionary EOR for MAPBUF
00781 ;-----
00782 ;HEADER buffer
00783 ;

```

```

00784 ;byte label purpose
00785 ; 8-9 HSEC 'MINDEX' and version
00786 ;10-18 0DH
00787 ;11-11 HSECFP format: 0DH record
00788 ;
00789 ;12-19 blank (for future use)
00790 ;20-43 HFN source file spec
00791 ;
00792 HSEC DEFM 'MINDEX 1.2'
00793 DEFB 0DH
00794 HSECFP DEFB 0DH
00795 DEFM ' '
00796 DEFM ' '
00797 DEFB 0DH ;end of file spec
00798 DEFB 0DH ;backup end of file spec
00799 ;-----
00800 ;MINDEX (M3) messages
00801 ;
00802 MSGSPN DEFM 'Source and Index File must have'
00803 DEFM 'different names'
00804 MSGOP DEFM 'FILES OPENED'
00805 DEFB 0DH
00806 DSPRD DEFM 'READ COMPLETE'
00807 DEFB 0DH
00808 TITLE DEFM 'MAP INDEX PROGRAM Version 1.2'
00809 DEFB 3
00810 CPMMSG DEFM '(c) Copyright 1983 Softshell'
00811 DEFB 3
00812 FMMSG DEFM 'File Name:'
00813 DEFB 3
00814 FMMSG DEFM 'Enter name of file to be indexed, or ? for help'
00815 DEFB 0DH
00816 FMMSG DEFM 'Error in file name format'
00817 DEFB 0DH
00818 OOKMSG DEFM 'Opened'
00819 DEFB 3
00820 MSG09 DEFM 'Source File:'
00821 DEFB 3
00822 MSG10 DEFM 'MAP Index File:'
00823 DEFB 3
00824 PARM3 DEFM 'Paragraph Format'
00825 DEFB 3
00826 RECM3 DEFM 'Record Format'
00827 DEFB 3
00828 OPMSG DEFM 'Error in Options Code'
00829 DEFB 0DH
00830 MSGSER DEFM 'Error in opening Source File:'
00831 DEFB 03
00832 MSGMER DEFM 'Error in opening MAP Index File:'
00833 DEFB 03
00834 DEFB 0DH
00835 DEFB 0DH
00836 IDXSEC DEFM 'Indexing Sector:'
00837 DEFB 3
00838 ;-----
00839 END BEGIN

```

Program Listing 9. Assembly-language listing of S3/SRC.

```

Ln # Source Line
00001 ;S3/SRC VERSION 1.2
00002 ;Jun 15, 1983
00003 ;-----
00004 ;SEARCH INFORMATION RETRIEVAL PROGRAM
00005 ;MAIN ROUTINE
00006 ;COPYRIGHT 1983, SOFTSHELL CORPORATION ALL RIGHTS RESERVED
00007 ;-----
00008 SEARCH PSECT ;begin relocatable program section
00009 ;-----
00010 ;public routines
00011 PUBLIC HSN02B ;mini-menu
00012 PUBLIC OPNOUT ;open output file
00013 PUBLIC OUTREC ;write record to output file
00014 PUBLIC READIN ;read input (source) file record
00015 ;-----
00016 ;public variables
00017 ;
00018 ;
00019 PUBLIC ANSWER ;1 byte switch
00020 PUBLIC BCKEIP ;backspace through file routine
00021 PUBLIC BEGIN ;start of SEARCH program
00022 PUBLIC CFILN ;current file name
00023 PUBLIC CHDLFS ;cmd line file spec [Y/N]
00024 ;indicates whether file spec also entered
00025 ;along with SEARCH cmd
00026 ;-----
00027 PUBLIC EOF ;end of file switch
00028 PUBLIC INBUF ;input (source) file record buffer
00029 PUBLIC INBUFE ;last byte in input record (256th)
00030 PUBLIC INBUFU ;byte after INBUFE
00031 PUBLIC KEYBUF ;keybuf used to enter MINDEX file spec
00032 PUBLIC LSTSIC ;
00033 PUBLIC LINENR ;
00034 PUBLIC MAPBP ;
00035 PUBLIC NAKMAP ;
00036 PUBLIC NKTMAP ;
00037 PUBLIC OFNAM ;output file name
00038 PUBLIC PARFOR ;paragraph format routine
00039 PUBLIC RECFOR ;record format routine
00040 PUBLIC MODE ;display or list mode
00041 PUBLIC WINSST ;no. of spaces for inset
00042 PUBLIC NXTRC ;absolute position of next record
00043 PUBLIC OFPCMD ;output file status (O, R or A)
00044 PUBLIC OFNAM ;output file name buffer
00045 PUBLIC OFSTAT ;output file status (Open or Closed)
00046 PUBLIC OMODE ;output mode (C or M)
00047 PUBLIC PROMDE ;print mode (C or M)
00048 PUBLIC PSOR ;pseudo BOR char (if para format then = ' '
00049 ; if rec. format then = 0DH)
00050 PUBLIC RECBUF ;record buffer (record found during search)
00051 PUBLIC SDMODE ;search-display mode
00052 PUBLIC SINSET ;storage for inset value
00053 PUBLIC SPWORD ;space or word
00054 ;-----
00055 ;public messages
00056 ;
00057 PUBLIC MSGOPF ;'End of File' msg
00058 PUBLIC SEAMSG ;'Searching' msg
00059 ;-----
00060 ;calls to MODII or MODIII
00061 ;position cursor to last line of screen
00062 EXTERN BOTTOM
00063 ;close file (DE->DCB)
00064 EXTERN CLOSE
00065 ;determine cursor pos (coor:BC)
00066 EXTERN CURPOS
00067 ;disable break (for Model II)
00068 EXTERN DISBRK
00069 ;divide A into HL
00070 EXTERN DIVIDE
00071 ;jp to TRSDOS and execute command
00072 EXTERN DOSCMD
00073 ;erase to end of line
00074 EXTERN ERASEL
00075 ;erase to end of screen
00076 EXTERN ERASES
00077 ;MAP error display routine
00078 EXTERN ERASDP
00079 ;TRSDOS error msg routine
00080 EXTERN ERROR
00081 ;position cursor to top line of screen
00082 EXTERN HOME
00083 ;initialise file (create/open, pos to list rec)
00084 EXTERN INIT ; ; (DE->DCB, HL->rec buf)
00085 ;
00086 ;jp to TRSDOS
00087 EXTERN JP2DOS
00088 ;get char (or null) from keyboard
00089 EXTERN KBCHAR
00090 ;initialise keyboard (Mod II)
00091 EXTERN KBLINI
00092 ;get line from keyboard and end with #3
00093 EXTERN KBLIN3
00094 ;get line from keyboard and end with 0DH
00095 EXTERN KBLINE
00096 ;wait for char from keyboard
00097 EXTERN KWAIT
00098 ;get search key(s) from keyboard
00099 EXTERN KEYIN
00100 ;move line from screen to buffer
00101 EXTERN MOVBLN ;HL->buf, D=no. char, BC=cursor coor
00102 ;role screen and pos cur to next to last line
00103 EXTERN NEWLN

```

```

00085 EXTERN OPEN ;open file (DE->DCB, HL->record buffer)
00086 EXTERN OPINIT ;open and initialize file
00087 ; (DE->DCB, HL->record buffer)
00088 EXTERN POSCUR ;position cursor (coordinates in BC)
00089 EXTERN POSEOF ;position to end of file
00090 EXTERN POSN ;position to record in file
00091 EXTERN PRINT ;initialise printer
00092 EXTERN PRLINE ;print line (HL->buf, B=no. char, C=end char)
00093 EXTERN PRSCR ;print entire screen
00094 EXTERN PRTLN ;print last line of text
00095 EXTERN PRTRC ;print current record
00096 EXTERN READR ;read file; direct access
00097 EXTERN READNK ;read next record in file
00098 EXTERN SCRPRO ;set scroll protect line (A=line no.)
00099 EXTERN SETILR ;set INLR to true last record
00100 EXTERN SETMLR ;set MAPLR to true last record
00101 EXTERN STMEM ;store top of memory in MEMEND
00102 EXTERN VDCHAR ;display char in A register
00103 EXTERN VDCLS ;clear screen
00104 EXTERN VINIT ;initialise video I/O (for Model II)
00105 EXTERN VLLINE ;display line (HL->buf)
00106 EXTERN WRITNK ;write next record to file
00107 ;-----
00108 ;MODII/III buffers and I/O parameters
00109 ;
00110 EXTERN INDCB ;input (source) file DCB
00111 EXTERN IDCBLR ;input file DCB Record Length
00112 EXTERN IDCBCR ;input file DCB Current Record
00113 EXTERN IDCBL ;input file DCB Last Record
00114 EXTERN INLRL ;true last record of source file
00115 EXTERN IDCBS ;input file DCB xxxxxxx
00116 EXTERN MAPDCB ;MAP (index) file DCB
00117 EXTERN MDCBLR ;Map file DCB Record Length
00118 EXTERN MDCBCR ;Map file DCB Current Record
00119 EXTERN MDCBL ;Map file DCB Last Record
00120 EXTERN MAPLRL ;true last record of index file
00121 EXTERN MDCBS ;Map file DCB xxxxxxx
00122 EXTERN MEMEND ;contents -top of memory
00123 EXTERN OUTCHR ;record buffer (1 byte) for output file
00124 EXTERN OUTDCB ;output file DCB
00125 EXTERN PRBUF ;printer buffer (88 char)
00126 EXTERN SORLN ;start of record line no.
00127 EXTERN STMAP ;start of MAP index file (always last byte
00128 ;of SEARCH program)
00129 ;
00130 ;I/O parameters:
00131 EXTERN ARROWD ;down arrow
00132 EXTERN ARROWL ;left arrow
00133 EXTERN ARROWR ;right arrow
00134 EXTERN ARROWU ;up arrow
00135 EXTERN BRKKEY ;break key value
00136 EXTERN CPTPOS ;copyright notice position (52 or 36)
00137 EXTERN FENLW ;next to last line on screen (23 or 15)
00138 EXTERN SWIDT ;screen width (88 or 64)
00139 ;-----
00140 ;calls to GR (general routines)
00141 ;
00142 ;
00143 EXTERN APPEND ;append on string to another
00144 EXTERN BXDEC ;binary to decimal conversion
00145 EXTERN DECB ;decimal to binary conversion
00146 EXTERN DLINL ;display dotted line (e.g. ....)
00147 EXTERN DSPBR5 ;display 5-digit decimal no. (right justified)
00148 EXTERN DSPBR1L ;display 5-digit decimal no. (left justified)
00149 EXTERN GETM3 ;remove leading blanks
00150 EXTERN HFILE ;move cmd line file psec to KEYBUF
00151 EXTERN GETM3FN ;get MAP file names
00152 EXTERN LINE ;display line (from char in A reg)
00153 EXTERN PACKFS ;pack (compress) file spec in fixed table
00154 EXTERN PARSEP ;parse one file spec
00155 EXTERN RC3 ;zero-out 256-byte record
00156 EXTERN RECL ;blank-out 256-byte record
00157 EXTERN TAPENT ;'Tap enter to continue'
00158 ;-----
00159 ;GR buffers
00160 ;
00161 EXTERN SNAM,SEXT,SPW,SDOR ;source file table
00162 EXTERN ISAM,TEXT,IPW,IDDR ;index file table
00163 EXTERN ONAM,OXET,OPW,OODR
00164 ;-----
00165 ;calls to S3DSP display routines
00166 ;
00167 ;
00168 EXTERN BYUPDN ;bypass up-down switch
00169 EXTERN LIST ;list routine
00170 EXTERN DSP ;display current record on CRT
00171 ;-----
00172 ;calls to S3OPT options routine
00173 ;

```

Listing 9 continued

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Listing 9 continued

```

00174      EXTERN OPT      ;options routine
00175      ;-----
00176      ;calls to $3OPEN open files
00177      ;-----
00178      EXTERN GETFILE    ;get file spec, open files and
00179      ;then load index into memory
00180      ;-----
00181      ;SEARCH main segment
00182      ;syntax:
00183      ;SEARCH src file,ind file,out file;options
00184      ;options:
00185      ; T=return to TRSDOS or M=return to MAP
00186      ; M is default
00187      ;HL=cmd line buffer
00188      ;save while top of memory is found and
00189      ;break is disabled
00190      ;set memory end (as many sig sectors as
00191      ;possible will be stored in memory from
00192      ;end of program to top of memory)
00193      ;disable break on Mod II
00194      ;HL=cmd line buffer
00195      ;get cmd line file spec if any
00196      ;load file spec into KEYBUF
00197      ;if file spec present LD CMDLFS with 'Y'
00198      ;-----
00199      LD A,#
00200      CALL SCRPRO        ;no subwindow
00201      CALL VDCLS        ;erase screen
00202      LD HL,TITLE       ;point to title
00203      CALL VDLIN        ;display title
00204      LD BC,CYPOS       ;copyright notice coordinates (Mod II/III)
00205      CALL POSCUR       ;r1:c52 Model II, r1:c Model III
00206      LD HL,CYMSG       ;point to copyright notice
00207      CALL VDLIN        ;display copyright notice
00208      LD BC,1*256
00209      CALL POSCUR       ;r1:c1
00210      LD A,'-'         ;select '-' char for LINE routine
00211      CALL LINE         ;draw dashed line under title
00212      ;-----
00213      ;initialize variables:
00214      LD A,'M'
00215      LD (BYUPDN),A    ;do not bypass pause after displaying
00216      ;a record
00217      LD A,'R'         ;initial search dsp mode = record
00218      LD (SDMODE),A    ;initialize search dsp mode
00219      LD A,'M'         ;initial print mode = manual
00220      LD (PRMODE),A   ;initial output mode = manual
00221      LD (OMODS),A
00222      ;-----
00223      ;GETFSP
00224      ;get file spec, open files and
00225      ;then load index into memory
00226      ;-----
00227      ;MASTLP
00228      ;master loop
00229      ;after each search the program returns
00230      ;to this point
00231      MASTLP LD A,#
00232      LD (EOP),A      ;set EOP=0 (i.e. not end of file)
00233      CALL HOME       ;r1:c1
00234      CALL ERASEL     ;erase line
00235      LD HL,MSGKEY    ;'Enter Key'
00236      CALL VDLIN
00237      LD BC,10
00238      CALL POSCUR
00239      LD HL,CFIL     ;current source file name
00240      CALL VDLIN     ;display current file
00241      LD A,3
00242      CALL SCRPRO     ;set scroll protect at value in A
00243      LD BC,2*256
00244      CALL POSCUR
00245      LD A,'-'
00246      CALL LINE      ;select '-' char for LINE routine
00247      LD A,'-'
00248      CALL GETKEY    ;get key(a)
00249      CP BRKKEY     ;was break entered?
00250      JP NE,CALSYN  ;jp to CLASYN if break not entered
00251      CALL MSHW2    ;call mini-menu
00252      CP 'C'        ;change file spec?
00253      JP Z,GETFSP  ;loop back and get file spec
00254      CP 'O'        ;options?
00255      JP Z,GETFSP  ;loop back and get search key
00256      CP 'M'        ;MAP?
00257      JP Z,DOSCMD  ;jp to MAP
00258      CP 'T'        ;TRSDOS?
00259      JP Z,TRSDOS  ;jp to TRSDOS
00260      CP 'R'        ;loop back and get search key
00261      JP Z,MAP     ;check syntax of search key
00262      CALSYN CALL SYNTAX
00263      CP #         ;improper syntax
00264      JP Z,MAP     ;try again if improper
00265      CALL HSHKEY  ;hash search key
00266      ;-----
00267      FIND2 CALL SEAMSG ;display 'Searching' msg
00268      LD HL,        ;start at 1 since header = 0
00269      LD (CMSEC),HL ;current map sector = 1
00270      LD HL,STMAP   ;HL-> start of index in memory
00271      LD (NXTMAP),HL ;(NXTMAP) -> 1st map sec
00272      LD IX,#000H  ;IX -> 1st input sec
00273      CALL NDWLN
00274      ;-----
00275      FIND4 NOP
00276      CALL KCHAR     ;next op stored in NXTOP
00277      CP BRKKEY     ;checks for break
00278      ;<break?
00279      JP Z,MASTLP  ;jp to start of loop if break
00280      LD HL,HSBUP   ;HL -> HSBUP (search key signature buf)
00281      LD A,255
00282      LD (TBYTE),A ;set TBYTE = 255
00283      LD A,#
00284      LD (TBYTE),A
00285      LD A,253
00286      LD (NXTOP),A ;and
00287      LD C,#
00288      ;first length = 0
00289      ;-----
00289      FIND4P LD IV,(NXTMAP) ;IV-> byte 0 map sector
00290      LD A,(HL)       ;A(i) = hashcode(i)
00291      CP 253
00292      JR Z,SXNXTOP  ;and op?
00293      CP 254
00294      JR Z,SXNXTOP  ;or op?
00295      FIND4P NOP
00296      SNXTOP LD D,A
00297      LD A,(NXTOP)  ;D has future oper
00298      LD E,A        ;E has current oper
00299      LD A,D
00300      LD (NXTOP),A ;store NXTOP
00301      LD A,D
00302      CP 253
00303      AND Z         ;check future oper
00304      JP Z,FDAND   ;and?
00305      CP 254
00306      JR F,FOOR    ;or?
00307      FDAND NOP
00308      FIND4P NOP
00309      FDOR LD A,(TBYTE)
00310      LD B,A
00311      LD A,(TBYTE) ;B has TBYTE
00312      OR B
00313      LD (TBYTE),A ;or TBYTE with TBYTE
00314      LD A,255
00315      LD (NXTOP),A ;save new TBYTE
00316      LD A,(TBYTE),A
00317      LD (TBYTE),A ;reinit (TBYTE)
00318      FIND4P LD D,#
00319      LD E,A
00320      ADD IV,DE
00321      LD A,(TBYTE) ;HSBUP byte not op
00322      AND (IV+#)    ;see if bit pattern
00323      LD (TBYTE),A ;present in current sec
00324      FIND4P INC C ;and TBYTE with HSB byte
00325      LD A,(TBYTE),A ;save new value
00326      INC C         ;inc length counter

```

```

00325      LD A,(WDLEN) ;has (WDLEN) been reached
00326      CP C
00327      JP Z,FIND4K
00328      INC HL
00329      JP FIND4F
00330      ;-----
00331      FIND4K NOP
00332      LD A,(TBYTE) ;end of map sector search
00333      LD D,A
00334      LD A,(TBYTE)
00335      OR D
00336      JP FIND4T
00337      LD A,D
00338      OR E
00339      FIND4T CP #
00340      JP Z,NOKEY
00341      LD (TBYTE),A ;key found, save (TBYTE)
00342      JP FIND6
00343      NOKEY INC IX
00344      INC IX ;no key in MAP sector
00345      INC IX ;so bump source file pointer 8 sectors
00346      INC IX
00347      INC IX
00348      INC IX
00349      INC IX
00350      INC IX
00351      JP FIND8
00352      ;-----
00353      ;-----
00354      ;-----
00355      ;-----
00356      ;-----
00357      ;-----
00358      ;-----
00359      FIND6 NOP
00360      ; CALL KBRK
00361      ; JP NE,MASTLP
00362      LD A,#
00363      LD (BICT),A ;BICT = current bit being scanned
00364      FIND6D LD A,(TBYTE)
00365      LD RRCA
00366      LD (TBYTE),A ;move bit into carry
00367      JP NC,FIND6L ;if bit = 0, don't search sector
00368      CALL GETSEC ;get sector and search it for key(s)
00369      CP BRKKEY ;<break?
00370      JP Z,MASTLP ;abort search if <break> pressed
00371      FIND6L INC IX ;bump input rec #
00372      LD A,(BICT)
00373      CP 7
00374      JP Z,FIND8 ;have all 8 sectors been checked?
00375      INC A
00376      LD (BICT),A ;jp if all 8 sectors checked
00377      JR FIND6D ;increment bit count
00378      ;loop until all 8 sectors checked
00379      ;-----
00380      ;-----
00381      ;-----
00382      FIND8 LD HL,(NXTMAP)
00383      LD DE,256
00384      ADD HL,DE
00385      LD (NXTMAP),HL ;next map sector in memory bumped by 1 sector
00386      LD DE,(MAXMAP) ;store result
00387      XOR A
00388      LD DE,SBK
00389      JP F,FIND10 ;check if NXTMAP > MAXMAP
00390      JR Z,FIND10
00391      LD HL,(CMSEC) ;next map sector still in memory
00392      INC HL ;HL -> current MAP sector
00393      LD (CMSEC),HL ;inc CMSEC
00394      LD (CMSEC),HL
00395      JP FIND4 ;loop and search next 8 arc file sectors
00396      ;-----
00397      ;-----
00398      ;-----
00399      ;-----
00400      FIND10 LD HL,(CMSEC) ;required MAP sector not in memory
00401      LD DE,(MAPLLR) ;HL -> current MAP sector on disk
00402      XOR A ;DE = last sector in MAP file
00403      SEC
00404      JP P,FIND12 ;end of search if CMSEC > MAPLLR
00405      LD Z,FIND12 ;end of search if CMSEC = MAPLLR
00406      LD HL,(CMSEC)
00407      INC SL
00408      LD (CMSEC),HL ;bump current sec no.
00409      LD RDNSEC
00410      LD HL,MAPBUF ;read MAP sector pointed to by CMSEC
00411      LD DE,(MAXMAP) ;transfer from MAPBUF to MAXMAP position
00412      LD BC,256
00413      LD LR
00414      LD LR,(MAXMAP) ;move next sec to top of MAP
00415      LD HL,(NXTMAP),HL ;NXTMAP -> next MAP sector in memory
00416      LD (NXTMAP),HL ;loop and search next 8 sectors
00417      JP FIND4
00418      ;-----
00419      ;-----
00420      FIND12 JP MASTLP ;end of search
00421      ;-----
00422      ;-----
00423      ;-----
00424      ;-----
00425      ;-----
00426      ;-----
00427      GETKEY LD BC,1*256+0
00428      CALL POSCUR ;r2:c1
00429      CALL ERASEL ;erase to end of line
00430      LD B,60 ;max key length = 60
00431      LD HL,KEYBUF ;HL->search key buffer
00432      CALL KEYIN ;keyin routine for search key
00433      CP BRKKEY ;was break key pressed?
00434      JP NE,GKEY1
00435      LD BC,3*256 ;break was pressed
00436      CALL POSCUR ;r4:c1
00437      CALL ERASES ;erase to end of screen
00438      LD A,BRKKEY ;A returns with break key value
00439      RET
00440      ;-----
00441      ;-----
00442      GKEY1 LD HL,KEYBUF ;convert upper case letters to lower case
00443      LD A,(HL) ;get char from search key
00444      CP 80H ;EOR?
00445      JR Z,GKEY8 ;exit loop if end of search key
00446      CP 51
00447      JP Z,GKEY4 ;'A'
00448      JP P,GKEY4 ;needed?
00449      CP 65 ;'A'
00450      JP M,GKEY4 ;bypass if < 'A'
00451      OR 32 ;convert to lower case
00452      LD (HL),A ;overwrite upper case with lower case
00453      GKEY4 INC HL
00454      JR GKEY2 ;loop until EOR
00455      GKEY8 LD HL,#
00456      LD (LLRN),HL ;init (LLRN)=0
00457      LD BC,3*256
00458      CALL POSCUR ;r4:c1
00459      CALL ERASES ;erase to end of screen
00460      LD A,BDH ;return with A = EOR
00461      RET
00462      ;-----
00463      ;-----
00464      ;-----
00465      ;-----
00466      ;-----
00467      ;-----
00468      ;-----
00469      ;-----
00470      ;-----
00471      ;-----
00472      ;-----
00473      ;-----
00474      ;-----
00475      SYNTAX LD HL,KEYBUF ;check search key(s) for proper syntax
00476      LD C,# ;KEYIN routine stores
00477      LD A,# ; + operator as 253
00478      LD A,254 ; operator as 254
00479      LD A,# ;each key must be 3 or more char long
00480      LD A,# ;entry: no parameters passed
00481      LD A,# ;exit: A = validity of key(s)
00482      LD A,# ; A = 0, bad key; A = 1 proper key(s)
00483      LD A,# ;reg altered: AF, BC, DE, HL
00484      LD A,# ;HL-> search key buffer
00485      LD A,# ;C = key length (init to 0)

```

Listing 9 continued

Listing 9 continued

```

00476 SYNLP LD A,(HL) ;get char from search key buffer
00477 INC HL ;pt to next char in search key buffer
00478 CP 0DH ;EOR? (end of search key?)
00479 JP Z,SYNEND ;exit loop if end of key
00480 CP 253 ;and?
00481 JR Z,SYNOP
00482 CP 254 ;or?
00483 JR Z,SYNOP
00484 INC C ;valid char so bump key length count
00485 JR SYNLP ;loop until end of key reached
00486 SYNOP LD A,3 ;key terminated by operand
00487 CP C ;was key >= 3?
00488 JR Z,SYNRST ;key len = 3, so get next key
00489 JP M,SYNRST ;key len > 3 so get next key
00490 SYNER LD BC,3*256 ;syntax error (key < 3 char)
00491 CALL POSCUR ;:4:c1
00492 CALL ERASES ;erase to end of screen
00493 LD HL,THREE ;Each key must be three or more char*03
00494 CALL VDLINE ;Tap enter to continue
00495 CALL TAPENT
00496 LD A,0
00497 RET
00498 LD A,3 ;A=0 => bad syntax
00499 SYNEND CP C ;see M3 (index program) for hash algo.
00500 JR Z,SYNRST ;check that last key >= 3
00501 JP M,SYNRST ;len = 3
00502 JR SYNER ;len > 3
00503 SYNRET LD A,1 ;key < 3 so jp to error msg
00504 RET ;A=1 => proper syntax
-----
00506 ;HASHKEY
00507 ;-----
00508 ;hash search key
00509 ;search key in KEYBUF
00510 ;triplet hash codes stored in HSHBUF
00511 ;see M3 (index program) for hash algo.
00512 ;entry: no parameters passed
00513 ;exit: len of hsh code stored in WDLN
00514 ;reg altered: AF, BC, DE, HL, IX, IY
00515 HSHKEY LD C,0 ;C = key len
00516 LD IY,HSHBUF ;IY -> search key signature buffer
00517 LD IX,KEYBUF ;IX -> search key buffer
00518 HSH3 LD L,(IX+0) ;get char from search key
00519 LD H,0 ;HL contains char
00520 LD A,L
00521 CP 0DH ;end of string?
00522 JP Z,HSH8 ;if EOP then end hashing
00523 ;blank?
00524 JR NZ,HSH4 ;continue at HSH if not blank
00525 INC IX ;pt to next char
00526 JR HSH3 ;loop until non-blank char reached
00527 ;now get first 2 char of key.
00528 HSH4 CALL MURL10 ;mult value in HL by 10
00529 LD L,(IX+0) ;store in MBYTE
00530 INC IX ;pt to next char in search key
00531 LD L,(IX+0)
00532 LD H,0 ;store value of char in LBYTE
00533 LD L,(LBYTE),HL ;store in MBYTE
00534 INC IX ;pt to next char in search key
00535 ;-----
00536 ;HSHLP
00537 ;-----
00538 ;get triplet and hash it
00539 HSHLP LD A,(MBYTE) ;get 10ac2
00540 CALL HL18 ;mult by 10
00541 LD A,(MBYTE),HL ;store 10ac1
00542 ;-----
00543 LD HL,(LBYTE) ;get ac3
00544 CALL MURL10 ;mult by 10
00545 LD A,(MBYTE),HL ;store 10ac2
00546 ;-----
00547 LD A,(IX+0) ;get char (cl) from search key
00548 INC IX ;inc IX to next char
00549 CP 0DH ;EOR?
00550 CP Z,HSH8
00551 CP Z,HSH3 ;skip 3 hashes
00552 JP Z,HSH5 ;and op?
00553 CP 253
00554 JR Z,HSH5 ;or op?
00555 CP 254
00556 JR Z,HSH5
00557 JR HSH6
00558 HSH5 LD (IX+0),A ;store op in hash buffer
00559 INC IX ;pt to next byte in hash buffer
00560 INC C ;inc hash buf len counter
00561 JP HSH3 ;loop until end of search key
00562 ;-----
00563 ;HSH6
00564 ;-----
00565 ;hash triplet
00566 HSH6 LD L,A
00567 LD H,0 ;(LBYTE),HL
00568 LD DE,(MBYTE),HL
00569 ADD HL,DE ;10ac2+ac3
00570 LD DE,(PBYTE),HL
00571 ADD HL,DE ;10ac1 + (10ac2+ac3)
00572 LD A,251
00573 LD A,251
00574 CALL DIVIDE ;A has modulo 251 result
00575 LD (IX+0),A ;store hash code
00576 INC C ;inc hash code len
00577 INC IY
00578 JP HSHLP ;loop until end of search key(s)
00579 ;-----
00580 ;HSH8
00581 ;-----
00582 HSH8 LD A,C ;hashing complete
00583 LD (WDLN),A ;save hash len
00584 RET
-----
00585 MUAL10 NOP ;mult # in A by 10
00586 ;BC and DE used
00587 ;value returned in HL
00588 LD H,0
00589 LD L,A
00590 MURL10 NOP ;multiply # in HL by 10
00591 ADD HL,HL ;HL contains 2*no.
00592 LD E,L
00593 LD D,E
00594 LD D,E
00595 ADD HL,HL ;4
00596 ADD HL,HL ;8
00597 ADD HL,DE ;10
00598 RET
-----
00600 ;GETSEC
00601 ;-----
00602 ;get sector from source file
00603 ;entry: no para
00604 ;exit: sector from disk in INBUF
00605 ;reg altered: AF,BC,DE,HL
00606 GETSEC LD HL,INBUF ;pt to source file rec buf
00607 DEC HL ;HL-last char of record before INBUF
00608 LD A,(HL) ;last byte of SINBUF
00609 LD (B256),A ;save this byte for analysis of records
00610 ;that span sector
00611 PUSH IX ;BC -> input rec to read
00612 POP BC ;store current LRN
00613 LD (CLRN),BC ;read two sectors from src file
00614 CALL READ2
00615 CALL SECTOR
00616 RET
-----
00617 ;SECTOR
00618 ;-----
00619 ;searches records in sector for key(s)
00620 ;starts with remaining rec in SINBUF
00621 ;and reads across into INBUF
00622 SECTOR CALL NEWSEC
00623 LD (LLRN),DE
00624 INC DE
00625 LD HL,(CLRN)
00626

```

```

00628 LD (LLRN),HL ;CLRN will be next LLRN
00629 DE,HL ;is this needed??
00630 LD B,A
00631 XOR A ;carry = 0
00632 LD A,B ;restore A
00633 SBC HL,DE
00634 JP NZ,SECLP3
00635 LD A,(B256)
00636 CP 0DH ;EOR?
00637 CP Z,SECLP3 ;if EOR then read lat rec
00638 CP 0DH ;'
00639 JR Z,SECLP3 ;if EOR then read lat rec
00640 SECLP CALL RESTSC
00641 SECLP3 CP 0 ;
00642 JP Z,ENDSEC
00643 CALL SK ;scan for keys
00644 LD A,(HIT)
00645 CP 0 ;check if key found
00646 JR Z,SECLP ;loop until key found
00647 SECLP4 NOP
00648 SECLP6 LD HL,RE'BUF
00649 CALL DSP ;display record
00650 CP BRKKEY ;<break>?
00651 JP Z,ENDSEC ;RET if break
00652 CP '1' ;list cmd?
00653 JR NZ,SECLP ;list routine
00654 CALL LIST
00655 CP BRKKEY ;list routine
00656 RET ;no dotted line if brk
00657 CALL NEWLN
00658 CALL DLN
00659 CALL NEWLN
00660 ENDSEC RET
-----
00661 ;NEWSEC
00662 ;-----
00663 ;transfers logical rec from SINBUF to RECBUF
00664 ;entry: NXTREC = byte in SINBUF that is start
00665 ; of next logical rec
00666 ;exit: A=0 no more records
00667 ; A=1 more logical records
00668 ; NXTREC = byte in SINBUF that is start
00669 ; of next log rec
00670 ;reg altered: AF,BC,DE,HL
00671 ;next sector so NXTREC -> start of SINBUF
00672 NEWSEC LD HL,SINBUF
00673 LD (NXTREC),HL ;HL->RECBUF
00674 LD DE,RECBUF
00675 JR SKIP
00676 RESTSC LD HL,INBUF
00677 LD DE,(NXTREC)
00678 OR A ;set carry = 0
00679 SBC HL,DE
00680 JP M,NOMORE ;no more rec in pt'd sec
00681 JP Z,NOMORE
00682 LD HL,(NXTREC)
00683 LD DE,RECBUF
00684 ;
00685 SKIP LD BC,0 ;skip remainder of char in record
00686 NNWSCP LD A,(HL) ;New Sector Loop
00687 CP 0DH
00688 JP Z,NWSCP8
00689 CP 254
00690 CP Z,NWSCP8
00691 LD (DE),A ;transfer char from SINBUF to RECBUF
00692 LD BC ;inc char count (# of char moved to RECBUF)
00693 INC A,254 ;record length max reached?
00694 CP 255 ;EOR if record >= 255 char
00695 JR DE ;pt to next char in RECBUF
00696 INC HL ;pt to next char in SINBUF
00697 JR NNWSCP ;loop until EOR found
00698 ;
00699 NWSCP8 CP 0DH ;end of record
00700 JP Z,NWSCP4
00701 CP 254
00702 CP Z,NWSCP4
00703 LD A,(PSPOR)
00704 LD A,(PSPOR)
00705 CP 0DH
00706 CP Z,NWSCP4
00707 LD A,' '
00708 LD (DE),A
00709 INC DE
00710 NWSCP4 LD A,0DH
00711 LD (DE),A
00712 INC HL
00713 LD (NXTREC),HL
00714 LD A,1 ;1 -> more record SHOULD THIS BE 10H??
00715 RET
00716 NOMORE LD A,0 ;# -> no more record
00717 RET
-----
00718 ;SK
00719 ;-----
00720 ;search rec in RECBUF for key(s)
00721 ;entry: no para
00722 ;exit: HIT=1 if key(s) found
00723 ; HIT=0 if key(s) not found
00724 ;reg altered: AF,DE,HL
00725 ;calls: GTRYWD,INSTR,SKTOOR
00726 SK LD HL,KEYBUF
00727 LD (NXTKEY),HL ;(NXTKEY) -> start KEYBUF
00728 LD A,1 ;init (HIT) = 1
00729 LD (HIT),A
00730 LD A,0
00731 LD (ENDKEY),A ;init (ENDKEY)=0
00732 LD (OPER),A ;init (OPER) #and
00733 LD (NXTOP),A ;init (NXTOP) #and
00734 ;
00735 SK2 CALL GTRYWD ;get 1 key word from search key
00736 CALL INSTR ;search for 1 key word
00737 LD D,A ;temp store result in D
00738 LD A,(OPER) ;OPER stores type of oper
00739 CP 1 ;or op?
00740 AND D ;and operation
00741 LD (HIT),A ;D = (HIT) from INSTR
00742 AND D ;(HIT) updated
00743 LD (HIT),A
00744 JP SK4
00745 SKOR LD A,(HIT)
00746 OR D ;D = (HIT) from INSTR
00747 LD (HIT),A ;(HIT) updated
00748 ;
00749 SK4 LD A,(NXTOP)
00750 LD (OPER),A ;op bumped
00751 LD A,(ENDKEY)
00752 CP 1 ;end of keys?
00753 JP Z,SKEND ;jp if end of keys
00754 LD A,(HIT)
00755 CP 1 ;is HIT still true?
00756 JR NZ,SK7 ;HIT=1
00757 LD A,(NXTOP) ;is next (OPER) = or?
00758 CP 1 ;if so jp to end
00759 JR Z,SKEND ;else check next key
00760 JP SK2
00761 ;-----
00762 ;SK7
00763 ;-----
00764 ;HIT = 0 (search key not found)
00765 ;skip to next "or"
00766 ;operator in search key or
00767 ;end of search key
00768 SK7 LD A,(OPER) ;HIT=0; is next op = or?
00769 CP 1 ;is next op = "or"?
00770 JP Z,SK2 ;if "or" continue search
00771 CALL SKTOOR ;skip until "or" op or
00772 ;end of search key found
00773 CP 0 ;end of search key?
00774 JR Z,SKEND ;if end of search key jp to SKEND
00775 ;loop until end of search key
00776 SKEND RET ;end of record search
00777 ;A=0 no or; A=1 or found
00778 ;(NXTKEY) set if A=1
00779 ;-----

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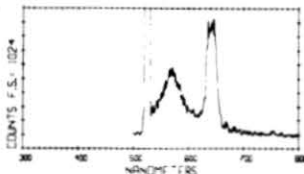
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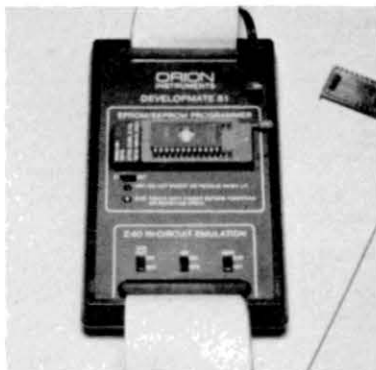
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Listing 9 continued

```

00788      ;GTKYWD
00781      ;-----
00782      ;get next key word from search key
00783      ;entry: HXTKEY=stact of next key word
00784      ;exit: ENDKEY=1 if end of search key
00785      ;       ENDKEY=0 if more key words in
00786      ;       search key
00787      ;req altered: AF,DE,HL
00788      ;HL -> next key to read
00789      ;DE -> word buffer
00790      NTCHAR LD HL,(NXTKEY)
00791      LD DE,KEY
00792      CP A,(HL)
00793      CF BDH
00794      JP Z,BOKEYS
00795      CP 253
00796      JP Z,ANDEND
00797      CP 254
00798      JP Z,OREND
00799      LD (DE),A
00800      INC HL
00801      INC DE
00802      JR NTCHAR
00803      ;loop until end of keyword
00804      ANDEND INC HL
00805      LD (NXTKEY),HL
00806      LD A,BDH
00807      LD (DE),A
00808      LD (NXTOP),A
00809      LD A,1
00810      RET
00811      OREND INC HL
00812      LD (NXTKEY),HL
00813      LD A,BDH
00814      LD (DE),A
00815      LD A,1
00816      LD (NXTOP),A
00817      RET
00818      BOKEYS LD (DE),A
00819      LD A,1
00820      LD (ENDKEY),A
00821      RET
00822      ;-----
00823      ;SKTOOR
00824      ;-----
00825      ;skip to "or" operator
00826      ;bypasses keywords that are "anded"
00827      ;entry:
00828      ;exit: NHTKEY=next key word in search key
00829      ;       OPER=1 if "or" op found
00830      ;       OPER=0 if end of search key
00831      ;exit points: SKT6,SKT8
00832      ;req altered: AF,DE,HL
00833      ;calls: none
00834      SKTOOR LD HL,(NXTKEY)
00835      LD A,(HL)
00836      CP BDH
00837      JP Z,SKT4
00838      CP 254
00839      JR Z,SKT6
00840      INC HL
00841      JR SKT2
00842      SKT4 LD A,0
00843      SKT5 RET
00844      SKT6 LD A,1
00845      INC HL
00846      LD (NXTKEY),HL
00847      LD A,1
00848      LD (OPER),A
00849      SKT8 RET
00850      ;-----
00851      ;INSTR
00852      ;-----
00853      ;search RECORD for key
00854      ;entry: no parm passed
00855      ;exit: A=1 keyword found
00856      ;       A=0 keyword not found
00857      ;req altered: AF,BC,DE,HL
00858      INSTR LD HL,RECBUF
00859      LD HL,HL
00860      LD DE,KEY
00861      LD C,0
00862      MFP NOP
00863      LD A,(DE)
00864      LD B,A
00865      LD A,(HL)
00866      CP 91
00867      JP P,COE
00868      JP Z,COE
00869      CP 65
00870      JP M,NOTUC
00871      OR JZ
00872      JP COE
00873      NOTUC CP BDH
00874      JP Z,NOFIND
00875      COE CP B
00876      JP Z,CMATCH
00877      JP RESET
00878      CMATCH INC C
00879      INC HL
00880      INC DE
00881      LD A,(DE)
00882      CP BDH
00883      JP Z,FOUND
00884      MFP MFP
00885      RESET LD DE,KEY
00886      POP HL
00887      INC HL
00888      PUSH HL
00889      LD C,B
00890      JP MFP
00891      FOUND POP HL
00892      LD A,1
00893      RET
00894      NOFIND POP HL
00895      LD A,0
00896      RET
00897      ;-----
00898      ;READ2
00899      ;-----
00900      ;reads 2 sectors from src file
00901      ;necessary to read 2 since record may
00902      ;span sectors
00903      ;entry: BC-> 1st sector to read
00904      ;exit:
00905      READ2 LD DE,INDCB
00906      CALL READ2B
00907      PUSH BC
00908      LD HL,INBUF
00909      LD DE,SINBUF
00910      LD BC,256
00911      LDIR
00912      ;
00913      LD A,(EOF)
00914      CP Z
00915      JR NZ,READ2D
00916      LD HL,INBUF
00917      CALL RECB
00918      LD HL,INBUF
00919      LD (HL),BDH
00920      POP BC
00921      RET
00922      ;
00923      READ2D POP BC
00924      INC BC
00925      CALL REDIN0
00926      RET
00927      ;
00928      REDIN0 LD DE,INDCB
00929      CALL READDR
00930      PUSH AF
00931      JP Z,REDOK2

```

```

00932      CP Z
00933      JP NZ,ERROR
00934      JR REDOK2
00935      ;
00936      READIN LD DE,INDCB
00937      CALL READDR
00938      REDIN5 PUSH AF
00939      JR Z,REDOK
00940      CP Z
00941      JP NZ,ERROR
00942      REDOK CALL DSPSNR
00943      REDOK2 LD HL,(INDCBR)
00944      LD DE,(INLDR)
00945      A
00946      SRC HL,DE
00947      JP NZ,READRT
00948      ;
00949      LD A,(INDCBR)
00950      CP 0
00951      JP Z,REDIN0
00952      LD HL,INBUF
00953      D,0
00954      LD E,A
00955      ADD HL,DE
00956      LD E,A
00957      LD A,255
00958      SUB E
00959      INC A
00960      LD E,A
00961      REDIN7 LD A,' '
00962      LD (HL),A
00963      LD A,E
00964      CP 0
00965      JP Z,REDIN0
00966      DEC E
00967      INC HL
00968      JP REDIN7
00969      REDIN0 LD HL,INBUF
00970      LD (HL),BDH
00971      DEC HL
00972      LD (HL),BDH
00973      ;
00974      LD A,1
00975      LD (EOF),A
00976      READRT POP AF
00977      RET
00978      ;-----
00979      ;RDMSEC
00980      ;-----
00981      ;read MAP sector
00982      ;entry:
00983      ;exit:
00984      RDMSEC PUSH BC
00985      PUSH HL
00986      POP BC
00987      LD DE,MAPDCB
00988      CALL READDR
00989      POP BC
00990      RET
00991      RET Z
00992      PUSH AF
00993      LD HL,EDMSG
00994      CALL VDLIN
00995      POP AF
00996      JP ERROR
00997      ;-----
00998      ;RDMSG
00999      ;-----
01000      RDMSG DEFB 'Error while reading MAP index file'
01001      DEFB BDH
01002      ;-----
01003      ;OUTREC
01004      ;-----
01005      ;output record
01006      OUTREC LD A,(OFSTAT)
01007      CP 'C'
01008      RET Z
01009      LD (TBC),BC
01010      LD (TDE),DE
01011      LD (THL),HL
01012      CALL CURPOS
01013      LD (CURSOR),BC
01014      LD B,0
01015      LD C,55
01016      CALL POSCUR
01017      HL,OUTMSG
01018      CALL VDLIN
01019      LD BC,(CURSOR)
01020      CALL POSCUR
01021      OUTR4 PUSH HL
01022      LD A,(HL)
01023      LD (OUTCHR),A
01024      LD HL,OPCHR
01025      LD DE,OUTDCB
01026      CALL WRITX
01027      JR NZ,OUTR6
01028      POP HL
01029      LD A,(HL)
01030      CP BDH
01031      JP Z,OUTR7
01032      INC HL
01033      JR OUTR4
01034      ;
01035      OUTR6 POP HL
01036      CALL NEWLN
01037      CALL ERMSG
01038      CALL NEWLN
01039      CALL TAPENT
01040      LD DE,OUTDCB
01041      CALL CLOSE
01042      LD A,'M'
01043      LD (OMODE),A
01044      LD A,'C'
01045      LD (OFSTAT),A
01046      OUTR7 NOP
01047      CALL CURPOS
01048      LD (CURSOR),BC
01049      LD B,0
01050      LD C,55
01051      CALL POSCUR
01052      CALL ERASEL
01053      LD BC,(CURSOR)
01054      CALL POSCUR
01055      LD BC,(TBC)
01056      LD DE,(TDE)
01057      LD HL,(THL)
01058      ;
01059      OUTMSG DEFB 'Outputting'
01060      DEFB 3
01061      TBC DEFB 0
01062      TDE DEFB 0
01063      THL DEFB 0
01064      ;-----
01065      ;BACKSP
01066      ;-----
01067      ;backsp 1 sector in source file
01068      BACKSP PUSH DE
01069      PUSH HL
01070      LD HL,(INDCBR)
01071      LD A,L
01072      CP 0
01073      JP NZ,FFOSNI
01074      CP H
01075      JP Z,FFOSI
01076      FPOSNI DEC HL
01077      LD HL,(INDCBR),HL
01078      FPOSI POP HL

```

Listing 9 continued

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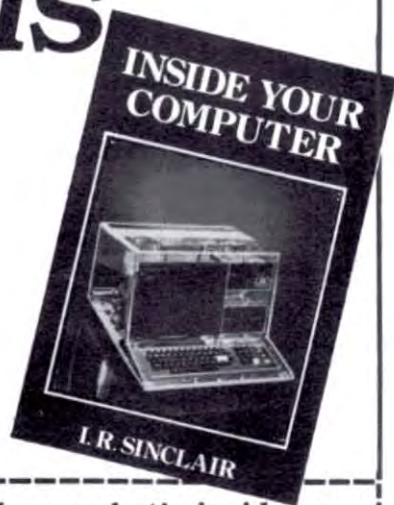
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Listing 9 continued

```

01078 CALL DSPSNR
01079 POP DE
01080 RET
-----
01081 ;SEAMSG
01082 ;SEAMSG
01083 ;display 'Searching' msg
SEAMSG PUSH DE
01084 PUSH HL
01085 CALL HOME ;r1:c1
01086 LD HL,MSGSEA ;'Searching'03
01087 CALL VDLINE
01088 CALL NEWLN
01089 POP HL
01090 POP DE
01091 RET
-----
01092 ;MENU2
01093 ;mini-menu routine
01094 ;r1:c1
MENU2 CALL HOME
01095 MENU2B LD HL,MSGM2
01096 CALL VDLINE
01097 CALL KBWAIT
01098 RES A
01099 CP 'C'
01100 RET Z
01101 CP 'O'
01102 JP Z,M2OPT
01103 CP 'T'
01104 JP Z,M2CMD
01105 CP 'M'
01106 JP Z,M2CMD
01107 LD A,'O'
01108 RET ;return to Enter Key
M2CMD PUSH AF
01109 LD A,(OFSTAT)
01110 CP 'C'
01111 JP Z,M2CMD3
01112 LD DE,OUTDCB
01113 CALL CLOSE ;close output file
M2CMD3 CALL VDLINIT
01114 CALL VDCLS
01115 POP AF
01116 CP 'T'
01117 RET Z
01118 LD HL,NAPCMD
01119 RET ;A = 'M' so set up buffer
M2OPT NOP
01120 CALL OPT ;options
01121 LD A,'O'
01122 RET
-----
OPNOUT NOP ;open output file
01123 LD A,(OFSTAT)
01124 CP 'O'
01125 RET Z
01126 LD DE,OUTDCB
01127 LD HL,OUTBUF
01128 LD B,1
01129 CALL OPINIT
01130 JP Z,OPOUT4
01131 PUSH AF
01132 LD B,PENULN ;error in opening file
01133 LD C,B
01134 CALL POSCUR ;error msg on penultimate line
01135 POP AF
01136 CALL ERRDSP
01137 CALL BOTTOM ;tap ent msg on bottom line
01138 CALL TAPENT
01139 LD A,'C'
01140 LD (OFSTAT),A
01141 RET
OPOUT4 LD A,'O'
01142 LD (OFSTAT),A
01143 RET
-----
PARFOR NOP ;paragraph format
01144 LD A,2EH
01145 LD HL,CP2E2
01146 INC HL
01147 LD (HL),A
01148 LD HL,CP2E4
01149 INC HL
01150 LD (HL),A
01151 LD (PSEOR),A
01152 LD A,'L'
01153 LD (SDMODE),A ;display mode = line
01154 LD HL,MSGPF
01155 LD VDLINE
01156 RET
-----
RECFOR NOP ;record format
01157 LD A,BDH
01158 LD HL,CP2E2
01159 INC HL
01160 LD (HL),A
01161 LD HL,CP2E4
01162 LD (HL),A
01163 LD (PSEOR),A
01164 LD A,'R'
01165 LD (SDMODE),A ;display mode = record
01166 RET
-----
DSPSNR NOP ;display sector number
01167 PUSH BC
01168 PUSH DE
01169 PUSH HL
01170 PUSH IX
01171 PUSH IY
01172 CALL CURPOS
01173 LD (CURSOR),BC ;save current cursor pos
01174 LD BC,11
01175 CALL POSCUR ;r1:c12
01176 LD HL,(IDCBRCR) ;LRL
01177 CALL DSPSNR ;display no.
01178 LD BC,(CURSOR)
01179 CALL POSCUR ;restore cursor
01180 POP IY
01181 POP IX
01182 POP HL
01183 POP DE
01184 POP BC
01185 RET
-----
01186 LSTSEC DEFW 0 ;last sec: no new storage
01187 ;beyond this point
01188 CNSEC DEFW 0 ;current MAP sector
01189 NXTMAP DEFW 0 ;next map page
01190 MAXMAP DEFW 0 ;last map byte
01191 TBYTE DEFB 0 ;total hash byte
01192 TBYTLEN DEFB 0 ;temp total hash byte
01193 WLEN DEFB 0 ;hash word len
01194 HIT DEFB 0 ;l -> key(s) found

```

Listing 9 continued

```

01213 NXTKEY DEFW 0 ;next key in KEYBUF
01214 OPER DEFB 0 ;operation #and; l=or
01215 NXTOP DEFB 0 ;next operation
01216 ENDKEY DEFB 0 ;l=end of keys reached

01217 CLR# DEFW 0 ;current LR#
01218 LLR# DEFW 0 ;last LR#
01219 SPCW# DEFB 0 ;(S)pace or (W)ord
01220 EOP DEFB 0
01221 MODE DEFB 0 ;list or search mode
01222 SDW# DEFB 0 ;search display mode: line,rec,all
01223 EXTRA DEFB 0 ;EXTRA
01224 PRMODE DEFB 'M' ;output mode (C)ontinuous or (M)annual
01225 OFCOND DEFB 'C' ;output file: (C)lose, (R)eset or (A)ppend
01226 OFSTAT DEFB 'C' ;output file status: (C)losed or (O)pen

01227 ONODE DEFB 'M' ;output mode (C)ontinuous or (M)annual
01228 B256 DEFB 0 ;storage last byte SINBUF
01229 LINENR DEFB 0 ;line number for DSP
01230 NINSET DEFB 2 ;no. of spaces to inset
01231 SINSET DEFB 0 ;storage for inset
01232 PSOR DEFB 0DH ;pseudo BOR
01233 ;!!!
01234 CFILE DEFB 9 ;current file name xxxxxxxx
01235 NXTREC DEFW 0 ;abs position of next rec
01236 SINBUF DEFB 256

01237 INBUF DEFB 255 ;second source buf
01238 INBUF DEFB 0 ;byte 256 of INBUF
01239 INBUF DEFB 0DH ;end of record mark
01240 RCBUF DEFB 256 ;BOR mark
01241 DEFB 0DH
01242 MAPBUF DEFB 256 ;BOR mark
01243 DEFB 0DH
01244 OUTBUF DEFB 256 ;output buffer
01245 DEFB 0DH
01246 OFNAME DEFB 0DH ;output file name

01247 DEFB ' '
01248 DEFB 0DH
01249 HSHBUF DEFB 80
01250 KEYBUF DEFB 80
01251 DEFB ' ' ;extra space if needed!!
01252 DEFB 0DH
01253 KEY DEFB 80
01254 DEFB 0DH
01255 MSGPF DEFB 'Paragraph Format'
01256 DEFB 0DH
01257 MSGRF DEFB 'Record Format'
01258 DEFB 0DH
01259 MSGOP DEFB 'FILES OPENED'
01260 DEFB 0DH

01261 MSGEOF DEFB 'END OF FILE'
01262 DEFB 0DH
01263 MAPCMD DEFB 'MAP'
01264 DEFB 0DH
01265 CODE DEFB 'INDEX 1.2'
01266 DEFB 0DH
01267 TITLE DEFB 'MAP SEARCH PROGRAM 1.2'
01268 DEFB 3
01269 CPYMSG DEFB '(c) Copyright 1983 Softshell'
01270 DEFB 3

01271 THREE DEFB 'Each key must contain at least three '
01272 DEFB 'characters'
01273 DEFB 0DH
01274 MSGNAM DEFB 'File Name: '
01275 DEFB 3
01276 FNMMSG DEFB 'Error in file name format'
01277 DEFB 0DH
01278 MSGM2 DEFB '(C)hange File, (M)AP, (O)ptions or (T)RSDOS: '
01279 DEFB 03
01280 MAPRD DEFB 'MAP READ COMPLETE'

01281 DEFB 0DH
01282 MSGKEY DEFB 'Enter Key '
01283 DEFB 3
01284 MSGSEA DEFB 'Searching '
01285 DEFB 3
01286 QINSET DEFB 'Inset '
01287 DEFB 3
01288 CURSOR DEFB 0 ;cursor position
01289 ;-----
01290 ;buffers used by S3

01291 ;general purpose variables
01292 ;one byte key in variable (Y/N etc)
01293 ANSWER DEFB 0 ;cmd line file spec (Y/N)
01294 CMDLFS DEFB 0 ;indicates whether file spec
01295 ;was entered along with INDEX cmd
01296 ;hash routine variables
01297 ;hash value of first byte of triplet
01298 FBYTE DEFB 0 ;hash value of middle byte of triplet
01299 MBYTE DEFB 0 ;hash value of last byte of triplet
01300 LBYTE DEFB 0

01301 SCROSS DEFB 0 ;sector cross variable
01302 ;if 0 then sector boundary is not
01303 ;crossed by a record
01304 ;if >0 then the value in SCROSS
01305 ;is equal to the no of bytes in record
01306 ;prior to end of sector
01307 BICT DEFB 1 ;bit points to sector (0 to 7)
01308 ;-----
01309 ;HEADER buffer
01310 ;-----

01311 ;byte label purpose
01312 ; 8- 9 HSCC 'INDEX' and version
01313 ;10-10 0DH
01314 ;11-11 HSCCFF format: 0DH record
01315 ; ' ' paragraph
01316 ;12-19 blank (for future use)
01317 ;20-43 HFN source file spec
01318 ;-----
01319 END BEGIN

```

Program Listing 10. Assembly-language listing of S30PEN/SRC.

```

Ln # Source Line
00001 ;S30PEN/SRC VERSION 1.2
00002 ;Jun 9, 1983
00003 ;-----
00004 ;SEARCH INFORMATION RETRIEVAL PROGRAM
00005 ;ROUTINE TO OPEN FILES
00006 ;COPYRIGHT 1983, SOFTSHELL CORPORATION ALL RIGHTS RESERVED
00007 ;-----
00008 S30PEN PSBCT ;begin relocatable program section

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Listing 10 continued

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```

00089 PUBLIC GETFILE ;gets file specs
00090
00091
00092 EXTERN CFILE ;current file name
00093 EXTERN CMDLFS ;cmd line file spec (Y/N)
00094 ;indicates whether file spec also entered
00095 ;along with SEARCH cmd
00096
00097 EXTERN CODE
00098 EXTERN INBUF ;input (source) file record buffer
00099 EXTERN KEYBUF ;keybuf used to enter MINDEX file spec
00100
00101 EXTERN LSTSEC
00102 EXTERN MAXMAP
00103 EXTERN MENU2B
00104 EXTERN NXTMAP
00105 EXTERN OFNAME
00106 EXTERN PARFOR
00107 EXTERN RECFOR
00108
00109 ;
00110 ;calls to MODII or MODIII
00111
00112 EXTERN BOTTOM ;position cursor to last line of screen
00113 EXTERN CLOSE ;close file (DE->DCB)
00114 EXTERN CURPOS ;determine cursor pos (coord:BC)
00115 EXTERN DISBRK ;disable break (for Model II)
00116 EXTERN DIVIDE ;divide A into HL
00117 EXTERN DOSCMD ;jp to TRSDOS and execute command
00118 EXTERN ERASEL ;erase to end of line
00119 EXTERN ERASES ;erase to end of screen
00120 EXTERN ERASBP ;erase to end of screen
00121 EXTERN ERASBP ;erase to end of screen
00122 EXTERN ERROR ;MAP error display routine
00123 EXTERN ERROR ;TRSDOS error msg routine
00124 EXTERN HOME ;position cursor to top line of screen
00125 EXTERN INIT ;initialize file (create/open, pos to 1st rec)
00126 ; (HL->buf, D=no, char, BC=cursor coord)
00127
00128 EXTERN JP2DOS ;jp to TRSDOS
00129 EXTERN KBCAR ;set char (or null) from keyboard
00130 EXTERN KBLINE ;initialize keyboard (Mod II)
00131 EXTERN KBLINE ;set line from keyboard and end with #3
00132 EXTERN KBLINE ;set line from keyboard and end with B0H
00133 EXTERN KBLAIT ;wait for char from keyboard
00134 EXTERN KEYIN ;set search key(s) from keyboard
00135 EXTERN MOVELN ;move line from screen to buffer
00136 ; (HL->buf, D=no, char, BC=cursor coord)
00137 EXTERN NEWLN ;role screen and pos cur to next to last line
00138 EXTERN OPEN ;open file (DE->DCB, HL->record buffer)
00139 EXTERN OPINIT ;open and initialize file
00140 ; (DE->DCB, HL->record buffer)
00141 EXTERN POSCUR ;position cursor (coordinates in BC)
00142 EXTERN POSEOP ;position to end of file
00143 EXTERN POSN ;position to record in file
00144 EXTERN PRINT ;print line (HL->buf, B=no, char, C=end char)
00145 EXTERN PRCLNE ;print entire screen
00146 EXTERN PRCLNE ;print last line of text
00147 EXTERN PRCLNE ;print current record
00148 EXTERN READOR ;read file: direct access
00149 EXTERN SETLIR ;set INLR to true last record
00150 EXTERN SETLIR ;set MAPLIR to true last record
00151 EXTERN SYNEND ;store top of memory in MEMEND
00152 EXTERN VDCAR ;display char in A register
00153 EXTERN VDCLS ;clear screen
00154 EXTERN VDINIT ;initialize video I/O (for Model II)
00155 EXTERN VDLINE ;display line (HL->msg)
00156 EXTERN WRITNK ;write next record to file
00157
00158 ;
00159 ;MODII/III buffers and I/O parameters
00160
00161 EXTERN INDCB ;Input (source) file DCB
00162 EXTERN IDCBLR ;input file DCB Record Length
00163 EXTERN IDCBCR ;input file DCB Current Record
00164 EXTERN IDCBLR ;input file DCB Last Record
00165 EXTERN INLIR ;true last record of source file
00166 EXTERN IDCBOB ;input file DCB xxxxxx
00167 EXTERN MAPDCB ;MAP (index) file DCB
00168 EXTERN MDCBCL ;Map file DCB Record Length
00169 EXTERN MDCBCR ;Map file DCB Current Record
00170 EXTERN MDCBLR ;Map file DCB Last Record
00171 EXTERN MAPLIR ;true last record of index file
00172 EXTERN MDCBOB ;Map file DCB xxxxxx
00173 EXTERN MEMEND ;contents -> top of memory
00174 EXTERN OUTCHR ;record buffer (1 byte) for output file
00175 EXTERN OUTDCB ;output file DCB
00176 EXTERN PRTPBF ;printer buffer (88 char)
00177 EXTERN SORLIN ;start of record line no.
00178 EXTERN STMAP ;start of MAP index file (always last byte
00179 ; of SEARCH program)
00180 ;
00181 ;I/O parameters:
00182 EXTERN ARROWD ;down arrow
00183 EXTERN ARROWL ;left arrow
00184 EXTERN ARROWR ;right arrow
00185 EXTERN ARROWU ;up arrow
00186 EXTERN BRKKEY ;break key value
00187 EXTERN CFPYPS ;copyright notice position (52 or 36)
00188 EXTERN PENULN ;next to last line on screen (23 or 15)
00189 EXTERN SMIDTH ;screen width (80 or 64)
00190
00191 ;
00192 ;calls to GR (general routines)
00193
00194 EXTERN APPEND ;append on string to another
00195 EXTERN BKDECB ;binary to decimal conversion
00196 EXTERN DC2BC ;decimal to binary conversion
00197 EXTERN DLNE ;display dotted line (e.g. ....)
00198 EXTERN DSPNBR ;display 5-digit decimal no. (right justified)
00199 EXTERN DSPNBR ;display 5-digit decimal no. (left justified)
00200 EXTERN ERASEL ;remove leading blanks
00201 EXTERN ERASBP ;move cmd line file spec to KEYBUF
00202 EXTERN ERASBP ;get MAP file names
00203 EXTERN LINE ;display line (from char in A reg)
00204 EXTERN PACKFS ;pack (compress) file spec in fixed table
00205 EXTERN PARSEP ;parse one file spec
00206 EXTERN REC3 ;zero-out 256-byte record
00207 EXTERN RECBL ;blank-out 256-byte record
00208 EXTERN TAPENT ;'Tap enter to continue'
00209
00210 ;
00211 ;GR buffers
00212
00213 EXTERN SNAM,SEXT,SPSM,SDDR ;source file table
00214 EXTERN INAM,IXT,IPSM,IDDR ;index file table
00215 EXTERN ONAM,OXET,OPSM,ODDR
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00160 LD HL,KEYBUF ;file spec entered on cmd line
00161 CALL VDLINE ;dsp file spec
00162 LD A,B0H
00163 CP A
00164 LD B,1 ;I (set)
00165 JR GETAUTO ;so rec length not = 8
00166
00167
00168
00169
00170
00171
00172
00173 GETFILI LD BC,3*256+11
00174 CALL POSCUR
00175 CALL ERASEL ;erase to end of line
00176 LD B,51 ;no more than 51 char in file spec
00177 LD HL,KEYBUF ;use KEYBUF to hold file spec
00178 CALL KBLINE ;key in file spec
00179 GETAUTO CP BRKKEY ;was break bit?
00180 JR NE,GETFIL2 ;jp to GETFIL2 if break not pressed
00181
00182 LD BC,2*256
00183 CALL POSCUR ;rc:cl
00184 CALL ERASES ;erase to end of screen
00185 MENU2B ;call mini-menu
00186 CP 'M' ;(M)AP?
00187 JP TO,TRSDOS ;jp to TRSDOS and load MAP
00188 CP 'T' ;(T)RSDOS?
00189 JP TO,TRSDOS ;jp to TRSDOS
00190 JP GETFIL ;jp back and get file name
00191
00192 GETFIL2 LD C,B ;B = no. of char's keyed in with KBLINE
00193 LD A,C
00194 JR L ;GETFIL ;null entry so loop and get name again
00195
00196
00197
00198
00199
00200
00201 GETFIL4 LD HL,KEYBUF
00202 CALL ERASEL ;remove leading blanks if any
00203 LD A,(HL)
00204 CP ' '
00205 JP Z,MHELP ;was ? (for help) entered?
00206 LD HL,KEYBUF ;jp to MHELP (minihelp screen)
00207 CALL GETMFL ;jp to KEYBUF again
00208 JR J,FNOK ;jp FNOK if file spec OK
00209 LD BC,8*256 ;bad file specs
00210 CALL POSCUR ;rc:cl
00211 CALL ERASES ;erase to end of screen
00212 LD HL,FNMSG ;file name error msg
00213 CALL VDLINE
00214 CALL TAPENT ;'Tap enter to continue'
00215 JP GETFIL ;loop back and get file spec's
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LETTERS

This option allows the child to select letters at random, match the current letter displayed or type in the next letter. When a correct response is given, an animation associated with the letter moves across the screen, e.g., Z or Zebra. The computer says the letters also.

NUMBERS

This option allows the child to select the numbers zero to nine at random, match the current number displayed, or type in the next number. Men walk out on the screen equal to the number chosen. This section also contains speech.

SHAPES

This section allows the child to control the menu-man, moving shapes from the left hand of the screen to the right hand of the screen. The first level allows the child to pick up shapes using the spacebar. The second level, in addition allows the child to control the menu-man with the arrow keys. The third level puts a small 'Bee' on the screen which the child must avoid while manipulating the menu-man and shapes.

WORDS

This final section allows the child to type in letters to form words. The first level asks for a word to be typed in, then to be repeated

before another word can be tried. The second level prompts the child with a word which must be matched before an animation will appear on the screen. The last level shows the animation on the screen. Then the child must type in the correct word before the next animation is shown. This section contains speech also.

SPEECH

The program can be bought as a stand-alone program with computer-generated speech, which uses 'your' speaker amplifier. However, we have also made the program compatible with an 'Alpha Products VS100' speech synthesizer for improved speech quality. (This can be purchased from 'Alpha Products' subject to availability). The speech is not available for a 16K machine.

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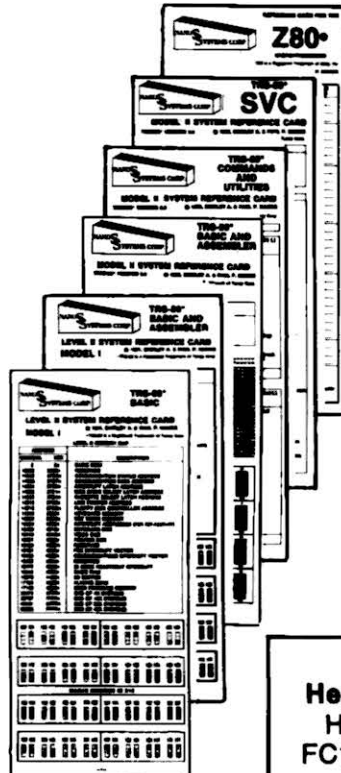
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POCKET: BASIC	FC1009	2.95
APPLE II + II PLUS: BASIC & 8502	FC1008	4.95
APPLE II + II PLUS: BASIC Only	FC1007	3.95

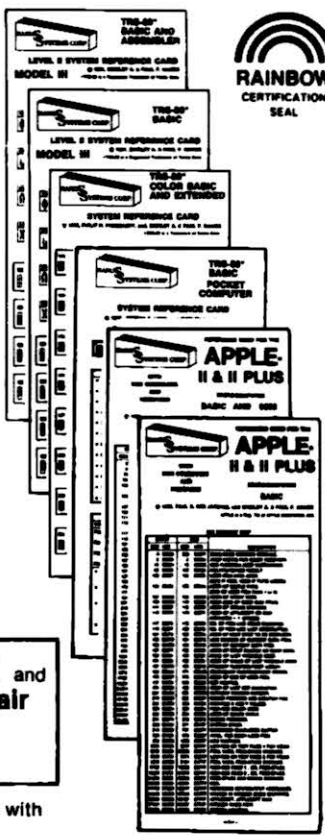
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


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Listing 10 continued

```

00311 LD DE,20 ;offset 20
00312 ADD HL,DE ;HL->start of file spec
00313 LD DE,INDCB ;DE->source file DCB
00314 CALL DE,APPEND ;trans file spec to DCB
00315
00316 ;if source file drive specified by
00317 ;user append to current file spec
00318 LD HL,SDDR ;HL->source file drive spec
00319 LD A,(HL)
00320 CP 00H ;? EOR
00321 JR Z,OPSRC5 ;skip if no source file dr specified
00322 ;source file drive specified so add
00323 ;' ' and drive no.
00324 ;remember DE->end of src file spec in DCB
00325 LD A,',' ;add colon to file spec
00326 LD (DE),A
00327 INC DE ;bump DE
00328 LD A,00H
00329 LD (DE),A ;add EOR to file spec
00330 LD HL,SDDR ;point to source file drive spec
00331 CALL APPEND ;move src file drive spec to DCB
00332 LD HL,SRCFIL ;'Source File.'
00333 CALL VDLINE
00334 LD HL,INDCB ;source file spec in INDCB
00335 CALL VDLINE ;display source file spec
00336 ;
00337 ;move source file name to CFILE buffer
00338 ;CFILE used to display file name during
00339 ;operation of program
00340 LD HL,INDCB ;HL->to source file spec
00341 LD DE,CFILE ;DE->CFILE (current file)
00342 LD C,0 ;set counter to 0
00343 CP A,C
00344 CP 8 ;were eight char moved to CFILE
00345 JR Z,OPSRC6 ;j/p to OPSRC6 if 8 char in source file name
00346 LD A,(HL) ;get char from file spec
00347 CP '/'
00348 JR Z,OPSRC6 ;j/p if ext
00349 CP '.'
00350 JR Z,OPSRC6 ;j/p if drive
00351 CP ':'
00352 JR Z,OPSRC6 ;j/p if password
00353 LD (DE),A ;copy file name char to CFILE
00354 INC HL ;pt to next char in file spec
00355 INC DE ;pt to next char in CFILE
00356 INC C ;inc counter
00357 JR OPSR5L ;loop until entire file name transferred
00358 ;
00359 ;
00360 OPSRC6 LD A,3
00361 LD (DE),A ;put 03 at end of file name
00362 ;03 indicates end of record
00363 ;when current file name is displayed
00364 ;VDLINE will not position cursor to next line
00365 ;
00366 LD HL,INBUF ;HL->source file record buffer (afrb)
00367 LD DE,INDCB ;DE->source file DCB
00368 LD S,0 ;record len = 0
00369 CALL OPEN ;open source file
00370 JP Z,OPSRC8 ;j/p to OPSRC8 if not error
00371 PUSH AF ;save error code
00372 LD HL,DATAER ;'Error in data/text file' msg
00373 CALL VDLINE ;restore error code
00374 POP AF ;restore error code
00375 LD HL,ERRDSP ;dep error msg
00376 LD C,0
00377 CALL POSCUR ;next to last line, 1st col
00378 CALL TAPENT ;Tapent to continue
00379 JP GETFILE ;loop back and get file spec
00380 ;
00381 OPSRC8 LD A,0
00382 LD (IDCBRL),A ;set LRL(record length) = 256
00383 CALL SETLRL ;set INLRL to true last record
00384 CALL LDMAP ;load as much of the index file
00385 ;into memory as possible
00386 CALL VDCLS ;clear screen
00387 RET
00388 ;
00389 ;LDMAP
00390 LD HL,LDMMSG ;loads map sectors into memory
00391 CALL VDLINE
00392 LD HL,(MEMEND) ;memory end
00393 LD DE,512 ;safety buffer: 512 bytes
00394 XOR A
00395 SBC HL,DE
00396 LD (LSTSEC),HL ;no more storage beyond
00397 LD HL,STMA ;
00398 LD (NXTMAP),HL ;NXTMAP -> first map byte
00399 LD BC,0
00400 LDMAPL NOP
00401 INC BC
00402 LD DE,MAPDCB
00403 CALL READDR
00404 JR Z,LDMAP3
00405 CP ZS
00406 JF NZ,ERROR
00407 JF LDMAPL
00408 LDMAP3 NOP
00409 PUSH BC
00410 LD HL,MAPBUF
00411 LD DE,(NXTMAP)
00412 LD BC,256
00413 LDIR
00414 POP BC
00415 LD (NXTMAP),DE
00416 LD HL,(LSTSEC)
00417 XOR A
00418 LD HL,DE
00419 JR C,NOROOM
00420 JF LDMAPL
00421 NOROOM NOP ;no more mem for MAP
00422 DEC BC
00423 PUSH BC
00424 LD HL,LIMIT
00425 CALL VDLINE
00426 POP HL
00427 CALL BXDEC
00428 CALL VDLINE
00429 LD HL,LIMIT1
00430 CALL VDLINE
00431 LD HL,(MDCBCR)
00432 CALL BXDEC
00433 CALL VDLINE
00434 LD HL,LIMIT2
00435 CALL VDLINE
00436 LD HL,LIMIT2
00437 CALL VDLINE
00438 CALL TAPENT
00439 LDMAPL NOP ;end of map storage
00440 LD HL,(NXTMAP),HL
00441 LD HL,MAPRD ;(MAXMAP) = last map byte
00442 CALL VDLINE
00443 RET
00444 ;
00445 ;.....
00446 LDMSG DEFM 'Loading MAP Index'
00447 DEFM 00H
00448 LIMIT DEFM 'Memory not sufficient to hold entire MAP Index'
00449 DEFM 00H
00450 LIMIT1 DEFM ' of '
00451 DEFM 00H
00452 LIMIT2 DEFM 'MAP Index sectors contained in memory'
00453 DEFM 00H
00454 ;
00455 ;MHELP
00456 ;mini-help screen
00457 MHELP LD BC,5*256 ;r:6:1
00458 CALL POSCUR
00459 CALL ERASES
00460 LD HL,RMSG2
00461 CALL VDLINE

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00463 LD A,00H
00464 CALL VCHAR ;skip line
00465 LD HL,RMSG4
00466 CALL VDLINE
00467 LD HL,RMSG6
00468 CALL VDLINE
00469 LD HL,RMSG8
00470 CALL VDLINE
00471 LD B,PENULN
00472 LD C,0
00473 CALL POSCUR
00474 CALL TAPENT
00475 JF GETFILL
00476 HMSG2 DEFM 'Format: SOURCE FILE,INDEX FILE,OUTPUT FILE'
00477 DEFM 00H
00478 HMSG4 DEFM 'Only the source file specification is required'
00479 DEFM 00H
00480 HMSG6 DEFM 'The index file will have the same name, but extension "MAP"'
00481 DEFM 00H
00482 HMSG8 DEFM 'The output file may be specified from within the program'
00483 DEFM 00H
00484 ;
00485 HMSG2 DEFM 'Enter file name, or ? for help'
00486 DEFM 3
00487 HMSGPF DEFM 'Paragraph Format'
00488 DEFM 00H
00489 HMSGRF DEFM 'Record Format'
00490 DEFM 00H
00491 HMSGOP DEFM 'FILES OPENED'
00492 DEFM 00H
00493 MAPCMD DEFM 'MAP'
00494 DEFM 00H
00495 HEADER DEFM 'Error in MAP Index File Header'
00496 DEFM 00H
00497 MAPOER DEFM 'Error in Attempt to Open MAP Index File'
00498 DEFM 00H
00499 DATAER DEFM 'Error in Attempt to Open Data/Text File'
00500 DEFM 00H
00501 IDXFIL DEFM 'Index File: '
00502 DEFM 00H
00503 SRCFIL DEFM 'Data/Text File: '
00504 DEFM 00H
00505 MSGNAM DEFM 'File Name: '
00506 DEFM 3
00507 FMSG DEFM 'Error in file name format'
00508 DEFM 00H
00509 MAPRD DEFM 'MAP READ COMPLETE'
00510 DEFM 00H
00511 ;
00512 END

```

Program Listing 11. Assembly-language listing of S3DSP/SRC.

```

00001 ;S3DSP/SRC. Ver. 1.2
00002 ;Jun 21, 1983
00003 ;
00004 ;SEARCH DISPLAY ROUTINE (DISPLAY RECORD OR LIST FILE)
00005 ;COPYRIGHT 1983, SOFTSHELL CORPORATION ALL RIGHTS RESERVED
00006 ;
00007 S3DSP PSECT ;begin relocatable program section
00008 ;
00009 ;public routines
00010 ;
00011 PUBLIC BYUPDN ;bypass updown control buffer
00012 PUBLIC LIST ;list file routine
00013 PUBLIC DSP ;display record routine
00014 ;
00015 ;calls to MODII or MODIII
00016 ;
00017 EXTERN KBLINE,KBLIN3,KBCHAR,KBNWIT,KEYIN,KBNIT
00018 EXTERN KBRK
00019 EXTERN VDCLS,VDLINE,VCHAR,VDNIT
00020 EXTERN HOME,BOTOM,NEWLN
00021 EXTERN CURPOS,POSCUR
00022 EXTERN SCRPRO
00023 EXTERN ERASEL,ERASES
00024 EXTERN OUTCHR
00025 EXTERN PRINT,PRSCR,PRTBIN,PRTRC
00026 EXTERN PRLINE,NOVELN,PRTPB
00027 EXTERN POSEOF,POSN,READR,WRITN,BACKSP
00028 ;
00029 ;MODII/III buffers and I/O parameters
00030 ;
00031 EXTERN INDCB,IDCBRL,DCBCR,DCBRL,INLRL,DCBOS
00032 EXTERN MAPDCB,MDCBRL,MDCBCL,MAPLRL,MDCBOS
00033 EXTERN OUTDCB
00034 EXTERN ERDSP
00035 EXTERN SORLN,STWEND,MEMEND
00036 EXTERN ARROWD,ARROWL,ARROWR,ARROWU,BRKEY,SMIDTH,PENULN
00037 ;
00038 ;S3 buffers
00039 ;
00040 EXTERN INBUF,INBUFE,INBUFU,MINSET,SINSET
00041 EXTERN LINENR,SPWORD,EOF,MSGEOF,SEAMG
00042 EXTERN QMODE,SOWODE,FRMODE,MODE,RECBUF
00043 EXTERN NXTREC
00044 ;
00045 ;calls to S3 routines
00046 ;
00047 EXTERN READIN,OPNOUT,OUTREC
00048 ;
00049 ;calls to GR (general routines)
00050 ;
00051 EXTERN BXDEC,DCXCB,DSPWR
00052 EXTERN DLINE
00053 ;
00054 ;LIST
00055 ;
00056 ;list file from start of current rec
00057 ;entry: current record in INBUF
00058 ; current sector in INBUF
00059 ; IX -> current src sector
00060 ;exit:
00061 ;reg altered: AF,BC,DE,HL
00062 ;calls: LIST1
00063 LIST LD A,'N'
00064 LD (BYUPDN),A ;N = do not bypass updown routine
00065 CALL DLNE ;display dotted line under last search record
00066 LD A,'1'
00067 LD (MODE),A ;list mode
00068 PUSH IX ;save
00069 PUSH IY ;save
00070 PUSH IX
00071 BC POP BC ;BC -> current src sector
00072 LD HL,(NXTREC)
00073 CALL LIST1
00074 POP IY
00075 POP IX
00076 RET
00077 ;
00078 ;LIST0
00079 ;entry pts: LIST1
00080 ;HL->src file input buffer
00081 LIST0 LD HL,INBUF
00082 JR LIST2
00083 LIST1 PUSH HL ;save HL (-> INBUF)
00084 LD HL,LISTM1 ;'Listing'03
00085 LD HL,LISTM1
00086 CALL VDLINE
00087 CALL NEWLN ;pos to next to last line
00088 HL -> INBUF
00089 LD A,(MINSET),A ;get current inset value
00090 LD (SINSET),A ;save current inset value
00091 LD A,0
00092 LD (INSET),A ;set inset to 0
00093 LIST2 LD A,1 ;set line no. = 1
00094 LD (LINENR),A ;B = screen width
00095 LD B,SMIDTH
00096 ;

```

Listing 11 continued

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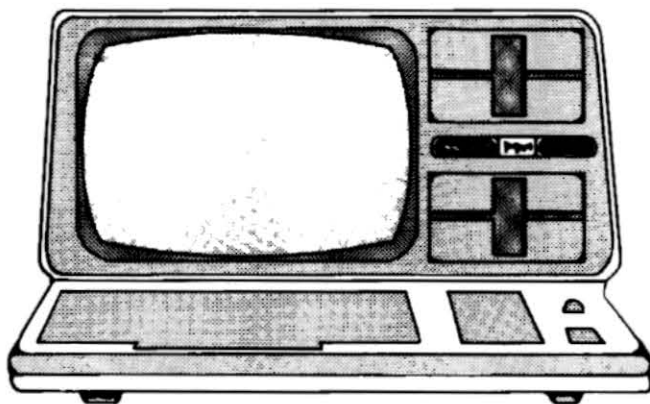
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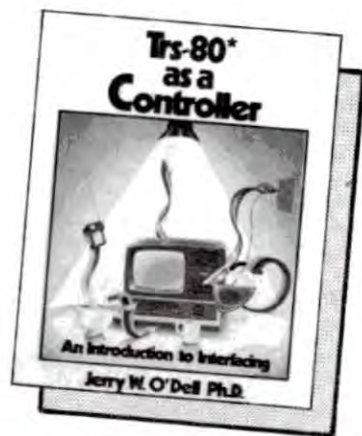
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00097 ;LIST3
00098 ;.....
00099 ;process next word
00100 LIST3 CALL NXTWRD
00101 LD A,'M'
00102 LD (SPWORD),A ;working with word
00103 PUSH HL ;save HL
00104 LD HL,INBUF0 ;@DR byte after INBUF0
00105 XOR A
00106 SBC HL,DE
00107 POP HL ;restore HL
00108 JP %LIST48 ;get next sec
00109 LD A,8
00110 CP C ;exit and resume search
00111 JR %LIST3C
00112 CALL DSPWRD ;display word
00113 CP BRKKEY ? ;<break> ?
00114 %LIST78 ;jp LIST78 if <break>
00115 CP 's' ;was 's' pressed
00116 JP %LIST78 ;end, then search
00117 CP ARROW ;was uparrow pressed? (backspace)
00118 JP %LIST8 ;
00119 LD A,(HL)
00120 CP 0DH
00121 JP %LIST5 ;
00122 LIST3C CALL SPACE ;get next space or set of spaces
00123 LD A,'S'
00124 LD (SPWORD),A ;space-word = (S)pace
00125 PUSH HL
00126 LD HL,INBUF0
00127 XOR A
00128 SBC HL,DE
00129 POP HL
00130 JP %LIST48
00131 CALL DSPSP ;used for listing only
00132 CP BRKKEY ? ;<break>?
00133 JP %LIST78 ;exit and get new search key
00134 CP 's' ;|s| pressed?
00135 JP %LIST78 ;|s| search cmd
00136 CP ARROW ;|up arrow|?
00137 JP %LIST8 ;backsp, so start listing again
00138 LIST4 LD A,(HL)
00139 CP 0DH
00140 JP NZ,LIST3 ;EOR?
00141 ;loop until EOR encountered
00142 ;LIST5
00143 ;.....
00144 ;DE-> char after INBUF
00145 LD DE,INBUF0
00146 PUSH HL
00147 XOR A
00148 SBC HL,DE
00149 POP HL ;restore HL
00150 JP %LIST28 ;jp if HL at end of buffer
00151 CALL UPDOWN ;<break>?
00152 CP BRKKEY ;exit and get next search key
00153 JP %LIST78 ;up arw
00154 CP ARROW ;backsp, so start listing again
00155 JP %LIST8 ;|s| search cmd
00156 CP 's' ;exit and continue search
00157 LD A,SWIDTH ;A=screen width
00158 LD B ;new line?
00159 CP B
00160 JP %LIST9 ;roll screen in new line needed
00161 CALL NEWLN ;reset count for char printed on line
00162 LD B,SWIDTH ;HL->next char after 0D
00163 LIST9 INC HL
00164 JP LIST3 ;loop until EOR
00165 LIST15 CALL NEWLN ;roll screen
00166 LD A,'s'
00167 JP LIST78
00168 ;.....
00169 ;LIST28
00170 ;@DR at INBUF0 (record extends past
00171 ;INBUF buffer)
00172 LIST28 CALL UPDOWN ;<break>?
00173 CP BRKKEY ;exit and get new search key
00174 JP %LIST78 ;|up arrow|?
00175 CP ARROW ;backsp, so start list again
00176 CP 's' ;|s| search cmd?
00177 JP %LIST15 ;new line?
00178 LD A,SWIDTH
00179 LD B ;roll screen
00180 CALL NEWLN
00181 LD B,SWIDTH
00182 LIST23 LD C,s
00183 LD A,'M'
00184 LD (SPWORD),A
00185 LD DE,INBUF
00186 JP LIST48
00187 ;.....
00188 ;LIST48
00189 ;has EOP been reached?
00190 LIST48 LD A,(EOP)
00191 CP 1 ;jp LIST58 if EOP
00192 JP %LIST58 ;transfer remainder of INBUF to SINBUF
00193 LD HL,INBUF0
00194 LD DE,INBUF
00195 BC B,0
00196 LD A,C
00197 CP 0 ;ct 0?
00198 JP NZ,LIST43 ;if 0 then no trans
00199 BC ;restore stack
00200 LIST43 INC BC ;include char before string to be transferred
00201 LDR ;trans to SINBUF
00202 INC HL ;adjust for inc of BC
00203 INC DE ;adjust for inc of BC
00204 INC DE ;DE-> 1st char of word
00205 PUSH HL
00206 ;.....
00207 ;LIST45
00208 LIST45 LD A,(EOP)
00209 CP 1 ;was EOP reached?
00210 JP %LIST58 ;jp LIST58 if EOP
00211 PUSH BC
00212 DE ;get current record
00213 LD DE,INDCB ;now points to next record
00214 CALL READIN ;read next record
00215 POP DE
00216 POP BC
00217 LIST47 POP HL ;HL->INBUF0-C
00218 POP DE ;DE-> wrd start in SINBUF
00219 EX DE,HL ;HL-> wrd start in SINBUF
00220 POP BC
00221 LD DE,INBUF
00222 LD A,(SPWORD)
00223 CP 's'
00224 JP %LIST3C
00225 JP LIST3
00226 LIST48 NOP ;no word/sp in SINBUF
00227 LD HL,INBUF ;start word at INBUF
00228 PUSH BC
00229 POP DE
00230 PUSH HL
00231 JP LIST45
00232 LIST58 NOP ;EOP reached
00233 POP HL
00234 POP DE
00235 POP BC

```

```

00248 CALL NEWLN
00249 LD HL,MSGEOP
00250 CALL VDLIN
00251 LIST52 CALL BRKAIT ;<break>?
00252 CP BRKKEY
00253 JP %LIST78
00254 OR 32
00255 CP 's'
00256 JP NZ,LIST52
00257 JP LIST78
00258 ;.....
00259 ;LIST78
00260 LIST78 PUSH AF ;save A status
00261 LD A,(SINSET) ;restore inset
00262 LD (INSET),A
00263 LD A,8 ;restore to not EOP
00264 LD (EOP),A ;restore A
00265 POP AF
00266 CP 's' ;return if <break>
00267 RET NZ ;Searching?
00268 CALL SEARNG ;return and continue searching
00269 LD A,'s'
00270 RET
00271 ;.....
00272 LISTM1 DEFB 'Listing '
00273 DEFB 3
00274 ;.....
00275 ;DSP
00276 ;display record found while searching
00277 ;continuous display
00278 ;B req used for count of char remaining
00279 ; on current line
00280 ;entry:
00281 ;exit: A = cmd from UPDOWN routine
00282 ;reg altered: AF,BC,DE,HL
00283 ;calls: NXTWRD,DSPWRD,SPACE,DSPSP
00284 DSP LD A,(MODE) ;is output mode continuous?
00285 CP 'C' ;if so, output record
00286 CALL %OUTREC
00287 LD A,PENULN ;since NEWLN dec's SORLN as soon as
00288 INC A ;start of record on penultimate line
00289 LD (SORLN),A
00290 LD A,(SDMODE) ;record?
00291 CP 'R' ;record?
00292 JP %DSPRC ;display entire record
00293 CP 'C' ;continuous display?
00294 JP %DSPRC ;display entire record
00295 ;.....
00296 ;DSPLN
00297 ;display record a line at a time
00298 ;call UPDOWN after each line
00299 DSPLN LD A,'N' ;do (N)ot bypass UPDOWN routine
00300 LD (BYUPDN),A
00301 JR ;.....
00302 ;DSPRC
00303 DSPRC LD A,'Y' ;do (Y)es bypass UPDOWN routine
00304 LD (BYUPDN),A
00305 ;.....
00306 ;DSP1
00307 DSP1 LD A,'s' ;start display
00308 LD (MODE),A ;search mode
00309 ;string ends with 0DH
00310 LD A,1 ;1 = first line
00311 LD (LIMENR),A ;2 = 2..n lines
00312 LD B,SWIDTH
00313 LD A,0
00314 ;start display
00315 ;.....
00316 ;DSP3
00317 DSP3 CALL NXTWRD ;checks for null record
00318 CALL DSPWRD ;get next word
00319 CALL BRKKEY ;display word
00320 JP %DSP6 ;<break>?
00321 CP 'l' ;exit if break
00322 JP %DSP8 ;switch to list mode?
00323 CP 's' ;exit if switch in mode
00324 JP %DSP12 ;was last char at 0?
00325 LD A,(HL) ;pt to next char in record
00326 CP 0DH ;EOR?
00327 JP %DSP5 ;if EOR
00328 CALL SPACE ;get next set of spaces form record
00329 CALL DSPSP ;display spaces
00330 CP BRKKEY ;<break>?
00331 CP 'l' ;exit if break
00332 JP %DSP8 ;switch to list mode?
00333 JP %DSP8 ;exit if switch in mode
00334 LD A,(HL) ;get next char in record
00335 CP 0DH ;check for null record
00336 NZ,DSP3 ;loop if not EOR
00337 ;.....
00338 ;DSP5
00339 DSP5 LD A,(SDMODE) ;get search display mode
00340 CP 'C' ;continuous
00341 JP %DSP5A ;jp DSP5A if continuous
00342 LD (BYUPDN),A ;do not bypass UPDOWN
00343 CALL UPDOWN
00344 PUSH AF
00345 CALL NEWLN ;roll screen
00346 POP AF ;restore A
00347 RET ;.....
00348 ;DSP8
00349 DSP8 CALL NEWLN ;switch from search to list mode
00350 LD A,'l' ;return with A = 'l' for list mode
00351 RET ;.....
00352 ;DSP12
00353 DSP12 LD A,(SDMODE) ;switch to list mode
00354 CP 'C' ;char on 0; cur at 1
00355 JP %DSP14
00356 LD A,'N' ;do not bypass UPDOWN
00357 LD (BYUPDN),A ;char on 0; cur at 1
00358 CALL UPDOWN
00359 PUSH AF
00360 CALL NEWLN
00361 POP AF ;roll screen
00362 RET ;restore A
00363 ;.....
00364 ;DSP14
00365 DSP14 CALL NEWLN ;roll screen
00366 LD A,ARROW ;restore A
00367 RET ;.....
00368 ;NXTWRD
00369 ;get next word
00370 ;entry:
00371 ;exit:
00372 ;entry: HL -> start of word
00373 ;exit: HL -> start of word
00374 ; DE -> char after word
00375 ; C = word len
00376 ; B = # char remaining on line
00377 ; A = char after word

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Listing 11 continued

Listing 11 continued

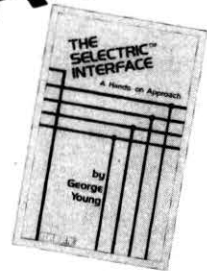
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00398 ;reg altered: AF,C,DE
00399 NXTWRD PUSH HL ;save start of word
00400 LD C,B ;initialize char count
00401 NWRDLP LD A,(HL)
00402 CP 0DH ;EOR?
00403 JP Z,NWRDRT ;EOR encountered
00404 CP 20H ;' '?
00405 JP Z,NWRDRT ;space encountered
00406 LD A,SWIDTH
00407 CP C
00408 JP M,NWRD65 ;don't inc C after SWIDTH
00409 INC C ;bump char counter
00410 NWRD65 INC HL
00411 JP NWRDLP ;loop until end of word
00412 NWRDRT LD D,H ;DE-> char after word
00413 LD E,L
00414 POP HL ;HL->start of word
00415 RET
-----
00417 ;DSPWRD
00418 ;
00419 DSPWRD NOP ;display word
00420 ;entry: HL-> start of word
00421 ; C = word length
00422 ; B = # spaces left on line
00423 ;exit: B = # spaces left on line
00424 ;exit pts: DWRD2,DWRD7,DWRD11,DWRD12
00425 ;reg altered: AF,BC,DE,HL
00426 DWRD2 LD A,B
00427 CP C
00428 RET Z ;return if null word
00429 LD A,B
00430 CP C ;is there room for word?
00431 JP Z,DWRD4
00432 JP P,DWRD4
00433 PUSH DE
00434 CALL UPDOWN
00435 CP ARROW ;? down arrow
00436 JP NZ,DWRD18 ;jp if not d. arrow
00437 CALL NEWLN
00438 POP DE
00439 CALL INSET
00440 DWRD4 LD A,(HL) ;point to char
00441 AND 7FH ;mask bit 7
00442 CALL VDCCHAR ;display char
00443 DEC B ;one less space
00444 LD A,B
00445 CP B
00446 JP NZ,DWRD7
00447 INC HL
00448 LD A,(HL)
00449 CP 0DH
00450 JP Z,DWRD12 ;no inset if EOR
00451 DEC HL
00452 CALL UPDOWN
00453 CP ARROW ;down arrow?
00454 JR NZ,DWRD11 ;jp DWRD11 if not down arrow
00455 CALL NEWLN
00456 INSET ;inset and adjust B (# char remaining on line)
00457 DWRD7 INC HL ;bump char pointer
00458 LD A,(HL) ;get next char
00459 CP ' '
00460 RET Z
00461 CP 0DH
00462 RET Z
00463 JP DWRD5 ;loop until word end
00464 DWRD18 POP DE
00465 DWRD11 RET
00466 DWRD12 LD A,'e' ;last char of word on last char of line
00467 RET
-----
00468 ;SPACE
00469 ;
00470 ;read spaces
00471 ;entry: HL-> start sp
00472 ;exit: HL-> start sp
00473 ; DE-> next word
00474 ; C = # of spaces
00475 ;reg altered: AF,C,DE
00476 ;calls: none
00477 SPACE PUSH HL ;save start of spaces
00478 LD C,B ;initialize space count
00479 LD A,(HL) ;get next char
00480 CP 20H ;' '?
00481 JP NZ,SPACE7 ;jp SPACE7 if not space
00482 LD A,SWIDTH
00483 CP C
00484 JP M,SPACE5 ;don't inc # of spaces if past end of line
00485 INC C ;inc # of spaces
00486 SPACES5 INC HL ;pt to next char
00487 JP SPACE4 ;loop until non-space char
00488 SPACE7 EX DE,HL ;DE->next word
00489 LD HL ;HL->start of spaces
00490 POP HL
00491 RET
-----
00492 ;DSPSP8
00493 ;
00494 DSPSP8 LD A,1 ;DSPSP8 routine when listing
00495 CP (LINENR),A ;see DSPSP below for more info
00496 DEC HL
00497 DSPSP8C PUSH DE
00498 LD A,(LINENR),A
00499 CP HL
00500 LD A,(HL)
00501 INC HL
00502 CP 0DH ;was last char before space EOR?
00503 JP Z,DSPSP3
00504 JP DSPSP2
-----
00505 ;DSPSP
00506 ;
00507 ;display spaces
00508 ;entry: HL->start of spaces
00509 ; C = # of spaces
00510 ; B = # char remaining on line
00511 ;exit: A = UPDOWN cmd
00512 ;save start of next word
00513 DSPSP PUSH DE
00514 LD A,(LINENR) ;skip if first line
00515 CP 1
00516 JP Z,DSPSP3
00517 LD A,(LINENR)
00518 ADD A,B ;start of line?
00519 JP Z,DSPSP8 ;bypass if start of 2...n
00520 DSPSP3 LD A,B
00521 CP C
00522 JP M,SPBOLN ;is there room for spaces
00523 LD A,SPBOLN ;jp to eoln routine
00524 DSPSP7 PUSH DE
00525 CALL VDCCHAR
00526 POP DE
00527 DEC B
00528 INC HL
00529 LD A,(HL)
00530 CP 0DH
00531 JP Z,DSPSP8
00532 CP ' '
00533 JP NZ,DSPSP8
00534 POP DE
00535 DSPSP8 LD HL ;HL->next word
00536 LD A,B
00537 RET
-----
00538 ;SPBOLN
00539 ;
00540 ;spaces to be printed at end of line
00541 ;therefore truncate spaces
00542 SPBOLN CALL UPDOWN
00543 CP ARROW ;? down arrow

```

Listing 11 continued

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Listing 11 continued

```

00548 JP HL,DSPSP9 ;jfp if not d arrow
00549 CALL HEMLA
00550 CALL INSET
00551 JR DSPSPG
00552 DSPSP9 PUSH AF
00553 PUSH DE
00554 LD D,A
00555 CP 0
00556 JP Z,DSPSP9
00557 CALL HEMLA
00558 DSPSP9 POP DE
00559 POP AF
00560 DSPSP9 POP HL ;HL->next word
00561 RET
-----
00562 ;INSET
00563 ;new line so inset number of
00564 ;spaces in INSET
00565 ;save C
00566 INSET PUSH BC
00567 LD B,WIDTH
00568 LD A,(INSET)
00569 CP B
00570 JR Z,INSET
00571 LD C,A
00572 LD A,B
00573 INSETL CALL VDCRCH
00574 DEC B
00575 DEC C
00576 LD A,B
00577 CP C
00578 JR Z,INSETL
00579 INSETL POP DE
00580 LD C,E
00581 LD A,(LINENR),A
00582 RET
-----
00583 ;UPDOWN
00584 ;This routine is called after a line
00585 ;is displayed by the LIST or DSP routines
00586 ;printing is initiated from this routine
00587 ;entry:
00588 ;exit: A returns key pressed
00589 ; one exit point: UPDOWN
00590 ;reg altered: AF,BC,HL
00591 ;save DE for entire routine
00592 UPDOWN PUSH DE
00593 LD A,(PRMODE)
00594 CP 'C'
00595 CALL Z,PRTRBLN
00596 LD A,(STUPDN)
00597 CP 'M'
00598 JP Z,UPDOWNL
00599 LD A,AROUND
00600 JP UPDOWN
00601 ;UPDOWNL
00602 ;master loop of UPDOWN routine
00603 ;clear key buf
00604 UPDOWNL CALL EBINIT
00605 LD A,2
00606 CALL VDCRCH
00607 CALL EBWAIT
00608 ;Cbreak?
00609 JP Z,UPDOWN
00610 ;jfp to end of routine if break
00611 ;down arrow?
00612 JP Z,UPDOWN
00613 ;up arrow?
00614 JP Z,AROUND
00615 ;jfp to back space routine
00616 ;convert char entered to lower case
00617 LD A,' '
00618 JP Z,UPDOWN
00619 ;'l' => switch from search to list
00620 ;'s' => switch from list to search
00621 ;'w' => write (print) entire screen
00622 ;'u' => write screen section
00623 ;'p' => print line
00624 ;'o' => output current record
00625 ;jfp to output section
00626 ;loop until arrow or break pressed
00627 ;UPDOWN
00628 ;switch from search to list mode
00629 ;UPDOWNL
00630 UPDOWN LD A,(MODE)
00631 CP 'l'
00632 ;list mode?

```

```

00633 JP Z,UPDOWNL ;do not exit if already in list mode
00634 LD A,'l'
00635 LD (MODE),A
00636 ;set MODE=(l)list
00637 ;exit
00638 ;
00639 ;-----
00640 ;UPDOWN
00641 ;output record
00642 ;loop until arrow or break pressed
00643 ;UPDOWN
00644 UPDOWN CALL OUTRBC
00645 JP UPDOWNL
00646 ;
00647 ;-----
00648 ;UPDOWN
00649 ;print either a line or current record
00650 ;get search-display mode
00651 ;L=line, R=record, C=continuous
00652 LD A,'l'
00653 CP Z
00654 JP Z,UPDOWNL
00655 CP 'C'
00656 JP Z,UPDOWNL
00657 PUSH BC
00658 PUSH DE
00659 POP HL
00660 CALL PRTRBC
00661 POP HL
00662 POP DE
00663 POP BC
00664 JR UPDOWNL
00665 UPDOWNL CALL PRTRBLN
00666 UPDOWNL JP UPDOWNL
00667 ;
00668 ;-----
00669 ;UPDOWN
00670 ;write (print) entire screen
00671 ;UPDOWN
00672 UPDOWN PUSH BC
00673 PUSH DE
00674 CALL PRTRBC
00675 POP HL
00676 POP DE
00677 POP BC
00678 JP UPDOWNL
00679 ;
00680 ;-----
00681 ;UPDOWN
00682 ;switch from list to search mode
00683 ;search mode?
00684 ;do not exit if already in search mode
00685 LD A,'s'
00686 LD (MODE),A
00687 LD (MODE),A
00688 JP UPDOWN
00689 ;
00690 ;-----
00691 ;UPDOWN
00692 ;up arrow press (backspace)
00693 ;list mode?
00694 ;do not back space if not list mode
00695 LD DE,INDCR
00696 CALL BACKSP
00697 CALL BACKSP
00698 CALL BACKSP
00699 PUSH BC
00700 LD BC,(INDCR)
00701 CALL READIN
00702 POP BC
00703 CALL HEMLA
00704 LD A,E
00705 LD (EOF),A
00706 LD HL,NSGBAK
00707 CALL VDLIN
00708 CALL HEMLA
00709 LD A,AROUND
00710 ;
00711 ;-----
00712 ;UPDOWN
00713 ;exit from UPDOWN
00714 ;restore DE
00715 UPDOWN POP DE
00716 RET
00717 ;bypass updown routine
00718 NSGBAK DEFB "Backspace 3 sectors"
00719 DEFB 03
00720 ;
00721 END

```

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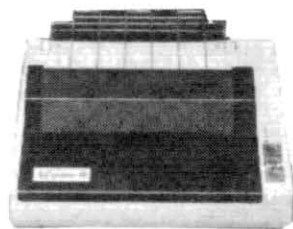
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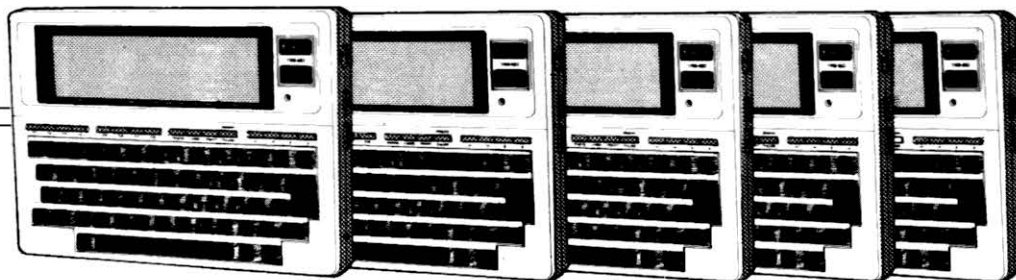
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Inside the Model 100

by David P. Sumner

To help you write sophisticated programs on your Model 100, I'm providing a fairly extensive memory map, some relevant documentation, and a list of the tokens for the Basic keywords.

One word of caution: It's possible that some versions of the Model 100 have a ROM slightly different from the one in my machine. You should also be aware that some locations have multiple uses, some of which may not be documented here.

Running a Machine-Language Program

You will find the addresses of several routines provided in the memory map useful (see Table 1) primarily for machine-language programs, but it's important to know how to access them from Basic. The secret is in the Basic command Call. To run a machine-language program that resides at location 30306 (the Model 100's sound routine), type in the Basic statement CALL 30306 and you'll hear a beep. Not all Calls are so direct. Often you'll need to pass data to the routine that you're calling. The Model 100 provides nicely for this. A statement of the form

CALL address,X,Y

initiates the execution of the machine code stored at the given address, but first it assigns the value in X to the accumulator, and the value in Y to the register pair HL. Thus, the value of X can only be between zero and 255 (so that it can fit into the 8-bit accumulator), and the value of Y can be any 16-bit integer from zero to 65535.

For example, a Call to location 32 prints the contents of the accumulator (considered an ASCII character) on the display. If you simply type CALL 32, nothing happens since the accumulator contains zero. However, if you type CALL 32,65 you'll see the letter A appear on the screen. You've put 65, the ASCII code for an A, into the accumulator prior to the Call. The effect of CALL 32,X is the same as printing CHR\$(X). In fact, since PRINT CHR\$(7) produces a beep, CALL 32,7 also results in a beep. Another example: The routine located at 10161 displays the message located at the address pointed to by the register pair HL. If you look at the memory map, you'll see that the 100 stores many messages throughout the ROM. For example, try typing CALL 10161,0,3442. The computer displays the message "extra ignored." Type CALL

The Key Box

The programs in "Blackjack" and "Program Length" will run in 8K RAM.

Table 1. The memory map.

NOTE: Material in single quotes represents ASCII text. A "+" after a location indicates a 2-byte pointer.

0	(RST 0) JMP 32051
3	'Menu'
8	(RST 1) Test for special character and fall into RST2.
16	(RST2) Set pointer to next character of BASIC text. (JMP 2136)
24	(RST3) Compare registers HL,DE directly
32	(RST 4) PRINT ASCII contents of accumulator.
36	(TRAP) Handles power-down. User interface at 62978.
40	(RST 5) JMP 4201 Checks variable type.
44	(RST 5.5) JMP 62969
48	(RST 6) Returns sign of FAC1. (JMP 13276)
52	(RST 6.5) JMP 28076 (62972 RAM vector interface)
56	(RST 7) Executes routine indicated by next byte. (JMP 32767)
60	(RST 7.5) Updates timer, adjusts power-down values etc. (JMP 6962, user can interface at 62975).
64	BASIC function addresses.
128	BASIC Keywords with high bit set in the first character of each word.
610	BASIC command addresses.
750	Table of BASIC addresses.
796	2-Byte error codes.
858	Initial values for pointers 62960-63103.
1003	'Error'
1010	'in'
1014	'ok'
1019	'Break'
1094	Syntax error. Other entry points at 1100, 1103 .. 1115 for other errors.
1117	Error message based on contents of E register.
1245	PRINTs error messages (accumulator holds a value from 28 to 58).
1520	Builds BASIC line pointers.
1576	Enter with DE containing a line number. Exit with BC containing

Table 1 continued

10161,0,32676, and the TRS-80 logo will appear on the display.

PEEK, POKE, and Pointers

There is more of interest here than just the addresses of particular routines. Basic uses many locations to store data such as the values of variables, the text of Basic programs, and pointers that determine how the computer behaves. The PEEK command accesses the values in these locations, and the POKE command can change them.

For instance, the location 63368 contains the horizontal position of the cursor. If you let $X = \text{PEEK}(63368)$ in a Basic program, the effect is the same as if you had used the expression $X = \text{POS}(0)$. Try the following short program as an illustration. (Don't overlook the semicolon in line 20.)

```
10 FOR I=1 TO 100
20 PRINT PEEK(63368);
30 NEXT I
40 END
```

If the number stored in location 64173 is zero, then you cannot use the label line. With a POKE command you can put a zero into this location. Try the following experiment. First enter Basic from the main menu and then press the label key.

You'll see the key menu displayed on the label line. Now clear the label line by pressing the label key again. Finally, type POKE 64173,0 and press the enter key. Pressing the label key now has no effect. If you type

```
POKE 64173,255
```

things return to normal.

Many of the pointers point to addresses, line numbers, and other 16-bit integers. The Model 100 stores such addresses with the low byte of the integer followed by the high byte. For instance, the computer stores the line number where a break occurred in locations 64426-64427. To determine the line number just type $\text{PRINT PEEK}(64426) + 256 * \text{PEEK}(64427)$.

To determine the starting location of the currently active program, type $\text{PRINT PEEK}(63100) + 256 * \text{PEEK}(63101)$.

Floating Point Operations

In order to use the floating point routines, you must first place the proper values in the floating point accumulators. For instance, to find the square root of 2 using a call to location 12378, you must place 2 in the primary floating point accumulator FAC1 prior to the call. After the call, the value of the square root of 2 resides in FAC1, and you must move it to the proper variable.

Table 1 continued

	the location of the line, and HL the location of the next line. The carry flag is used to indicate if the line exists.		
1606	Tokenize BASIC text.	2902	PRINT
1830	FOR	3073	TAB(
1899	TO	3141	LINE (general)
2112	BASIC command dispatcher; accumulator holds token.	3152	LINE INPUT
2136	Set pointer to BASIC text.	3188	'?Redo from start'
2162	DEF (general)	3225	INPUT #
2177	DEFDBL	3235	INPUT
2182	DEFINT	3289	READ
2198	DEFSNG	3442	'Extra ignored'
2207	DEFSTR	3625	>,=,<
2267	FC error.	3926	ERL
2283	Used by GOTO, GOSUB, and RUN to determine the 2-byte value of the line (in ASCII) to branch to. The HL register points to the ASCII string of digits, the 16-bit integer is returned in DE.	3966	VARPTR
2319	RUN	4072	If character in M is lowercase, the upper case equivalent is returned in the accumulator.
2334	GOSUB	4236	OR
2358	GOTO (contains a bug!)	4247	AND
2381	Jump here if UL error.	4258	XOR
2406	RETURN	4269	EQV
2462	DATA	4277	IMP
2464	REM,ELSE	4296	LPOS
2499	LET	4302	POS
2607	ON (general)	4305	Store accumulator as low byte of 16-bit integer.
2612	ON ERROR	4352	INP
2736	RESUME	4364	OUT
2831	ERROR	4398	ASCII text (string/variable) converted to integer.
2842	IF	4411	LLIST
2894	LPRINT	4416	LIST
		4514	PRINTs from buffer until 0 byte is encountered.
		4522	Put data into buffer until a 0 byte is reached.
		4740	PEEK
		4747	POKE
		4811	Saves registers, waits for

Table 1 continued

Table 1 continued

	character of input, and restores registers.
4848	PASTE.
5029	Toggles the label line.
5138	Break routine.
5145	POWER
5169	Power off /Returns to program on power-up.
5201	Power off
5209	POWER CONT
5225	Sets power-down values.
5288	Preliminary tape I/O routine.
5290	Called at the end of tape I/O.
5296	Returns byte from tape in accumulator.
5313	Sends byte in accumulator to tape.
6281	EOF
6404	TIME\$
6436	DATE\$
6485	DAY\$
6520	ASCII of days stored here.
6553	Converts byte pointed to by DE to an ASCII digit. Result placed in M.
6571	TIME\$ (as command/assignment).
6589	DATE\$ (as command/assignment).
6641	DAY\$ (as command/assignment).
6547	MAX RAM
6776	IPL
6814	COM,MDM
6851	KEY ON/OFF/STOP
6927	ON TIME\$
7096	KEY (general)
7101	KEY LIST
7136	PRINTS B PRINTable-characters starting at address in HL.
7182	Defines function key. HL points to string, accumulator holds key number minus one.
7255	PSET
7270	PRESET
7277	Line drawing routine.
7519	Subroutine for PRINT @
7568	CSRLIN
7579	MAX (general).
7602	MAX FILES
7609	HIMEM
7619	WIDTH
7621	SOUND (general)
7653	SOUND OFF
7654	SOUND ON
7660	MOTOR
7667	Turns motor on.
7669	Turns motor off.
7674	CALL
7714	SCREEN
7774	LCOPY
7994	FILES
8081	KILL
8247	NAME
8446	NEW
8832	CSAVE (general)
8856	CSAVEs current BASIC program.
8889	Sends the DE bytes starting at location in HL to tape.
8908	SAVEM
8925	CSAVEM
9079	CLOAD (general)

Table 1 continued

The routines that you need for these actions all appear in the map. You can use the machine code below to find the square root of the variable pointed to by the HL register pair.

```
PUSH H      ; We will need this address later.
CALL 12740  ; Put the variable into FAC1.
CALL 12378  ; Take the square root.
POP H       ; I told you we needed that address.
CALL 12746  ; Replace the value by its square root.
RET         ; That's all.
```

Access the program above from Basic by using the next program, being sure to protect it first by the command CLEAR 256,61999. This prevents Basic from destroying the machine code starting at location 62000.

```
5 GOSUB 100
10 INPUT "X ";X
20 A = VARPTR(X) + 65536
30 CALL 62000,0,A
40 PRINT X
50 END
100 FOR I=0 TO 11
110 READ V
120 POKE 62000+I,V
130 NEXT I
140 RETURN
150 DATA 229,205,196,49,205,90,48,225,205,202,49,201
```

This program assumes that you've placed the machine-language routine at location 62000. Line 20 determines the memory location of the variable X, and line 30 passes this address to the register pair HL before executing the routine at 62000.

Lines 100-150 POKE the machine code described earlier into memory.

Now run the program, and you'll see that the value of the variable X is replaced by its square root.

Some of the other floating point functions seem to require the setting of the variable type flag prior to a Call.

Interrupts and the RST Instructions

Like the 8080, the Model 100's 8085 chip contains eight restart instructions that are effectively 1-byte Call instructions. (See Table 1.)

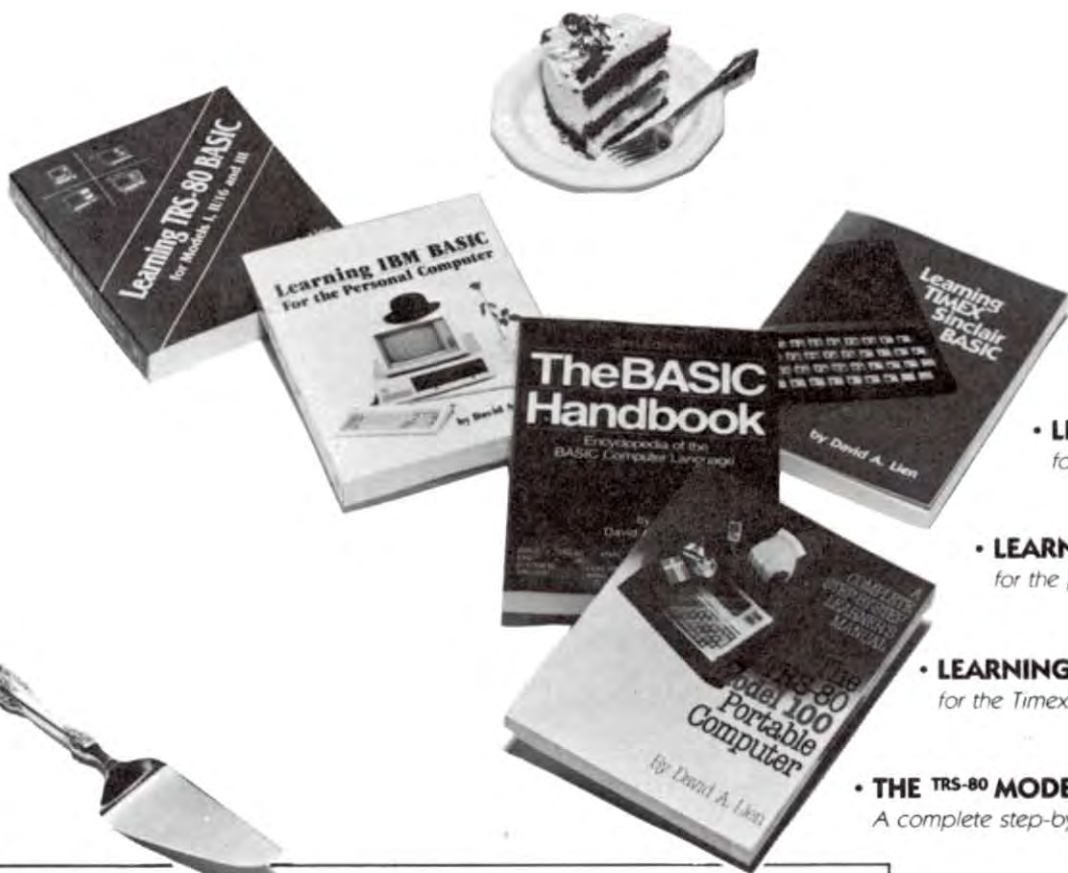
Unlike the 8080, the 8085 has several interrupt routines known by the mnemonics RST 5.5, RST 6.5, RST 7.5, and TRAP. The addresses of each of these resides in the low bytes of ROM. However, the Model 100 allows a user to intercept these routines by placing a Jump instruction in a particular location in RAM. These interface vectors are documented in the map.

The Basic Commands

The memory map contains the addresses of most of the Basic commands and functions. The important thing to realize is that most Basic commands expect the accumulator to contain the next byte of Basic text upon entry to the routine. Some commands, such as Beep and End, aren't modified by additional text. A simple call to the addresses of these routines has the desired effect. On the other hand, the actions of some commands depend upon the text that follows them. For example, consider the Key command. When this statement appears in a Basic program or in immediate mode, several things may

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C-Notes

follow it. For instance, KEY ON, KEY OFF, KEY LIST, or KEY 5, "PRINT" are all possible. At the time the program executes the command, the computer has already tokenized the keywords, and the Key routine expects to find the appropriate token or text in the accumulator. The token for ON is 151, and so typing CALL 7096,151 produces the effect of KEY ON. Similarly, since the token for LIST is 165, CALL 7096,165 will result in the same action as if you had entered KEY LIST. Unfortunately, you'll find that not all calls to Basic command locations respond as expected. So be cautious when experimenting with these addresses.

Using the Memory Map

The examples given earlier should help you take advantage of much of this information. You cannot use all of the routines in the ROM directly, however. Many of them, like the floating point operations, require setting up special conditions prior to the call. And, although I would strongly urge you to experiment with your computer, be sure you have saved any important data or programs on tape first. An inappropriate call or POKE can easily garble a program or cause the computer to hang. Of course, you will not damage the computer by such a crash, but you may be unable to restart the computer without using the memory kill button on the bottom of the computer.

About the Map

Notice that items enclosed in single quotes represent actual ASCII text. For instance, the word 'Error' is stored in memory starting at location 1003. The letters H,L,D,E,B,C, and A refer to registers in the 8085. ■

David P. Sumner can be reached at 1009 Walters Lane, Columbia, SC 29209.

Table 1 continued

9235	Gets DE bytes from tape and stores them at the location pointed to by HL.
9302	CLOAD?
9345	'Verify failed'
9361	LOADM, RUNM
9383	CLOADM
9538	Moves B bytes from address in HL to address in DE in an increasing manner.
9587	CLOADM?
9685	'Top End Exe'
9697	'Exe:'
9982	'Found'
9989	'Skip'
10042	STR\$
10161	PRINTs message pointed to by HL. Message ends in quote or 0-byte String addition.
10444	String addition.
10508	Moves L bytes from address in BC to address in DE (increasing).
10563	LEN
10575	ASC
10597	CHR\$
10605	STRING\$
10638	SPACE\$

Table 1 continued

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Table 1 continued

10667	LEFT\$		
10716	RIGHT\$		
10726	MID\$		
10759	VAL		
10807	INSTR		
11084	FRE		
11113	FAC1 <-- FAC1-FAC2.		
11128	FAC1 <-- FAC1+FAC2.		
11519	FAC1 <-- FAC1*FAC2.		
11719	FAC1 <-- FAC1/FAC2.		
12006	Moves C bytes starting from address in HL to address in DE in a decreasing manner.		
12015	COS		
12041	SIN		
12120	TAN		
12145	ATN		
12239	LOG		
12378	SQR		
12452	EXP		
12606	RND		
12686	MOVE FAC1 to 64633-64640.		
12692	Adds memory to FAC1.		
12698	Subtracts memory from FAC1.		
12704	FAC1 <-- FAC1*FAC1 (squares FAC1)		
12707	Multiplies memory and FAC1.		
12725	Moves FAC1 to FAC2.		
12728	Moves number at address HL to FAC2.		
12737	Moves FAC2 to FAC1.		
12740	Moves number at address HL to FAC1.		
		12746	Moves FAC1 to address in HL.
		12852	Saves FAC1 on the stack.
		12892	Floating point constants.
		12942	.25
		12974	pi/2
		12990	Square root of 3.
		13015	1
		13203	2*pi.
		13298	ABS
		13309	Negate FAC1.
		13319	SGN
		13417	Moves B bytes of memory from address in DE to address in HL in an increasing manner.
		13426	Moves B bytes of memory from address in DE to address in HL in a decreasing manner.
		13569	CINT
		13610	CSNG
		13754	CDBL
		13893	FIX
		13908	INT
		14804	PRINTs the 16-bit integer stored in the register pair HL.
		16288	TIME\$ ON
		16306	TIME\$ OFF
		16313	TIME\$ STOP
		16393	Clears COM and TIME\$ locations. Clears KEY definitions and sets 63060 to 0

Table 1 continued

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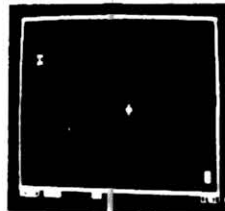
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Table 1 continued

15758		printer.
16511	RESTORE	19360 Sends carriage return to printer
16538	STOP	19434 INKEY\$
16543	END	19659 OPEN
16602	CONT	19824 LOAD
16625	Determines if HL points to an alphabetic character.	19825 MERGE
16626	Determines if the accumulator contains an alphabetic character.	19919 SAVE
16633	CLEAR	20008 CLOSE
16756	NEXT	20110 INPUT\$
16930	PRINTS CHR\$(13)+CHR\$(10)	20591 LFILES
16937	BEFP	20725 'CRT CAS COM WAND LPT MDM RAM'
16941	PRINTS CHR\$(11)	20806 TELCOM program.
16945	CLS	20558 Enter here or one of 20561, 20563...20579 in case of file errors.
17001	Turns on reverse video.	20593 DSKO\$
17006	Turns off reverse video.	20595 DSKI\$
17008	PRINTS CHR\$(27)+CHR\$ of accumulator.	20860 'Telcom'
17034	Clears the label line.	20869 'STAT'
17064	PRINTS label line.	20874 'TERM CALL RFIND MENU'
17994	Puts input data into input buffer.	20900 'Find Call Stat Term Menu'
18315	DIM	20906 'x pps'
18320	Get variable name and type.	21060 'Calling'
18833	USING	21890 'Full Half Echo'
19268	PRINTS ASCII character in accumulator.	21909 'Wait'
19322	Sends byte in accumulator to the	22353 'File to upload File to download'
		22385 'aborted'
		22396 'No file'
		22406 'Disconnect'
		22417 PRINTS message. Sends a cr if not at start of a line.

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Table 1 continued

22423	MENU	27611	Moves BC bytes from address in HL to address in DE increasing.
22574	PRINTs number of free bytes.	27636	'BASIC TEXT TELCOM ADDRSS SCHEDL Suzuki Hayashi'
22580	PRINTs 'Select:' and responds appropriately to input.	27721	BASIC (as called from MENU)
23128	PRINTs starting at address in HL until a zero byte is reached.	27795	Temporarily saves the function keys.
23164	Sets up function keys.	27804	Restores the function keys.
23273	Months stored in ASCII.	29156	Adds a character to the keyboard buffer.
23312	'Microsoft'	29250	Returns ASCII of keypress in the accumulator; does not wait-returns 0 if no keypress.
23332	'Select:'	29381	SOUND routine. DE contains pitch, and B contains duration.
23366	Original key definitions stored here. FILES LOAD" SAVE " RUN LIST MENU	29772	Turns on the pixel (x,y) where D contains x and E contains y.
23400	ADDRSS (program)	29773	Turns off the pixel (x,y) where D contains x and E contains y.
23407	SCHEDL (program)	30326	Toggles the speaker.
23450	PRINTs 'Not found press space bar for menu'	30306	Equivalent to BEEP.
23758	ADRS.DO	30481	Character set 5-bytes each.
23767	'Not found'	31729	Keyboard matrix
23852	'Call'	32051	Initialization
23920	PRINTs date and time at top of screen and updates it until a key is pressed.	32231	Initialize pointers (cold start)
24046	TEXT (program)	32422	PRINTs TRS-80 logo.
24051	Requests a file to edit.	32428	PRINTs number of free bytes.
24085	'File to edit'	32523	MAX FILES=
24106	'FIND LOAD SAVE COPY CUT SEL MENU'	32664	' bytes free'
24145	EDIT (program)	32676	TRS-80 logo stored in ASCII.
24367	Waits for a space keypress and then returns.	40960-62959	User RAM in 24K machine.
24376	'Text ill-formed'	62964+	HIMEM value.
24395	'Press space bar for TEXT'	62966	Code called at 32145 and 32197.
24753	'Memory full'	62969	RAM vector for RST 5.5.
26051	Moves memory starting at address in HL to address in DE until a 0 byte is reached.	62972	RAM vector for RST 6.5.
26062	'No Match'	62975	RAM vector for RST 7.5.
26071	'String'	62978	JMP 5169
26380	'Width'	62981	Code called at 32108 and 32292.
26421	'Save to:'	62991	Code called at 896.
26579	'Load from:'	63012	Code
		63024	8-bytes KEY ON/OFF flags; ON=1

Table 1 continued

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	OFF=0
63033	Vertical Print position 0 to 7.
63034	Next horizontal print position 0-39.
63035	Number of active lines 0-8.
63036	Number of active columns 0-40.
63037	Label line flag; 0=unused, 255=used.
63038	Inhibits return to first line if not zero.
63040	Cursor line.
63041	Horizontal print position.
63048	Reverse video if not zero.
63054	x-pixel set.
63055	y-pixel set.
63063	Power-down value (constant).
63070	Code (to 63078)
63079	OUT/INP self-modifying code.
63090	Error code
63092	Value of LPOS
63093	Output flag; 0=display, 1=printer.
63096+	Top of available RAM.
63098+	Current BASIC line number; 65535 stored here if no program is running.
63100+	Start of current BASIC program text.
63104	End of statement marker (: OR 0)
63105	Multi-purpose buffer area. Tokenized text starts at 63105. Input buffer starts at 63109 and extends to 63362.
63368	Value of POS
63369	Function key definitions currently active. (extends to 63497)
63498	Function key definitions used by BASIC. (extends to 63626)
63628+	Pointer to start of PASTE text.
63639	Start of work area.
63785	Day of the month low digit here, high digit in 63786.
63787	Current day of the week (e.g. 3=wed.)
63788	Current month - decimal 1 to 12.
63789	Current year stored with low decimal value here and the high decimal value in 63790
63791	Timer; decreases from 125 to 0.
63792	Timer decreases from 12 to 0.
63793	Power-down countdown value (varies).
63795	The computer stores the current time starting here with the low digit of the number of seconds. A numerical value - not ASCII.
63796	The high digit of number of seconds.
63797	Low digit of number of minutes.
63798	Time and date continues here with one decimal value per location.
63805	6-byte value of TIME\$ for ON TIME\$ statement (in reverse order).
63812	COM ON/OFF flag.
63813+	Address of COM ON routine.
63815	TIME\$ ON/OFF flag.
63816+	Address of TIME\$ ON routine.
63818	ON/OFF flag and routine address

Table 1 continue

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Table 1 continued

- of function keys; 3 bytes per key. (extends to 63841)
- 63842 Files in the format: address, 6-character name, 2-byte extension
- 63898+ Address of BASIC program that has not been saved to RAM. (Suzuki)
- 63909+ Address of Hayashi, points to the end of documents.
- 64173 Label line enable flag; enabled if not zero.
- 64175 Name of IPL program.
- 64190+ Used for temporary storage of stack pointer.
- 64208+ Length of CLOAded/CSAVEd program
- 64357 BASIC variable type.
- 64404+ Line number of active DATA statement.
- 64409+ Location of BASIC variable for assignment statement.
- 64411+ Start of current BASIC statement
- 64413+ 2 less than value in 63096-63097
- 64415+ Line where error occurred.
- 64417+ Most recently entered/listed line
- 64419+ Location of statement where error occurred.
- 64421+ Location of ON ERROR GOTO line.
- 64423 Error status flag.
- 64424+ End of BASIC expression.
- 64426+ Line where Break occurred.
- 64428+ Location after error (contains 0 or 58).
- 64430+ Start of documents.
- 64434+ Start of variables.

The region from 64536 to 64640 is used for floating point computations.

- 64536 FAC1 (floating point accumulator) 8-bytes.
- 64617 FAC2 (floating point accumulator) 8-bytes.
- 64642 Maxfiles.
- 64659 Name of current BASIC program; 6-bytes.
- 64668 Name of program loaded from tape; 6-bytes.
- 64904 Start of date and time stored in ASCII. Used for Menu display. Not used for TIME\$.
- 65024 Start of screen memory.
- 65348 Sound flag; on=0, off=175.
- 65349 Cassette on/off flag.
- 65424 Holds the value 2 as long as a noncontrol key is held down.
- 65429 Devoted to the number keys. Also uses location 65430
- 65431 Bits are set here according to which of the following keys are pressed: SPACE,DEL,TAB,ESC,PASTE,LABEL,PRINT,ENTER.
- 65432 Pressing a function key sets the corresponding bit in this location.
- 65441 Behaves like 65432.
- 65442 The following keys set bits in this location: SHIFT,CTRL,GRPH, CODE,NUM,CAPS LOCK.

- 65446 Code (not ASCII) for most recently pressed key.
- 65450 Number of characters in keyboard buffer.
- 65451 Keyboard buffer (32 byte maximum) Odd bytes contain ASCII values. A 255 in an even byte indicates a function key.
- 65515 Used to store 5-byte character code.

Token	Keyword	Token	Keyword	Token	Keyword
128	END	171	DATES	213	AND
129	FOR	172	DAYS	214	OR
130	NEXT	173	COM	215	XOR
131	DATA	174	MDM	216	EQV
132	INPUT	175	KEY	217	IMP
133	DIM	176	CLS	218	MOD
134	READ	177	BEEP	219	\
135	LET	178	SOUND	220	>
136	GOTO	179	LCOPY	221	=
137	RUN	180	PSET	222	<
138	IF	181	PRESET	223	SGN
139	RESTORE	182	MOTOR	224	INT
140	GOSUB	183	MAX	225	ABS
141	RETURN	184	POWER	226	FRE
142	REM	185	CALL	227	INP
143	STOP	186	MENU	228	LPOS
144	WIDTH	187	IPL	229	POS
145	ELSE *	188	NAME	230	SQR
146	LINE	189	KILL	231	RND
147	EDIT	190	SCREEN	232	LOG
148	ERROR	191	NEW	233	EXP
149	RESUME	192	TAB(234	COS
150	OUT	193	TO	235	SIN
151	ON	194	USING	236	TAN
152	DSKOS	195	VARPTR	237	ATN
153	OPEN	196	ERL	238	PEEK
154	CLOSE	197	ERR	239	EOF
155	LOAD	198	STRING\$	240	LOC
156	MERGE	199	INSTR	241	LOF
157	FILES	200	DSKIS	242	CINT
158	SAVE	201	INKEY\$	243	CSNG
159	LFILES	202	CSRLIN	244	CDBL
160	LPRINT	203	OFF	245	FIX
161	DEF	204	HIMEM	246	LEN
162	POKE	205	THEN	247	STR\$
163	PRINT	206	NOT	248	VAL
164	CONT	207	STEP	249	ASC
165	LIST	208	+	250	CHR\$
166	LLIST	209	-	251	SPACE\$
167	CLEAR	210	*	252	LEFT\$
168	CLOAD	211	/	253	RIGHT\$
169	CSAVE	212	^	254	MID\$
170	TIMES				

* Basic reads ELSE as :LSE, with LSE = 145.

Table 2. Basic keywords and tokens.

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—Make Your Own Modem Cable—

by Carl Oppedahl

While the Radio Shack modem cable for the Model 100 comes with one free hour each of CompuServe and Dow Jones services, this may be of little use to you if you already subscribe, or if you need more than one modem cable. For these reasons I built my own.

The circuit diagram for the Radio Shack cable appears in Table 3. One end is an exotic 8-pin DIN plug (see Photo 1) whose spacings are slightly different from those of the 8-pin cassette DIN plug. Look closely at the top panel of the Model 100: The difference lies in the placement of pins 6, 7, and 8. In the phone jack pins 7 and 8 sit directly below 1 and 3, while in the cassette jack pins 6, 7, and 8 are somewhat closer together.

Extending from the 8-pin plug are two conventional-looking modular telephone line cords. You would connect the beige cord to the local phone company dial tone, as with a wall jack, and the silver cord to a conventional telephone if you were using the computer as an automatic dialer for voice calls.

Unplug the modem cable from the Model 100, and the telephone connected to the silver cord will go dead. So Radio Shack provides a shorting connector to mate with the 8-pin plug in place of the Model 100. It connects pins 1 and 7, temporarily making the modem cable into a rather expensive telephone extension cord.

But with a bit of drilling and soldering, you can make your own cable at a cost of only a few dollars. Even if you buy all the parts new from Radio Shack and want to duplicate all the functions, including autodialing for voice telephone calls, you'll spend only \$10.88. (See Table 4.)

Since you need only pins 1, 3, and 7 (and you can omit pin 1 if you don't need the silver cord) you can pry loose one of pins

2, 4, or 5 to be used in position 7. However, it's difficult to remove pins from the black plastic. I ended up buying an extra 5-pin DIN plug, and simply cracked apart the plastic to get a spare pin to mount into a newly-drilled hole in the other.

After you extract an extra pin from a DIN plug, drill a hole in the 5-pin plug so that you can insert the new pin and glue it in place. This requires a 5/64-inch drill bit and a steady hand. Before drilling, slip off the plastic sleeve of the DIN plug by lifting the tab above pin 2. Then separate the two halves of the metal barrel inside. This exposes the black plastic carrier containing the five pins, which requires a hole for the new pin 7. The important thing is to drill the hole directly below pin 1, so that the new pin 7 fits into the matching hole in the Model 100 phone jack.

Then, mix up some epoxy glue. (I used a brand that sets in 10 minutes with satisfactory results.) Grasp the extra pin with a tweezer or needle-nose pliers, apply glue to it with a toothpick, and insert it carefully into the hole. (See Photo 2.) Hold it parallel to the other pins until the glue has hardened somewhat. Then let it set for the period recommended in the glue instructions.

Next take the modular phone cord and cut it in half. Taking one half, carefully remove about an inch of the outer jacket. Inside you'll find green, red, and probably black and yellow wires. Clip the yellow and black wires (if any) short and strip the red and green wires, which carry what the telephone com-

DIN pin	Modular plug
1	grey cable, green wire
2	NC
3	grey cable, red wire, and beige cable, red wire
4	NC
5	NC
6	NC
7	beige cable, green wire
8	NC

Table 3. Connections in Radio Shack Model 100 modem cable.

Part Description	Current Price
Two 5-pin DIN plugs, part number 274-003	\$1.49
Telephone line cord, part number 279-374	\$4.95
Inline coupler, part number 279-358	\$2.95

Table 4. Parts list for homemade modem cable.

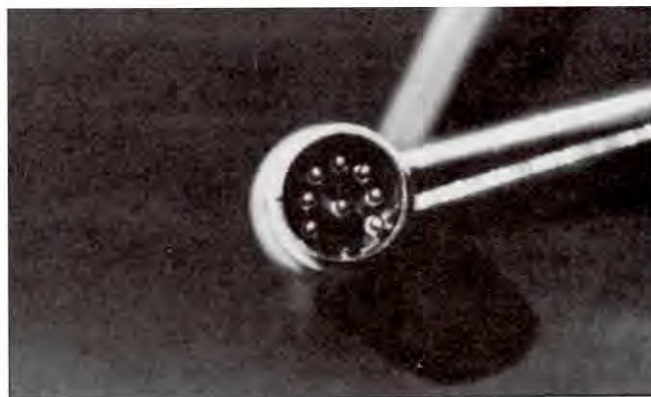


Photo 1. Radio Shack 8-pin DIN plug.



Photo 2. 5-pin DIN plug with new pin 7.



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Photo 3. The red wire goes to pin 3, while the green wire goes to pin 7.



Photo 4. Completed modem cable.

pany calls "ring" and "tip" signals, respectively.

Thread the DIN plastic sleeve onto the phone cord so that later you can slip it onto the DIN plug. Then solder the cord to the plug, connecting the red wire to pin 3 and the green wire to pin 7. Reassemble the metal barrel. (See Photo 3.) Slide the sleeve back on, and the cable should be ready to test. (See Photo 4.)

Testing the cable is easy. If you have access to an ohmmeter, use it to check that none of the DIN pins is shorted to any other, and that none of the modular plug pins is shorted to any other. Then check for continuity along the modem cable—the red wire at the modular plug should connect with pin 3 at the DIN plug, while the green wire should go to pin 7. Then plug the modem cable into the computer and the telephone line.

Call your local Radio Shack store to get the telephone number for Tymnet or Telenet. With the computer in TELCOM, dial that number on an extension phone, and when you hear the high-pitched carrier tone, push F4. Words and letters should appear on the screen. Then push F8, the Bye key, and type Y. The tone should stop. ■

Carl Oppedahl can be reached at 99 Park Ave., New York, NY 10016.

Program Length

by Ronald F. Balonis

Length.BA, an 8K RAM utility program, provides a method to compute program length in order to manage memory space on the Model 100. (See Program Listing 1.)

All memory references are in decimal notation. The user menu directory is located in RAM memory from 63930 to 64139, with each entry using 11 bytes. The first byte of each entry denotes the type of file: 0 is for a killed/empty file, 128 is for Basic program (.BA) files, and 192 for text (.DO) files. The next 2 bytes are the start address of the file in RAM memory, and the remaining 8 bytes are the file name and extension. Disassembly of the file area indicated that 26 is the end of file (EOF) indicator of a text file, and the standard string of three zeros is EOF for a .BA file.

The program conducts a sequential search of the directory for a file match, and then a sequential search of the file for the EOF byte, using PEEKs to read the memory. The menu directory search, while slow, proved acceptable, but the EOF search of the file had a tiresome wait with long files. This was an application in need of some machine language, and so I made my first attempt at a machine-language subroutine on the Model 100.

Borrowing on early Model I techniques, I fashioned a simple machine-language sequential search routine for the EOF search. The program loads it into the Model 100 with data statements, and the Basic PEEK and POKE statements pass the variables to and from the routine. A word or two of warning about my experience with machine language on the Model 100 is in order: Errors, at least of the types I made, cause the computer to do a cold restart, erasing all of the user programs.

Program Operation

Line 15 clears string space and reserves 50 bytes (from MAXRAM to HIMEM 63960 to 63910) for the machine-language subroutine. Lines 30-50 POKE the machine-language program (see Program Listing 2) into this memory space.

Lines 100-180 prompt for a file name, test that it has a valid formation, then construct a menu directory match string of it. The program stores the file names in the menu directory without the period before the extension, with the name left-justified and the extension right-justified, and with spaces filling the middle if necessary. Lines 200-260 do the sequential search of the menu directory using the PEEK function to create a match string. Line 205 tests for a killed/empty file, and line 225 tests for a match of file names. If a match is found, then lines 230-235 get its address. Line 310 passes this address to the machine-language program for the EOF search called in line 320 or 330. Lines 400-430 compute and display the results.

The utility program is simple to use. Just enter a valid file name and in two to three seconds the program displays its length for logging. Press the space bar for another program or to exit. ■

Write to Ronald F. Balonis at 118 Rice St., Trucksville, PA 18708.

```

5 'LENGTH.BA FIND LENGTH OF A PROGRAM
10 'BY R.F.BALONIS JULY 16, 1983
15 CLEAR 100,MAXRAM-50:'JULY 17, 1983
20 TITLES="LENGTH OF A PROGRAM"
25 '-MACHINE LANGAUGE PROG. END SEARCH-
30 FOR I=62911 TO 62958
40 READ Z:POKEI,Z:B$=B$+" "
50 NEXT I
60 DATA 0,0,229,42,191,245,43,
35,126,254,26,194,198
70 DATA 245,195,234,245,229,42,
191,245,43,35,126,254
80 DATA 0,194,213,245,35,126,254,
0,194,213,245,35
90 DATA 126,254,0,194,213,245,
34,191,245,225,201
95 '
100 B$="":FNM$="":ADRS=0
110 CLS:PRINT@10,TITLES
120 PRINT@82,"ENTER NAME AS IT APPEARS
ON THE MENU"
130 PRINT@165,"<ENTER> TO EXIT ";
135 INPUT FNM$:IF FNM$="" THEN MENU
140 I=INSTR(FNM$,"."):TYPE$="":TYPE=0
145 IF I=0 THEN 100
150 TYPE$=MID$(FNM$,I+1,2)
155 IF TYPE$="DO" THEN TYPE=1
160 IF TYPE$="BA" THEN TYPE=2
165 IF TYPE=1 OR TYPE=2 THEN 170
ELSE 100
170 FILN$=LEFT$(FNM$,I-1)
175 IF LEN(FILN$)<6 THEN FILN$=FILN$+"
":GOTO 175
180 FILN$=FILN$+TYPE$
185 PRINT@285,"**** SEARCHING DIRECTORY
****";
190 '
195 '--SEQUENTIAL DIRECTORY SEARCH--
200 FOR I=63930 TO 64139 STEP 11
205 B$="":IF PEEK(I)=0 THEN 240
210 FOR II=3 TO 10
215 B$=B$+CHR$(PEEK(I+II))
220 NEXT II
225 IF INSTR(B$,FILN$)<1 THEN 240
230 IL=PEEK(I+1):IH=PEEK(I+2)
235 ADRS=IH*256+IL:I=64139
240 NEXT I
245 IF ADRS=0 THEN 250 ELSE 290
250 PRINT@285," **** NOT IN DIRECTORY *
*** ";
260 FOR I=1 TO 1000:NEXT I:GOTO 100
280 '
290 '---FIND THE LENGTH---
300 PRINT@285," **** COMPUTING LENGTH *
*** ";
310 POKE62911,IL:POKE62912,IH
320 IF TYPE=1 THEN CALL 62913
330 IF TYPE=2 THEN CALL 62928
340 '
400 CLS:PRINT@10,TITLES
405 IADR=PEEK(62912)*256+PEEK(62911)
410 PRINT@163,"< "FNM$ " > IS "IADR-ADRS"
BYTES LONG"
420 PRINT@287,"**** PRESS <SPACEBAR> ***
**";
430 IF INKEY$="" THEN 100 ELSE 430

```

Program Listing 1. Length.BA—utility.

	Memory Address	Source Statement	Object Code
L Addr	62911		0
H Addr	62912		0
DO Entry	62913	Push HL	229
	62914	LD HL, 62911	42,191,245
	62917	Dec HL	43
	62918	Inc HL	35
	62919	LD A, (HL)	126
	62920	Cp 26	254,26
	62922	JNZ 62918	194,198,245
	62925	JP 62954	195,234,245
BA Entry	62928	Push HL	229
	62929	LD HL, 62911	42,191,245
	62932	Dec HL	43
	62933	Inc HL	35
	62934	LD A, (HL)	126
	62935	Cp 0	254,0
	62937	JNZ 62933	194,213,245
	62940	Inc HL	35
	62941	LD A, (HL)	126
	62942	Cp 0	254,0
	62944	JNZ 62933	194,213,245
	62947	Inc HL	35
	62948	LD A, (HL)	126
	62949	Cp 0	254,0
	62951	JNZ 62933	194,213,245
	62954	LD 62911, HL	34,191,245
	62957	Pop HL	225
	62958	Return	201

Program Listing 2. Length.BA—machine language.

Blackjack

by Paul Serotta

Blackjack isn't a mere conversion: This program uses the Model 100's unique features—graphics, sound, and interrupt-controlled function keys—to simulate the popular casino card game also known as 21. Like the Vegas version, the game program pits a single player against the house's dealer (the Model 100). The object of the game is to accumulate a hand worth 21 points, or as close to 21 as possible, without going over. The house wins if you draw over 21, or if the dealer's hand is closer to 21 than yours is.

The 8K program starts by asking you to type in your name and press the enter key. From now on, it addresses you personally. The program gives you a stake of \$1,000 and asks you to enter your bet. Should you decide to wager the entire amount on the first hand, the buzzer sounds and the program applauds your bravado with an encouraging "Go for it!"

Conversely, a low bet (under \$100) merits the program's disdainful "You are cheap!"

After you've entered your bet (in full-dollar amounts only), four boxes appear on the screen. The two upper boxes represent your first two cards; a typical deal might be a king of clubs and a six of hearts. In the lower right-hand box the program displays the dealer's first card, for example, a six of spades. You then have the following options, selected with the 100's function keys: hit, double, stay, and quit. Press the F1 key if you want another card, the F2 key if you want to be dealt another card and double your original bet, the F3 key to play a two-card hand against the dealer, or the F4 key to stop the game altogether.

When you stay, you're electing to play your current hand against whatever the house turns up for itself. The program then keeps dealing itself more cards until it has reached 21—an automatic win, beaten your hand, or gone over. If you lose, the program tells you "You are busted." If you win, it admits "I'm busted—you win!" Should the dealer's hand match your own, the program declares the deal a draw or "push" and no one wins or loses.

The program keeps a running tally of your stakes; after each deal it reminds you of how much money you have available and asks you to enter another bet.

It's impossible to cheat at this Blackjack, by the way. Try wagering more money than you have in your purse or doubling at the wrong time, and the program calls you on it.

When you decide to bail out, press the F4 key and the program totals your winnings—or your losses.

There's one born every minute. ■

Contact Paul Serotta at 131 Penrose Drive, Pittsburgh, PA 15208.

Program Listing 3. Blackjack.

```

10 REM *****
20 REM          BLACKJACK
30 REM
40 REM PAUL SEROTTA
45 REM 131 PENROSE DR.
50 REM PITTSBURGH, PA 15208
55 REM
60 REM *****

80 REM
99 REM DIMENSION CARD ARRAY, SET
  PLAYER'S AMOUNT OF MONEY
100 DIM C(52):PM=1000
105 REM CLEAR FUNCTION KEYS (F1-F4)
110 FOR LL=63369 TO 63432:POKELL,0:NEXT LL
112 REM TITLE PAGE
115 CLS:LINE(70,24)-(115,52),1,B:LINE(
  120,24)-(165,52),1,B:PRINT@173,"ACE
  ";:PRINT@181,"JACK ";
125 GOSUB9000:CLS:PRINT@121,"PLEASE
  TYPE YOUR NAME AND PRESS 'ENTER'"
140 PRINT:LINE INPUTN$:GOSUB9000
145 KEY OFF:IFPM=<=0 THEN GOTO3000
147 REM INITIALIZE LOGIC VARIABLES & ASK

```

```

FOR BET
150 PP=1:CS=2:PA=0:CA=0:PT=0:CT=0:CR=2:
  PC=81:CP=201:GOSUB9020:PRINT:PRINTN$;"
  YOU HAVE $";PM
160 PRINT@200,"";:INPUT"PLEASE ENTER
  YOUR BET";BET:BET=INT(BET)
170 IF BET >PM THEN GOSUB9050:GOTO160
180 IFSGN(BET)=-1ORSNG(BET)
  =0 THEN GOSUB9050:GOTO160
190 IFBET=PM THEN PRINT@293,CHR$(27);"p";"
  GO FOR IT !! ";CHR$(27)
  "q";:SOUND4000,15:SOUND3000,10:SOUND200
  0,8:FORDL=1TO500:NEXTDL
195 IFBET<100ANDPM>500 THEN PRINT@291,CHR$
  (27);"p";" YOU ARE CHEAP !! ";CHR$(27)
  "q";:SOUND4000,30:SOUND12000,30:FORDL=1
  TO500:NEXTDL
200
GOSUB9020:GOSUB9100:GOSUB9110:PP=1:GOSUB
9500:ONKEYGOSUB1000,4000,2000,3000
202 PRINT@100,CHR$(155);"
  YOU";:PRINT@220,CHR$(155);"
  DEALER";:FORDL=1TO300:NEXTDL:PRINT@100,S
  PACE$(6);:PRINT@220,SPACE$(9);
210 PRINT@PC,C$;CHR$(156+SU);:PC=PC+
  8:PT=PT+CV:GOSUB9500:PT=PT+
  CV:PRINT@PC,C$;CHR$(156+SU);:PC=PC+8
215 IFPA=2 THEN PA=1:PT=PT-10
220 PP=0:GOSUB9500:HC$=C$+CHR$(156+SU)
  :CT=CT+CV:CP=CP+8:GOSUB9500:CT=CT+
  CV:PRINT@CP,C$;CHR$(156+SU);:CP=CP-8
225 IFCA=2 THEN CA=1:CT=CT-10
230 IFPT=2LANDCT<>
21 THEN PRINT@CP,HC$;:PRINT@280,"BLACKJACK
  !$!$!$!$!$!";:PM=PM+BET+INT
  (BET/2)
  :FORDL=1TO5:SOUND4000,10:SOUND8000,10:NE
  XTDL:GOTO145
240 IFCT=2LANDPT<>
21 THEN PRINT@CP,HC$;:PRINT@280,"I HAVE
  BLACKJACK $$!! - YOU LOSE ";:PM=PM-
  BET:SOUND14000,15:SOUND16000,20:FORDL=1T
  O1000:NEXTDL:GOTO145
250
  IFCT=2LANDPT=21 THEN PRINT@CP,HC$;:GOTO221
  0
260 KEY ON
270 PRINT@280,"HIT DBL STAY
  QUIT";:FORWW=1TO200:NEXTWW:PRINT@280,SPA
  CE$(39);:FORWW=1TO200:NEXTWW
280 IFNH=1 THEN NH=0:GOTO145:ELSEGOTO270
999 REM PLAYER HITS
1000 CR=CR+1
1010 IFCR=3 THEN LINE(94,9)-(142,30)
  ,1,B:GOTO1050
1020 IFCR=4 THEN LINE(141,9)-(189,30)
  ,1,B:GOTO1050
1030 IFCR=5 THEN LINE(188,9)-(236,30),1,B
1050 PP=1:GOSUB9500:PRINT@PC,C$;CHR$(
  156+SU):PC=PC+8:PT=PT+CV
1060 IFPT>2LANDPA=<=0 THEN PRINT@280,N$;"
  YOU ARE BUSTED
  ";:FORDL=1TO10:SOUND12000,DL:NEXTDL:PM=P
  M-BET:FORDL=1TO500:NEXTDL:NH=1:RETURN
1070 IFPT>2LANDPA>0 THEN PA=PA-1:PT=PT-10
1100 IFCR<>5 THEN RETURN
1200 PRINT@280,"5 CARD CHARLIE - YOU WIN
  !!";:FORDL=1TO8:SOUND5000,DL:SOUND15000,
  DL:NEXTDL:PM=PM+BET+INT(BET/2)

```

Listing 3 continued

Listing 3 continued

```

:NH=1:RETURN
1999 REM COMPUTER'S LOGIC
2000 KEY OFF
2005 PRINT@280,SPACE$(38);
2010 PP=0:PRINT@CP,HC$:CP=CP+16
2020 WC=94: IFCT>16THEN2200
2050 CS=CS+1:
IFCS=6THENGOTO2206:ELSELINE(WC,32)-(WC+
48,53),1,B:GOSUB9500
2060 WC=WC+47:CT=CT+CV:PRINT@CP,C$;CHR$(
156+SU);:CP=CP+8
2070 IFCT>21 AND CA>0 THENCA=CA-1:CT=CT-
10
2075 IFCS=6ANDCT<22THENGOTO2206
2080 IFCT<=16THEN2050
2199 REM WHAT HAPPENED?
2200 IFCT>21THENPRINT@280,"I'M BUSTED --
- YOU WIN
!!";:SOUND14000,20:SOUND10000,20:SOUND50
00,20:SOUND3500,20:PM=PM+BET:GOTO2500
2206 IFCS>=5THENPRINT@280,"I'VE GOT A 5
CARD CHARLIE -- YOU LOSE";:PM=PM-
BET:SOUND7500,20:SOUND5000,15:SOUND10000
,20:GOTO2500
2210
IFCT=PTTHENPRINT@280,"PUSH.....
";:FORDL=7000TO10000STEP1000:SOUNDL,8:N

```

```

EXTDL:GOTO2500
2220 IFCT>PTTHENPRINT@280,"I WIN
$$$$$$$$";:SOUND16000,25:PM=PM-
BET:GOTO2500
2230 IFCT<PTTHENPRINT@280,"YOU WON
!!!!";:SOUND3000,20:SOUND8000,20:SOUND3
000,20:PM=PM+BET
2500 FORDL=1TO1250:NEXTDL: IFCO>
25THENGOSUB9100
2505 NH=1: RETURN
2999 REM QUIT
3000 CLS:PRINT@80,"BYE ";N$:IFPM>
=1000THENPRINT@200,"YOU WON $";PM-
1000:END:ELSE
3010 PRINT@200,"YOU LOST $";ABS(PM-1000)
:END
3999 REM PLAYER DOUBLES
4000 IFCR>2THENPRINT@280,"YOU CAN'T
DOUBLE NOW --- DUMMY
!!";:SOUND7500,20:SOUND13000,20:FORDL=1T
O1000:NEXTDL:PRINT@280,SPACE$(38)
;:RETURN
4002 IFBET*2>PMTHENPRINT@280,"YOU DON'T
HAVE ENOUGH MONEY ****
";:SOUND3000,10:SOUND15000,10:SOUND8000,
10:FORDL=1TO1000:NEXTDL:PRINT@280,SPACE$
(35);:RETURN

```

Listing 3 continued

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Listing 3 continued

```

4005 PP=1:CR=CR+1:LINE(94,9)-(142,30)
,1,B:GOSUB9500
4010 PRINT@PC,C$;CHR$(156+SU):PT=PT+
CV:BET=BET*2
4020 IFPT>21ANDPA<=0THENGOTO1060
4030 IFPT>21ANDPA>0THENPT=PT-10
4050 GOTO2000
8999 REM PRINT WELCOME
9000 FORLL=1TO5:PRINT@50,"WELCOME TO
";CHR$(27);"P";"BLACKJACK";CHR$(27);"Q"
9010 FORDL=1TO60:NEXTDL:BEEP:
PRINT@50,SPACE$(20)
;:FORDL=1TO60:NEXTDL,LL:RETURN
9015 REM PRINT NAME OF GAME ON FIRST
LINE
9020 CLS:LINE(0,0)-(239,7)
,1,BF:PRINT@15,"BLACKJACK":LINE(0,7)-(
239,7):RETURN
9030 REM ANY CHEATING ??????
9050 PRINT@280,"NO CHEATING IN THIS GAME
1";:SOUND4000,10:SOUND10000,10:SOUND1600
0,10
9060
FORDL=1TO750:NEXTDL:PRINT@223,SPACE$(96)
;:RETURN
9099 REM SHUFFLE THE CARDS
9100 CO=0:FORLL=1TO52:C(LL)

```

```

=1:NEXTLL:RETURN
9105 REM DRAW THE INITIAL 4 CARDS
9110 LINE(0,9)-(48,30),1,B:LINE(47,9)-(
95,30),1,B:LINE(0,32)-(48,53),1,B:LINE(
47,32)-(95,53),1,B
9115 RETURN
9499 REM PICK A CARD
9500 SEC=VAL(RIGHT$(TIME$,2))
:FORI=1TOSEC:DUM=RND(1):NEXTI:RN=INT(RND
(1)*53)
9510 IFC(RN)=0THEN9500
9520 CO=CO+1:C(RN)=0:SU=RNMOD4:
9530 IFRN>4THENGOTO9535:ELSEC$="ACE
":CV=11
9532 IFPP=1THENPA=PA+1:ELSECA=CA+1
9533 GOTO9600
9535 IFRN>40THENGOTO9540:ELSEC$=STR$(INT
(RN/4))+":CV=INT(RN/4)
9537 IFRNMOD4<>0THENC$=STR$(INT(RN/4)+1)
+"":CV=INT(RN/4)+1
9538 GOTO9600
9540 IFRN<45THENC$="JACK
":CV=10:GOTO9600
9545 IFRN<
49THENC$="QUEEN":CV=10:GOTO9600
9550 C$="KING":CV=10
9600 RETURN

```

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION

1. Title of publication, 80 Micro. A. ISSN 07447868. 2. Date of filing, Oct. 1, 1983. 3. Frequency of issue, Monthly. A. No. of issues published annually, 12. B. Annual subscription price, \$36.00. 4. Location of known office of publication, 80 Pine Street, Peterborough, Hillsborc County, NH 03458. 5. Location of headquarters or general business offices of the publishers, Same. 6. Names and complete addresses of publisher, editor, and managing editor. Publisher and Editor, Wayne Green, 80 Pine Street, Peterborough, NH 03458. Managing Editor, Eric Maloney, 22A Pine Street, Peterborough, NH 03458. 7. Owner, International Data Group, PO Box 1450, 5 Speen Street, Framingham, MA 01701; Patrick J. McGovern, PO Box 1450, 5 Speen Street, Framingham, MA 01701. Stockholders, Wayne Green, Peterborough, NH 03458. 8. Known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities.

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RAM FILES

Monitor 100 Changes

I found the "Monitor 100" program (August 1983, p. 17) particularly interesting, but to make it work I had to make two changes to the printed version.

First, statement 58 is redundant and should be deleted. Also, in line 200, MID\$(0\$,3,4) should be MID\$(0\$,2,4).

The Model 100 is an excellent complement to my big computer (a Kaypro II set up as an RCPM/RBBS). I can prepare draft documents on the go, then capture the incoming text file to disk.

A Basic program on the Kaypro (ADDF.BAS) adds a line feed at each carriage return (required by CP/M and many non-TRS-80 computers). You can then print the resulting file as is, or process it further on your home computer. You can upload Model 100 Basic programs in a similar manner if you save them in ASCII format.

I use an Epson MX-80 printer. Its ability to skip over perforations by either software command or hardware switch lets you paginate documents created on the Model 100 without the intermediate step of uploading to a more powerful computer.

Anyone buying a printer for the Model 100 should look for this feature, as well as the capability to add line feeds (a hardware switch option on the MX-80).

The usefulness of the Model 100 is enhanced by the series of features initiated in your July issue. Although it is not my primary use of this computer, methods of installing machine language code would be a good subject for a future article.

*Phil Wheeler
5539 Towers St
Torrance, CA 90501*

Foxfighter Glitch

I just bought my first copy of *80 Micro*, and I'm delighted to find the C*Notes section dedicated to the Model 100. I am satisfied with my Model 100, but until recently thought that no one was writing software for it.

I enjoyed the Foxfighter program (August 1983, p. 200) but I did find a couple of glitches in it.

The program always presents one of seven predefined screen displays for the air mines. This becomes routine after a little while and encourages high scoring.

The changes shown in lines 10 and 25-34 in Program Listing 1 display the air mines in random patterns instead. Occasionally this results in an invisible air mine or two, adding to the challenge of the game.

Line 10 sets the RND function to one of 60 different starting points based on the Model 100's built-in clock. Lines 25-34 use the RND function to display the air mines in various screens instead of the seven predefined screens used in the original listing.

Also, line 150 of Foxfighter is supposed to provide an additional fighter plane when the score reaches 500, 1,000, and 2,000. Actually, it only increments the number of fighters displayed by 1 at these three points. Lines 150-158 in Listing 1 change the number of fighters as well as the display.

*Harold Shaver
509 Mulberry #6
Suisun, CA 94585*

```
10 DIMX(6),A(42):V=3:SCR=0:
CLS:PRINT@92,"<<FOXFIGHTER>>":
PRINT:PRINT:FOR T=1 TO VAL(RIGHT$(TIMES,2))
:SEC=RND(1):NEXT:INPUT"DO YOU NEED
INSTRUCTIONS (Y OR N) ";A$:IF A$="Y"
THEN 390 ELSE 20
25 FOR I=1 TO 42:READA(I):NEXT
30 FORM=1 TO 6
32 Y=INT(41*RND(1))+1:FOR I=1 TO
6:IF X(I)=A(Y) THEN 32
34 X(M)=A(Y):NEXTM
150 IF SCR=500 AND
BN=0 THEN V=V+1:BN=1:GOTO 155 ELSE IF SCR=1000
AND BN=0 THEN V=V+1:BN=1:GOTO 155 ELSE IF
SCR=2000 AND BN=0 THEN V=V+1:BN=1:GOTO
155
155 IF SCR<>500 AND SCR<>1000 AND SCR
<>2000 THEN BN=0
158 PRINT@0,V
```

Program Listing 1. Adjustments for Brad Dixon's "Foxfighter" program.

Calculator Program

The short calculator program in Program Listing 2 is one of the first programs I wrote on my Model 100.

To run the program, input a value and press the enter key. Then input either a plus (P), multiplication (.), subtraction (-), or division (/) sign.

Type in your next number and press the enter key. Now press the equals key to get an answer, or key in another function and continue calculating. Once you have an answer, you can start over, stop, or carry your balance forward.

By using P for addition and a period for multiplication, you don't need to use the shift lever.

*Mark Fox
774 Hazelwood Drive
North Wales, PA 19454*

```
5 CLS
6 PRINT"CALCULATOR PROGRAM"
10 INPUT Y
11 CLS
15 PRINTY
20 Y$=INKEY$:IF Y$="" THEN GOTO 20
21 IF Y$="." THEN 100
25 PRINTY$
30 INPUT X
31 IF Y$="P" THEN Y=Y+X:GOTO 20
32 IF Y$="-" THEN Y=Y-X:GOTO 20
33 IF Y$="*" THEN Y=Y*X:GOTO 20
34 IF Y$="/" THEN Y=Y/X:GOTO 20
100 PRINT"-----"
200 PRINTY;" IS YOUR ANSWER"
210 PRINT
220 PRINT"ANOTHER EQUATION? OR BAL
FWD(Y,N,B)"
223 Z$=INKEY$
230 IF Z$="" GOTO 223
230 IF Z$="Y" THEN 5
240 IF Z$="Y" THEN 5
250 IF Z$="B" THEN 15
260 END
```

Program Listing 2. Model 100 Calculator program.

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NEWS THIS MONTH



14,000 miles with a Model 100

Steve Roberts' bicycle odyssey.

Anyone who's bought a TRS-80 Model 100 will tell you that the portable lets you work without being chained to a desk, but one owner is taking Tandy's "Micro Executive Work Station" idea far beyond an armchair or plane ride. Steve Roberts, a Columbus, OH, freelance writer, plans to conduct a year's business with his Model 100, without stepping into his office once.

In fact, most of the time he'll be lying down—on a custom-designed recumbent bicycle, festooned with generators and solar cells, which he'll pedal 14,000 miles across America.

On the road, Roberts will record his various writing projects using a helmet-mounted microphone and a portable tape recorder. After setting up camp, he'll transcribe his prose onto his 32K Model 100 and upload it via telephone to his main computer, a Micromax System 1000, in Columbus. Kacy Branstetter, Roberts' manager and editor, will be standing by to receive copy, forward phone calls, and serve as what Roberts calls his "interface with the universe."

Roberts' .DO files, he says, will make a pit stop between bike and Branstetter: The trip's primary sponsor, Compu-Serve Information Service, is supplying "essentially unlimited time and file-space" for uploading. CIS members are encouraged to chat with the rolling writer (his user ID number is 70007,362), and his saga will be available as a regularly updated data base: "I think you'll be able to just type GO SKR and it'll be there as a display file," Roberts predicted.

An on-line travelogue isn't Roberts' first high-tech writing assignment. A former software and systems consul-



Roberts: "I'll exist in a totally asynchronous fashion."

tant, the 31-year-old author turned to Words'worth Inc., a business communications firm, he alternates magazine ar-

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ticles and books (Prentice-Hall's *Creative Design with Microcomputers* and *Complete Guide to Microsystem Management*) with corporate technical writing assignments. The former, he told CompuServe's *Today* magazine editor Carole Gerber, offer "fame and glory," while the latter "[provide] steady income."

His bicycle trip is a shot at both. Interviewed two weeks before his scheduled Sept. 28 departure, Roberts told *80 Micro* he planned a 700-mile "shake-down cruise" around Indianapolis, IN, and Louisville, KY. Then, in early November, he'll begin his journey with a turn south from Washington, DC, toward Florida to start a clockwise loop of the U.S.

"I'm anticipating [the trip's taking] about a year, finishing up around the idea, of course, is to take advantage of as much good weather as possible."

In preparation for the voyage, Roberts said, he was wringing out both his Model 100 and his legs: "I'm basically living off the Model 100 now for everything. Between the Model 100 and CompuServe, my office is very light."

As for physical preparation, "The obscene part of all this is that I've been riding around central Ohio, which is very flat and [where it's] very easy to get cocky about your ability to go long distances. [But] unless there are physical problems I don't see any trouble. I may bust a knee and jettison all this high-tech equipment."

He's already jettisoned an item that would have spared him frequent visits to phone booths. Technical problems and the unit's weight aborted his plans to carry a second computer, a home-made CMOS CP/M system with 3½-inch microfloppies for mass storage; that leaves him the stock Model 100, no storage except RAM, and obligatory stops to upload every 15 pages or so.

"I'm hoping to get something that'll be useful for [bulk storage] fairly soon," Roberts admitted. "I've looked at wafertape drives, and I'm interested in what people are doing with 3½-inch floppies. If all else fails I have cassette, though I'm not crazy about it."

"If anyone comes up with more memory, I'm ready. I've talked a little to Holmes Engineering about the 256K bubble memory and it sounds like it's not quite ready, but that would be a worthwhile purchase if it comes out

sometime during the trip."

Meanwhile, he estimates that his cycle, camping gear, and electronics equipment total about 110 pounds, some taken up by a high-tech way to save batteries: "A couple of solar panels that were donated by Solarex provide 15 volts in full sun," he said, and another sponsor has contributed rechargeable Ni-Cad cells.

Besides relying on them, plus an ac line when available, Roberts has a generator similar to those that run bicycle headlights: "If I've got a good tailwind or I'm flying downhill, it's a simple matter to pop [the generator] against the wheel and get power."

There's one item he doesn't expect to use—a CB radio, carried in case of emergency. "I've stripped it down almost to just a PC board," Roberts said. "It's not even near me when I'm doing my regular writing, but if I'm crashed in a ditch somewhere I'd like to be able to call for help."

While the trip will challenge not only Roberts' stamina but the Model 100's—"how well it will do in the sun and vibration and dirt and everything else"—Radio Shack is keeping its distance from the project. "They know about it but seem kind of unresponsive," Roberts said when asked about any contact with Tandy. "I encountered such a huge, faceless organization when I [approached them] for a sponsorship that I went back to CompuServe."

That may be because Radio Shack is unwilling to share other people's publicity stunts. Roberts seems sincere and enthusiastic about the trip and eager to discuss it as an affirmation of new technologies' ability to liberate desk-bound workers, but the enterprise is not exactly free of Madison Avenue-style merchandising.

In addition to his CompuServe updates, there's the matter of what Roberts will write during his year on the road. Besides freelance magazine articles and material for corporate clients, he plans two books. One will be either a "boring but easy to write" text about on-line communications and engineering, or a computer science text which Roberts calls "potentially a huge money-maker but a lot of work."

Roberts' second and more important effort will be a book tentatively titled *Computing Across America: A Bicycle Odyssey*, for which his agent is currently negotiating with several publishers.

Suspicion of Roberts' making the trip in order to write about it, rather than making it and then writing about it, lessens the credibility of his words to *Today's* Gerber: "The whole trip offers an opportunity to test the viability of the information society. I want to see if I can maintain a heavily interactive, information-oriented professional practice involving a lot of clients [with] complete freedom from the confines of an office. I'll exist in a totally asynchronous fashion."

Also, Roberts' point is to be free from desks and papers, yet he'll be carrying generators and solar cells. Is that practical? "I think it is practical," he told *80 Micro*, "and I've been doing it on a very small scale recently as I've been practicing."

"I find I get a lot more done when I'm out on a beach or something with a Model 100. This morning, in fact, I wrote most of an article at a Wendy's restaurant while having breakfast. When I'm out of the office, there are fewer distractions and I can get more done."

This makes sense, but sounds more like most users' appreciation of the 100 as a handy notepad than a defense of a full-time career with one. Also, of course, Roberts' job fits his thesis better than most other professions would; the freelance writer is the most insecure financially, but the least place- and equipment-bound, worker there is.

Nevertheless, Roberts insists, his trip goes beyond both commercial aspects and his point about the open office. "If I wasn't writing for a living and had lots of money I'd be doing it anyway," he said. "The fact that I'm not independently wealthy forces me to work while I'm on the road, and [the 100's] a convenient way to do that."

"I don't think it is [a publicity stunt]. I've thought about it a lot and wondered if it was, and it doesn't feel that way. It's something I do privately as well as publicly."

And, anyway, Roberts' tour is an adventure. *Computing Across America* is unlikely to rival de Tocqueville's *Democracy in America* or William Least Heat Moon's *Blue Highways*, but Roberts' combination of gee-whiz Woodstock spirit and "Real People" PR might produce a bestseller.

How about *Zen and the Art of Model 100 Maintenance*? ■

—E.G.

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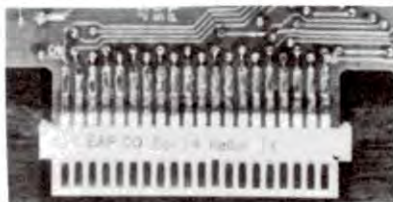
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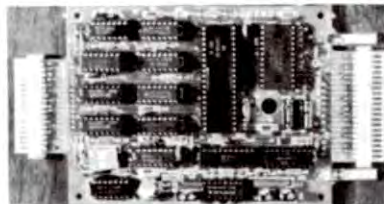


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SOFTWARE

ROM is copyright

Apple wins; Franklin to appeal.

Diving into a hazy maze of 0's and 1's, a federal appeals court in Philadelphia has issued a ruling that makes the question of software copyright one step clearer, even as it blurs the distinction between software and hardware.

On August 30, a three-judge panel upheld Apple Computer Inc.'s lawsuit against Franklin Computer Corp., allowing Apple to seek an injunction against sales of Franklin's Apple-compatible Ace 1000. The key decision: computer manufacturers can copyright operating systems and programs in ROM, as well as applications programs.

Writing that "the medium is not the message," Circuit Court Judge Darcy Sloviter overturned a lower court's denial of Apple's suit. Franklin admitted copying 14 operating system programs before the lower court, but argued that such programs embodied in chips are essential parts of the machine—hardware—and, as such, ineligible for copyright.

The presiding federal district judge agreed, finding that firmware was not written "in a language of description" and refusing to issue a temporary restraining order against Franklin. The appeals court's decision lets Apple return to district court and seek the injunction, even as Franklin's lawyer, James Shestack, announced plans to ask for a rehearing—round 3 of the battle, so to speak—before the entire Court of Appeals. Round 4 might take place in the U.S. Supreme Court.

In upsetting Franklin's claim that the programs were an uncopyrightable "process, system, or method of operation," Sloviter and his colleagues said that that approach "mistakenly focuses on the physical characteristics of the instruction," like paying attention to a book's ink and paper rather than its contents. "Apple," the panel declared, "does not seek to copyright the method which instructs the computer to perform its operating functions but only the instructions themselves."

"Franklin's attack on operating sys-

tem programs as 'methods' or 'processes' seems inconsistent with its concession that application programs are an appropriate subject of copyright," the court continued. "Both types of programs instruct the computer to do something."

"The statutory definition of a computer program...makes no distinction between application programs and operating programs. We reaffirm that a computer program in object code embedded in a ROM chip is an appropriate subject of copyright."

The decision makes an important distinction between the two legal means by which people protect their ideas—copyright and patent. As the *New York Times'* David E. Sanger wrote, "Under U.S. law, copyrights protect the expression of an idea, such as a literary work. Ideas themselves, in the form of novel inventions, are protected by patents."

In Franklin's view, Apple's operating programs were unpatented hardware, and therefore free for copying. Computer makers, Sanger pointed out, "have shied away from using the patent system to protect their programs," because patents take a long time to obtain and because "it is not clear whether most computer programs are sufficient-

ly novel and distinct from one another to merit patent protection."

For example, Scripsit and Newsprint, both TRS-80 word processors, are alike in many ways—generally, they're both written in 1's and 0's; more specifically, they use similar routines to perform similar tasks such as opening and closing files. Like two novels written with the same words, they are not different enough to be patented. They are, however, copyrighted by Radio Shack and Prosoft respectively.

As for Apple, the Cupertino, CA, firm's vice president and general counsel, Albert Eisentat, was naturally pleased with the ruling, telling *Computerworld*, "I think it's one of the most definitive statements of the law that's been done yet."

Whatever the odds, however, Franklin vowed to continue the fight. The Cherry Hill, NJ, company's executive vice president and chief operating officer, Avram Miller, told reporters, "Our plans right now are to go back to the court for redress. We believe we'll prevail and the injunction will be denied."

Added attorney Shestack, "We still contend that Apple was abusing the copyright laws to gain a monopoly on

As this issue went to press, Osborne Computer Corp. stopped production of its portable computers, laid off 300 of its 400 remaining workers, and filed for protection from creditors under Chapter 11 federal bankruptcy laws.

The Hayward, CA, firm employed 1,000 people before closing its New Jersey plant and beginning California layoffs last summer, plagued by more powerful and less expensive competitors to its Osborne I and delays in shipping its successor, the Osborne Executive.

On Sept. 12, two San Jose component suppliers filed a lawsuit claiming Osborne owed them more than \$4.5 million for circuit boards, disk drives, and other parts. The portable pioneer filed for Chapter 11 protection in U.S. Bankruptcy Court in Oakland on Sept. 13.

James Lopes, attorney for Osborne, told the Associated Press that three banks had agreed to loan the company \$600,000 while Osborne sought possible buyers or investors.

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equipment compatible with its machine.”

Ekos Inc., a Franklin distributor, issued a press release affirming its support of the Ace manufacturer. Ekos President Steven R. Gerbsman declared, “There are other alternatives not yet explored, including royalty payments, that cause us to believe we’ll be marketing Franklin computers for some time to come.”

The mention of royalty payments indicates a possible direction for settlement, though no one’s talking at pres-

ent; all Miller would tell *ISO World* was, “We have contingency plans if we fail.”

One of Franklin’s contingency plans is probably its IBM PC-compatible micro, being prepared under the direction of engineer William Sydnese, who designed the original PC and reportedly was working on IBM’s Peanut when he moved to Franklin in April.

The Philadelphia ruling does not affect makers of IBM clones, because IBM’s “open architecture” policy

makes details of its PC system readily available.

Nevertheless, the Apple/Franklin decision means that computer companies can protect all software—whether on a disk, a listing, or a chip, and in source or object code—by copyright. Manufacturers continue to worry about small-scale piracy and product backups, but system pirates have apparently been sunk. ■

—E.G.

BUSINESS

Waiting for Santa

The micro industry looks to the Christmas market.

After a summer of rollercoaster stock prices and grim predictions for TI and Atari, the microcomputer industry tried to pull itself into shape for the Christmas buying season. By September, some companies had asserted themselves as movers and shakers, some were on the move, and others were merely shaking.

Taking the latter first, **Texas Instruments** moved swiftly to reduce towering TI 99/4A inventories. A price cut to \$99 helped move the overstocked machine, and a peripheral package consisting of a disk drive and controller, 32K RAM expansion, and rack mount, was slashed from \$1,200 to \$550. In addition, stores received a free \$100 software package for every system ordered.

According to *Electronic News*, dealers immediately started selling the expansion package and software for as little as \$449, with industry observers predicting \$399 before long. Such a price, bringing a 48K disk system to around \$500, would be competitive, though other questions remained unanswered: whether buyers would be attracted to the software-scarce micro, and whether TI could survive at such a low (perhaps negative) profit margin.

Turning the knife in TI’s wound, Montgomery Ward issued its 1983 Christmas catalog on September 9—and bumped the 99/4A to give space to Coleco’s Adam.

Timex dealers had even less to smile about. Ken Coach, marketing and sales

director of Softsync, told *InfoWorld*, “The Timex-Sinclair 1000 has petered right out.” Coach hoped that the forthcoming TS 2068, the U.S. version of the Sinclair Spectrum color machine, might share the under-\$200 market with Commodore, but saw no prospects for the black-and-white TS 1500: “I’m not putting any hopes on it at all.”

Following TI’s lead, meanwhile, **Atari** cut prices for most of its lineup, from the 2600 VCS game console (effectively trimmed to \$59 after a rebate) to the new 600XL and 800XL home computers, given wholesale tags of \$140 and \$240 respectively. Even so, Atari’s retail prices were some \$60 above the competition’s—the 600XL versus the 99/4A in the 16K arena, and the 800XL versus the Commodore 64. Just as TI disappeared from Montgomery Ward shelves, the 203-store Target chain added Coleco and dropped Atari.

The Warner Communications subsidiary seemed to be pinning its hopes on its AtariSoft line of programs for non-Atari micros, announcing 12 games for the 99/4A and eight for Commodore, IBM, and Apple. In addition to computer versions (expected to retail for \$38 to \$50 apiece), Atari launched several titles for rival Intellivision and ColecoVision game machines.

While VIC-20 sales slowed to a crawl, **Commodore 64**’s were jumping off the shelves. While \$199 prices gave only a \$5 margin over wholesale cost, vendors relied on peripherals and software for

profit. For instance, 90 percent of C64 buyers also choose the 1541 disk drive—supplies of which nearly ran out in late summer, obliging Commodore to schedule an emergency airlift from Japan.

Spinnaker Software President Bill Bowman echoed the industry consensus when he told *InfoWorld*, “If the low end is going to have a savior, it will be the Commodore 64.” The only machine that seemed competitive was **Radio Shack**’s white-cased 64K Color Computer, which debuted at \$399.95—well under the C64’s original \$595, but twice Commodore’s current price. (The compact new Color Computer 2 with 64K RAM and Extended Basic lists for \$468.95, plus upgrade installation.)

How low will Commodore go? In its July 25 issue, *ISO World* claimed that building a C64 costs Commodore less than \$60 and that the firm could “apparently sell the 64 for \$99 wholesale and still make a profit.”

While no one seemed ready to tackle Commodore in the trenches, many manufacturers were comfortable in the higher levels of the market. **Kaypro** was making about 12,000 machines a month, while **Apple** and **IBM** each produced perhaps 70,000 IIs and PC’s respectively. **Compaq** predicted \$100 million in revenues for its first year, selling 50,000 copies of its portable PC clone.

There were rumors of more **middle-range micros** to compete with Adam

and Peanut—a \$500, 16-bit, 256K Commodore; an under-\$1,000 TI with concurrent CP/M in ROM. Steve Wozniak told the *San Jose Mercury News* that Apple's McIntosh, due in November or December for \$1,200 or so, would "just [boggle] everyone. It's just totally unbelievable and unexpected, not just a better version of something that is already around."

Coleco rebounded from pessimists' gossip to show production units of Adam (though a press release said "less than \$700" instead of the usual \$600 cost figure), and Child World, Markline, and Diners Club joined Wards and Target in placing orders for fall delivery. In mid-September, though, the press reported that Adam's FCC approval would be a month behind

schedule.

Coleco also joined AT&T in plans for "an interactive game and entertainment service," bringing Zaxxon and company to anyone with a home computer or game console. The service will use standard phone lines and an AT&T/Coleco modem; subscribers will pay a monthly charge plus user fees to play a game. The announcement upstaged Mattel, which developed the Playcable service now offered by 20 cable TV companies.

And IBM prepared to upstage everybody, with 100,000 Peanuts sold by Christmas. There was talk of still other news from Big Blue—a portable PC by year's end, a \$10,000, 32-bit challenger to Lisa by spring 1984—but IBM's home computer continued to rule the

gossip world.

Analysts couldn't agree on specifications, *Datamation* reported, but they agreed on one thing: Whether it cost \$700 or \$900, had 64K or 90K, and used a tape drive or a standard 5¼-inch disk or IBM's orphan 3.9-inch disk or CP/M or MS-DOS on a ROM chip, Peanut would use the IBM name to become the dominant force in home computing.

In the words of Peter Cunningham, president of Input, a Mountain View, CA, research firm: "Coleco's Adam might be state of the art for the home market and have the lowest retail price, but it will probably be IBM that makes all the money." ■

—E.G.

PULSE TRAIN

Magic/L challenges Basic

Loki, in Norse mythology, is a malevolent, mischievous god, always making trouble around the gods' home of Asgard and (in Marvel Comics' version) trying to defeat the mighty Thor. If Basic is the Thor of microcomputer languages, Loki Engineering of Cambridge, MA, is hoping to raise a little mischief of its own with a syntax called Magic/L.

According to *Mass High Tech*, Magic/L is "a Forth equivalent with simpler syntax and a high level of interactivity with the user." Its authors, Loki's Jeff Epstein and Arnold Morris, compare it to C and Pascal in terms of structure, but claim it's more powerful and more interactive.

"Magic/L is much faster than Basic, and can be learned in hours," Morris said.



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"[It's] the ultimate in user friendly, and once you get good, it allows you to do things like access Assembly language directly."

While working on satellite data display systems at the Smithsonian Astrophysical Laboratory, Epstein recalled,

he and Morris became "frustrated because [Forth] was so hard to read. Forth is what some people call a write-only language." In other words, what looks fine to a Forth programmer might prove baffling to someone who wants to modify the program

later.

In addition, Epstein claims, Forth and other languages "have their roots in prehistory. Basic, for heaven's sake, was written on an IBM 1130, much less of a machine than an Apple."

To overcome these short-

PULSE TRAIN

comings, the two programmers developed Magic/L, working on a Data General Nova in Epstein's basement in early 1981. Today, *Mass High Tech* says, Loki "is betting its future that Magic/L will become a standard language of the 1980s—perhaps even competing head-to-head with Basic in the personal computer market."

After selling it as a development tool for minicomputers, Marketing Manager Barry Unger said, Loki planned to launch CP/M-86 and MS-DOS versions of the new language at Boston's CP/M East show in October, and hoped to make Magic/L a household word before long.

"New languages are usually developed by large teams at universities," Unger said,

"but we believe we have something that is way ahead of anything else, and we see a tremendous growth potential."

Who knows? If Magic/L proves a threat to Microsoft and Digital Research, Loki Engineering may incur the wrath of the gods.

Non-programmable portable

While Tandy's Model 100 and its rivals are lap-sized workstations suitable for almost any computing task, Convergent Technologies Inc., of Santa Clara, CA, has taken a different approach. Its WorkSlate is designed for

specific applications, giving executives a spreadsheet, calculator, terminal, and telephone in an 8½- by 11-inch package.

The 3½-pound portable, introduced in ComputerLand and Businessland stores and in the American Express catalog, has a 16-line, 46-character LCD display, an 8-bit CMOS 6800 CPU, a 300-baud modem, and a built-in microcassette recorder. Its 16K RAM is expandable to 32K, but its strength is its 64K ROM—which includes an advanced spreadsheet and windowing capabilities.

For instance, users can put a spreadsheet at the top of the display and a financial calculator at the bottom, moving data back and forth between the windows.

WorkSlate's audio recorder lets it serve as a speaker-telephone and phone-answering machine; spreadsheet templates, called Taskware, are available on special data/voice tapes. Its maker, Convergent's new Advanced Information Systems division, claims users can use the tape recorder to make vocal annotations to spreadsheets, up to 10 of which can be stored on a microcassette.

The firm plans communications, financial-modeling, and memo-writing software—not full-featured programs, but patches or templates to WorkSlate's spreadsheet environment. There may also be different machines for writers and students; Convergent marketing manager Karen Toland admits Work-

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PULSE TRAIN

Slate's circular keys discourage typing, but says, "Executives don't type. They do word processing with their mouths.

"WorkSlate is designed to replace the calculator, pencil, paper, and eraser," Toland told *InfoWorld's* John Markoff and David Needle. "It will not compete directly with the Tandy Model 100."

The unit costs \$895, with Taskware tapes selling for \$19.95 to \$49.95 and a printer for \$250.

Small is profitable

Most office automation firms such as DEC, Wang, and IBM hope to place their products with the prestigious Fortune 1,000 companies, whose business totals over \$1.8 trillion in annual revenues. However, according to Focus Research Systems of West Hartford, CT, there's an even bigger market among small businesses. U.S. companies with annual sales of under \$25 million apiece combine for over \$2 trillion a year—and the advent of office micros has made them prime candidates for automation.

American business, Focus points out, consists "of a handful of large companies and a gigantic number of small businesses": of an estimated 3.56 million non-agricultural companies, 3.55 million—99.7 percent—have under 500 employees. Perhaps 3.1 million, or 88 percent of all U.S. businesses, have fewer than 20 people on their payrolls.

Except for a copier (most firms with eight or more employees have a copy machine), these offices stayed unautomated while mainframe and mini salesmen

made their rounds. "A small company with \$200,000 in annual sales may allocate \$4,000 annually for automation, and such a sum hardly warrants a major sales effort by any vendor," Focus' survey, "Small Business Automation," admits.

The microcomputer era changed that. From 1979 to 1982, Focus' survey states, 254,000 small firms bought computers. Of those buyers, 80 percent had 1-19 employees; while only 78,000 firms that size had a computer in 1979, over 278,000 had one three years later.

Looking ahead, Focus predicts over 900,000 small businesses will buy their first computer within the next three years. By 1984-85, the researchers claim, the computer market among companies with under 450 workers will total \$8 billion, with more than half of that coming from firms with under 20.

"Computer vendors with low-cost products and distribution systems capable of selling in volume are well positioned to reap the benefits of this massive market," Focus concludes.

Say it with paper

In a recent "Side Tracks" column (November 1983, p. 6), *80 Micro's* editor-in-chief Eric Maloney remarked that the magazine prefers submissions and queries on paper to messages on CompuServe. The market researchers at International Resource Development Inc. see broader implications, describing an anti-videtex backlash that illustrates Hegelian philosophy.

Proclaiming, "The 'Paperless' Home? According to Hegel, No Way!", IRD

claims that the telecommunications boom will actually increase the consumption of certain kinds of paper—that, with "uniformity, mechanization, and depersonalization" as the thesis, people will long for its antithesis.

"People don't need paper just for business reasons," says IRD researcher Ken Bosomworth. "They need paper for personal reasons, too. A letter written on personalized stationery will be far more meaningful than the same words appearing on a CRT—and, for that matter, more meaningful than the same words printed out on computer paper."

Thus, the Norwalk, CT, analysts predict, the future will bring not one big happy Network Nation but "a resurgence in demand for" high-quality stationery, business forms, and greeting cards, as people seek more sincere correspondence. "And the Hegelian synthesis," IRD concludes, "shall be a world in which the old and new media are each appreciated for the respective strengths they bring to communications."

While rejecting the idea of videotex Valentines, Bosomworth admits that telecommunications will prevail over printed catalogs, directories, and Yellow Pages. "The synthesis-antithesis concept only applies in situations where deeply felt human needs are involved," he says. "If it's a question of efficiencies on the one hand and no emotional need on the other, the efficiencies will win out every time."

CRT users see pink

It seems the debate over possible health effects of

CRT displays will never end. A National Academy of Sciences panel concluded in July that terminal use has no adverse effects on operators' vision, but the National Institute of Occupational Safety and Health (NIOSH) vowed to continue research on health-related CRT problems, including a study focusing on CRTs and pregnancy (see *80 Micro*, October 1983, p. 294).

Now three IBM PC users have discovered that gazing into a computer monitor does indeed have an effect on vision, if not exactly an adverse one. Look at a CRT long enough, and white figures on a black background turn pink.

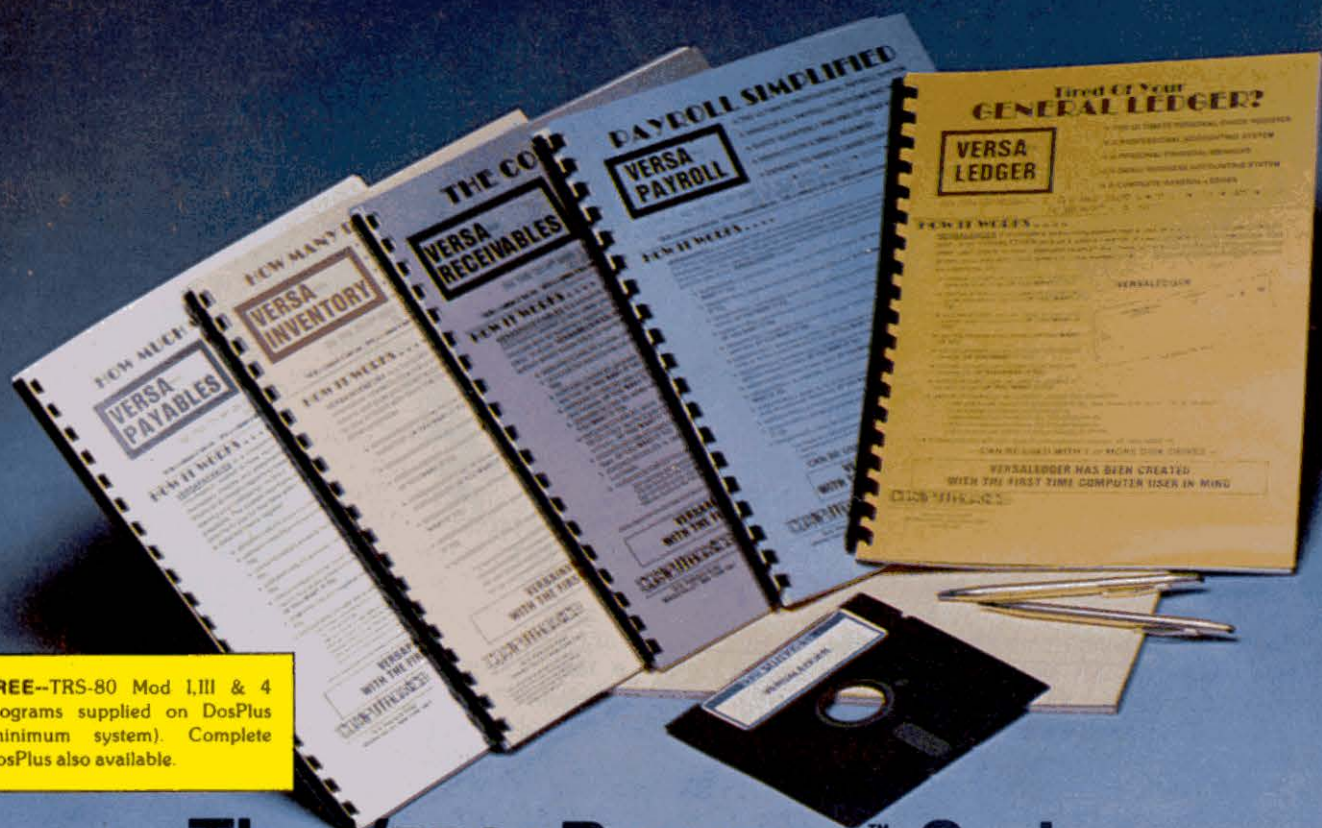
Susan Greenwald, an Evanston, IL, architect, noticed the color distortion after a session of PC word processing. Greenwald's husband Mark, an ophthalmologist, contacted Randolph Blake, a Northwestern University psychologist who specializes in visual perception. Blake took one look at the CRT and gave a rosy diagnosis: the McCollough effect, a minor optic maladjustment that can last from several minutes to several weeks.

"I routinely explain the McCollough effect in my lecture courses," Blake told *Computerworld*. "The conditions under which the effect is produced have to be fairly constrained. But it just so happens that the green letters on the black terminal generate just this aftereffect."

"The most interesting thing is that the pattern of the color distortion conforms to the pattern and contour of the letters on the screen. That is, if you stare for a long time at a CRT, then see white letters on a black background that are of similar size and shape, you'll get the pinkish tint."

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PULSE TRAIN

While the effect is physiologically harmless, Blake told *CW's* Katherine Hafner, physicians should be aware of it in case computer-owning

patients call, worrying that they've suddenly been struck color-blind.

To former typists or scribes, the McCollough

effect may be a small price to pay for the convenience of word processing ("There aren't really a lot of instances where we read white letters

on black," Blake admitted). If you'd rather see straight, time away from the CRT and keyboard will restore normal color perception. ■

Uncle Sam goes micro

● News flash: The **FEDERAL GOVERNMENT** has discovered that microcomputers are powerful tools, if people know how to use them. Halfway through a six-month study designed to develop policies and plans for federal micro use, the General Services Administration told *Computerworld* that employees find micros help them make decisions faster and complete their work more quickly and accurately.

"In-depth, hands-on training and ongoing availability of technical assistance are essential," the GSA's preliminary findings declare. "Also, formal instruction in software selection and application are essential in managing the successful transition to microcomputer use."

● Radio Shack, continuing its new policy of **COOPERATION** with outside software marketers, has swapped conversion rights with CBS Inc. Tandy earns worldwide rights to market TRS-80 versions of selected CBS programs, while CBS will sell some Radio Shack software for non-Radio Shack micros. The agreement marks the first time Tandy has allowed its software to be converted to other formats.

● As reported in October's End Bytes (p. 300), Tano Corp. of New Orleans, LA, has brought the **DRAGON** to the U.S., one year after its debut in the U.K.—where it's ceased to impress the British magazine *Computer Dealer*. "The Dragon is beginning to look distinctly archaic," writes *CD's* Peter Craig. "Sales figures prove the value of good marketing and distribution over a good product."

Assessing the low-end micro market in Britain, Craig comments that Apple's IIe "still suffers from having the decimal point in its price in the wrong place" and that its "specification is also beginning to look a bit dated," while "the soon-to-be-released Atari models are disappointing evolutions of the old models." Commodore, Craig concludes, is "arrogant in knowing that the 64 is a world beater. The machine is so cheap to manufacture and so superior in performance that Commodore could quite easily zap their competition from a vast altitude."

● From distributing printers and disk boxes, **LEADING EDGE PRODUCTS** has moved into the IBM PC market. The Canton, MA, firm has followed its much-ballyhooed PC word processor with its own MS-DOS micro, an 8088-based system said to run 70 percent faster than the PC and cost 40 percent less. The 128K machine, assembled by a num-

ber of overseas contractors, will be the first hardware product marketed under the Leading Edge name.

● 1983 was the year that computer prices fell through the floor; 1984 may be the year that **SOFTWARE PRICES** follow. Microsoft Vice-President Jim Spillars told *ISO World* in July, "I think you are going to see products in the \$100 to \$150 range by Christmas that have been selling in the \$250 to \$350 price range."

By September, Spillars' prediction seemed on target, with Commodore cutting some C64 software prices 50 percent. Silicon Valley Systems of Belmont, CA, slashed its popular Apple word processor, Word Handler, from \$199 to \$59.95, and offered a package of Word Handler and List Handler, formerly \$298, for \$89.95. It's clear that buyers of the new sub-\$1,000 micros are unwilling to pay \$250 apiece for programs.

● Despite extra courses and upgraded facilities, *The Wall Street Journal* reports, America's **COLLEGES** are falling behind the demand for computer classes. Georgia Tech has had to impose quotas on computer science majors, and the University of Wisconsin at Madison turns away 1,000 would-be computer science students a semester. Those who get in may have to use a terminal located in a hallway outside a crowded classroom, with terminal time available only after midnight.

● The Model 100 is only the beginning: The market researchers at International Resource Development Inc. see **PORTABLES** as accounting for one-quarter of all personal business computers and office workstations by 1987. More and more portables will have integrated voice/data functions like Convergent Technologies' WorkSlate's, that can answer the phone and digitize users' spoken notes as addenda to files or programs; by the late 1980s, "pocket consultants" with optical-card memory should replace "whole shelves of medical or law books" for professionals in those fields.

● The Boston-based analysts of the Yankee Group, meanwhile, see **TELECOMMUNICATIONS** as achieving "mass market status in the fourth quarter of 1985." By then, a Yankee study predicts, 20 percent of home computers and up to 12 percent of video game consoles will have modems, and an additional 1.5 million telephones will sport terminal capabilities and built-in displays.

● And, if all those on-line homes grow tired of talking to each other, they can turn to The Source and do **CROSSWORD PUZZLES**. The McLean, VA, data base now offers a weekly British-style (cryptic clues) puzzle, created by New York attorney J. Baxter Newgate. Besides having "instant access to the answers" and being able to challenge or compliment the author, Source puzzlers will soon have the option of choosing different levels of difficulty. ■

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Notes from New England

(Editor's note: With regret and some embarrassment, we must report that the Gamer's Cafe did not submit a column this month. We're not exactly sure why, since Rodney and Mad Max were right here in New Hampshire under our watchful eye. They disappeared mysteriously one day without even a good-bye, leaving behind only a photo of some guy smashing a computer and a disk marked "Misc." That disk contained, among the clutter of half-finished programs and bizarre bits of prose signed "T. DeQuincey" (we suspect that Max wrote them, owing to the many references to the Woodstock Nation and Studebakers), a Scripsit file entitled "Notes," which we suspect comprised the core of the December



column. Those scrawls (and it's not easy to scrawl in Scripsit) are presented here, minus, of course, the many spelling errors and coffee stains.)

Whine, whine, whine! It seems like everybody is accusing everybody else of cheating on Big Board games. We're going to need the Magnificent Seven to

clean up the mess. "It's no fun reading the Big Board mail anymore," says Max.

For starters, Scott Trent challenges Jer McLanahan's 261 in Space Warp. "If you have ever played that game one of the first things you will notice is that the highest possible score is 255," he claims. "The other thing is that it is very

The Big Board

Apple Panic	287,620	Mary Phinney, Stockbridge, MI
Arex	138,780	Rob Mitchell, Peterborough, NH
Assault	97,457	Zagros Sadjadi, Petaluma, CA
Astrobball	317,240	Stefan Kunze, Moers, W. Germany
Attack Force	1,732,820	Dave Smith, Raleigh, NC
Bable Terror	8,857	Mad Max
Barricade	17,520	Troy Scraphansky, Uncasville, CT
Caterpillar	362,883	Alvah Werner, New Albany, OH
Centipedes	94,836	Belinda Chron, Tempe, AZ
Chicken	12,035	Noble Chowchuech, Demarest, NJ
Clash	174,300	Zagros Sadjadi, Petaluma, CA
Convoy	34,770	Rick Sayre, Stockton, CA
Cosmic Fighter	806,280	Robert Newman, Stoney Creek, Ont.
Crazy Painter	1,087,000	Mike Beebe, Sacramento, CA
Cyborg	317,000	Robert Cavin, Laredo, TX
Danger in Orbit	69,640	Steve Sustacek, Danube, MN
Defense Command	128,230	Bette Dufraigne, Bolton, CT
Demise/Defend	165,000	David Russell, Ardrossan, Scotland
Demon Seed	103,160	Markus Blum, Ludwigshafen, W. Germany
Desert Peril	84,400	Jay McLain, Clatskanie, OR
Devil's Tower	25,700	Rick Sayre, Stockton, CA
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Flying Saucers	2,186	Stuart Lory, Victoria, B.C.
Fortress	515,925	Greg Samson, Loudonville, NY
Frogger	400,900	Shawn Roberts, Oklahoma City, OK
Galactic Empire	1,850	David Russell, Ardrossan, Scotland
Galaxy Invasion Plus	1,600,058	Shawn Lipman, Nelspruit, S. Africa
Gauntlet	58,360	David Schwartz, San Jose, CA
Ghost Hunter	41,190	John Kane, Nelson, N.Z.
Insect Frenzy	691,156	Tommy Seniuk, Vegreville, Alta.
Invaders from Space	655,360	Darren Cotter, Oceanside, CA
Jovian	148,300	Greg Samson, Loudonville, NY

Jungle Boy	851,900	Zagros Sadjadi, Petaluma, CA
Killer Gorilla	28,312	Alex Poon, Baton Rouge, LA
Laserball	72,530	Neil Matson, Panama City, FL
Laser Defense	1,504,610	Greg Samson, Loudonville, NY
Leaper	144,500	Tommy Seniuk, Vegreville, Alta.
Lunar Lander	15,100	Brent Lewis, Long Valley, NJ
Mad Mines	10,220	Gorman Miller, Titusville, FL
Martian Patrol	30,496	David Schwartz, San Jose, CA
Meteor Mission 2	119,750	Bob Brown, Dallas, TX
Missile Attack	44,000	Raimo Hansen, Mesa, AZ
Monster Invaders	32,620	Troy Scraphansky, Uncasville, CT
Olympic Decathlon	10,278	Adrie van Geffen, Rotterdam, Netherlands
Outhouse	1,000,000	Kyle Hoyt, Titusville, FL
Panik	85,075	Mark Owens, Houston, TX
Penetrator	585,460	David Schwartz, San Jose, CA
Planetoids	56,450	Carl Pflanzler, Gillette, NJ
Rear Guard	195,240	John Hope, Kingston, Ont.
Robot Attack	143,250	Mark Fertig, Northville, MI
Sea Dragon	610,180*	Robert Fitzwilliam, Houston, TX
Sky Sweep	1,000,540	Tommy Seniuk, Vegreville, Alta.
Space Castle	69,750	Rick Sayre, Stockton, CA
Space Intruders	14,030	Ron Johnston, Emporia, KS
Space Warp (Level 8)	261	Jer McLanahan, New Canaan, CT
Stellar Escort	625,000	Kevin Josephson, Chilliwack, B.C.
Super Nova	2,138,710	Mark Fertig, Northville, MI
Swamp Wars	59,130	Farhad Abrishami, Silver Spring, MD
Temple of Apschai	390	Carl Pflanzler, Gillette, NJ
Time Runner	89,479	Mad Max
Venture	58,550	Darren Cotter, Oceanside, CA
Voyager 1	833	Farhad Abrishami, Silver Spring, MD
Weerd	61,180	Tommy Seniuk, Vegreville, Alta.
Wild West	15,400	Gorman Miller, Titusville, FL

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4	DAYYEAR	Day of year a particular date falls on
5	LEASEINT	Interest rate on lease
6	BREAKVEN	Break-even analysis
7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDDB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCNST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEP	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queuing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQOQ	Fixed quantity economic order quantity model
53	FQEOQSH	As above but with shortages permitted
54	FQEQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAP1	Cap. Asset Pr. Model analysis of project

59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Pasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSIBUD	HOME business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
96	LOANAFD	Loan amount a borrower can afford
97	RENTPRCH	Purchase price for rental property
98	SALELEAS	Sale-leaseback analysis
99	RRCNVBD	Investor's rate of return on convertible bond
100	PORTVAL9	Stock market portfolio storage-valuation program

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The GAMER'S CAFE

hard to play Space Warp if you have other games." Maybe that's why 261 has stood for so long.

Then there's this cranky letter from Greg Samson of Loudonville, NY. He doesn't trust anybody, including the high-score holders for Martian Patrol, Cosmic Fighter, and Robot Attack. And he openly accuses Venture king Darren Cotter's 58,550 of being phony, charging that you can't get any more than 57,500. That Samson is going to be a real popular guy; I hope he can keep his kneecaps intact.

Max says all this cynicism concerning high scores is because of the 1968 Democratic Convention. He walks around the 80 Micro offices shouting, "The whole world is watching! The whole world is watching!"

I was hoping this vacation would do him some good, but I don't know.

The one-line games keep trickling in. Most of them come from Australia,

where the magazine seems to arrive three to five years late. I think I could swim there with a copy in my teeth and beat the overseas mail.

The van finally broke. We've got it down at Roland's Exxon for a tune-up. Max wanted to replace the plugs with pennies, but I think that only works in fuse boxes.

I tore Max away from Convoy long enough to get his opinion on dropping some more scores from the Big Board.

"PURGE," he grunted.

"Dig Out (Y/N/Q)," I said. "Y."

"Paddle Pinball (Y/N/Q)." "Y."
"Scarfman (Y/N/Q)." "Y."

You have to know how to speak Max's language if you want to get through to him.

Confessions of an Honest Gamer: Jack Martin of Somis, CA, sent in a score of 999,970 in Scarfman with the comment, "I feel honor bound to mention that there is a weird mode in Scarfman which enables one to obtain an unlimited number of additional men and that is the way in which these high scores are obtained. Playing with the customary number of men, the highest score obtainable is probably less than 400,000."

Confessions of a Sneaky Kind of Guy: James Griffith of Searcy, AR, reports 910,980 and says, "This score was achieved by a secondary methodology which I prefer not to disclose yet."

"Well, nah-nah to you, too," Max commented snidely.

Today, I found a blueberry on Mount Monadnock the size of a volleyball.

Max is nuts about Computer Shack's Convoy. He particularly likes the suicidal paratroopers. They run backwards into your truck and then explode.

"This is almost as good as a George Romero movie," he keeps saying.

Maybe we should retire Lunar Lander, too.

"In the [September] Gamer's Cafe you stated that the final disgrace will be in the cheating of Lunar Lander," writes Seth Eliot of Brooklyn, NY. Then he proceeds to give instructions on refueling:

On the Model I, exit the game by pressing Break and Reset, hit Enter at the memory size prompt, type in SYSTEM, and then type in /33767.

"It seems that this memory location refuels you without any damage to the game," writes Seth. "Sorry, Max."

"Not half as sorry as I am," Max grunted.

"It's obvious to me that you have a severe problem with very high scores in the Gamer's Cafe," writes Mark Schmidt. "Why don't you print the scores players get by just using one man?"



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I thought it was an interesting suggestion, but Max was less than excited. "Sure," he said. "Credibility? Verification? No problems."

Shawn Lipman's father called Peterborough twice in one day to report Shawn's Galaxy Invasion Plus score. We don't take high scores over the phone too often (partly because the van doesn't have a phone), but the Lipmans live in Nelspruit, South Africa. Wonder how long it takes the mail to get there?

Max is depressed. First it was the Big Board mail. Then Mary Schmidt of Stockbridge, MI, wrote, "Tell Mad Max to watch out; I'm within a few points of knocking him off his Bable Terror perch."

"Oh, yeah?" Max shouted. "Oh, yeah?"

Finally, to end the week, we were

about to post Max's high score in Convoy when Rick Sayre of Stockton, CA, blew him out with 34,770.

"Oh, yeah?" Max mumbled meekly as he slumped over the keyboard.

The guys at Wally's Hardware in Spencer, MA, sure know how to have a good time.

"These people are *strange*," Max marveled as he looked at a photo of some fellow smashing a Model III with a large hammer.

"When it comes to serious gaming, we employees at Wally's Hardware are real hard-core players," said Bob Noonan in the accompanying letter. "We wring out every point we can get, until the computer screams for mercy."

If they're not playing games, Bob and Dave (the goofy stockboy) are reformatting all of Wally's disks or copying Galaxy Invasion on top of his accounts receivable program.

"Don't tell Wally that Dave cut the cord off the plotter to fix Mrs. Archambeault's lamp, 'cause he didn't feel like wiring in a new cord cap from stock," Bob added, "or that I chopped up his IBM/360 Assembly language textbook to show a customer how a gasoline-powered Weed-Whopper worked."

"These people are *really* strange," Max repeated.

Max is restless. He wants to hit the road again. I've suggested that we go down to Boston to visit Mercedes while she works on her top-secret project at MIT.

The van is fixed. The guy at Roland's called it a miracle. He suggested that we change the oil at least once every 50,000 miles.

I don't know if I'm going to have time to write the December column. Oh, well—I'm sure the people at *80 Micro* will figure something out. ■

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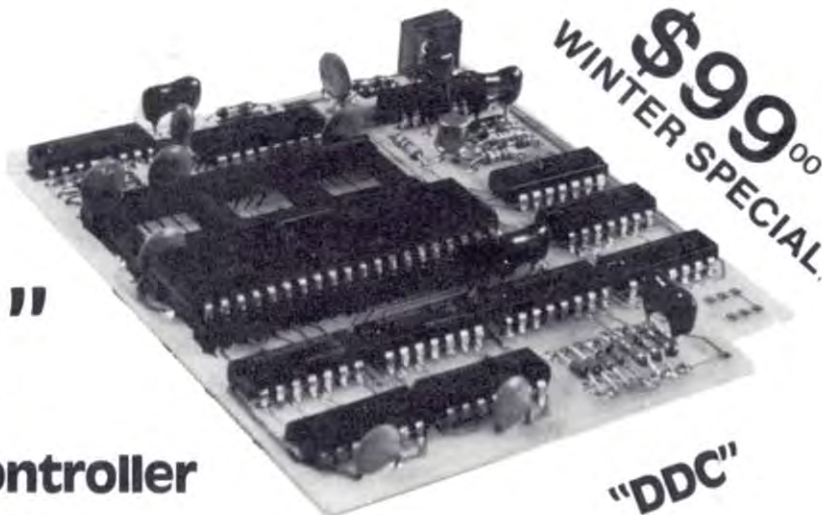
Tests were conducted on AEROCOMP'S "DDC", Percom's "Doubler A" and "Doubler II" and LNW's "LNDoubler" using a Radio Shack TRS80 Model I, Level 2, 48 K with TRS80 Expansion Interface and a Percom PFD100 disk drive (Siemens Model 82). Diskette was Memorex 3401. The test diskette chosen was a well used piece of media to determine performance under adverse conditions. The various double density adapters were installed sequentially in the expansion interface. The test consisted of formatting 40 tracks on the diskette and writing a 6DB6 data pattern on all tracks. The 6DB6 pattern was chosen because it is recommended as a "worst case" test by manufacturers of drives and diskettes. An attempt was then made to read each sector on the disk once - no retries. Operating system was Newdos/80, Version 1.0, with Double Zap, Version 2.0. Unreadable sectors were totalled and recorded. The test was run ten times with each double density controller and the data averaged. Test results are shown in the table.

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PERCOM "DOUBLER A"	250	0
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The Christmas Pageant

by Richard Ramella

The best Christmas pageant I ever saw was in the third grade. Icky Vannoy played Santa Claus. A serious actor, he insisted on filling his pillow case sack with real toys. He could hardly lift it.

All he had to do was come

running out when the kids on stage yelled, "Santa is here!" Out he ran from stage left, and the weight of his sack propelled him straight ahead for a quick exit off stage right. He kept going.

Icky went home and didn't

come back to school. Ever. I think he moved to another state during Christmas vacation.

But you're not here to listen to old third grade stories. You want to be in the Fun House Christmas Pageant.

This month I have a secret Yule Greeting program and A Talk with Santa, each with separate Level II and Color listings.

I also have something else. Like Santa, I've been getting letters. Some Fun House visitors don't believe I know how to program in Extended Color Basic. Well, it's not true. I learned how last night and I wrote St. Nick Portrait to prove it.

So far, I've tried to make as many Fun House programs as possible available for as many TRS-80 models as possible. With the introductions of the Model 100 and the Micro Color

```
100 REM * YULE GREETING * TRS-80 LEVEL II BASIC
110 REM * FUN HOUSE * DEC. '83 * RICHARD RAMELLA
120 CLS
130 A=RND(1022)
140 IF A>133 AND A<138 OR A=142 OR A=143 OR A=198 OR A=199 OR A=20
1 OR A=202 OR A=206 OR A=207 OR A=262 OR A=263 GOTO 130
150 IF A=266 OR A=267 OR A=270 OR A=271 OR A>273 AND A<284 OR A=32
6 OR A=327 OR A=331 OR A=332 OR A=334 OR A=335 GOTO 130
160 IF A=338 OR A=339 OR A=346 OR A=347 OR A=390 OR A=391 OR A>395
AND A<400 OR A=402 OR A=403 OR A=410 OR A=411 GOTO 130
170 IF A>413 AND A<424 OR A=466 OR A=467 OR A=474 OR A=475 OR A=47
8 OR A=479 OR A>529 AND A<540 OR A>541 AND A<548 GOTO 130
180 IF A=554 OR A=555 OR A=606 OR A=607 OR A=618 OR A=619 OR A>669
AND A<680 OR A=682 OR A=683 OR A=746 OR A=747 OR A>809 AND A<820
GOTO 130
190 PRINT @ A,CHR$(191);
200 GOTO 130
210 END
```

Yule Greeting—Level II.

```
100 REM * YULE GREETING * TRS-80 COLOR BASIC 4K
110 REM * FUN HOUSE * DEC. '83 * RICHARD RAMELLA
120 CLS(0)
123 GOTO 130
125 PRINT @ A,CHR$(143+48);
130 A=RND(510)
140 IF A=67 OR A=68 OR A=72 OR A=99 OR A=101 OR A=104 OR A=131 O
R A=134 OR A=136 OR A>137 AND A<144 GOTO 125
150 IF A=163 OR A=167 OR A=168 OR A=170 OR A=175 OR A=195 OR A=2
00 OR A=202 OR A=207 OR A>208 AND A<215 GOTO 125
160 IF A=234 OR A=239 OR A=241 OR A>265 AND A<272 OR A>272 AND A
<276 OR A=280 OR A=305 OR A=312 GOTO 125
170 IF A>336 AND A<343 OR A=344 OR A=376 OR A>407 AND A<414 GOTO
125
180 PRINT @ A,CHR$(207);
190 GOTO 130
200 END
```

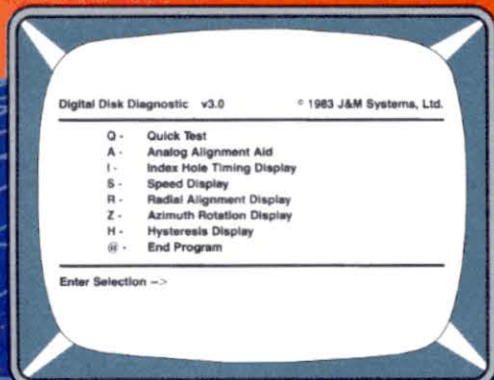
Yule Greeting—Color Basic.

The Key Box

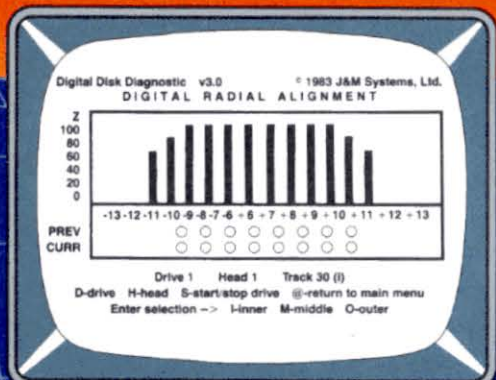
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Color Basic
Extended Basic

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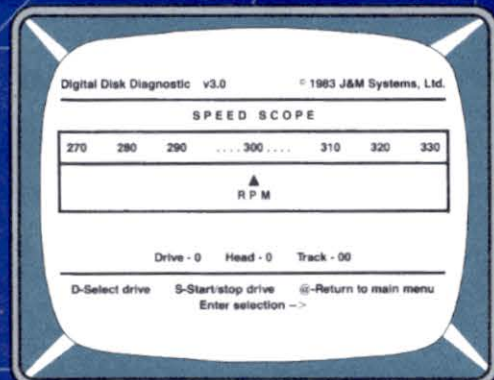
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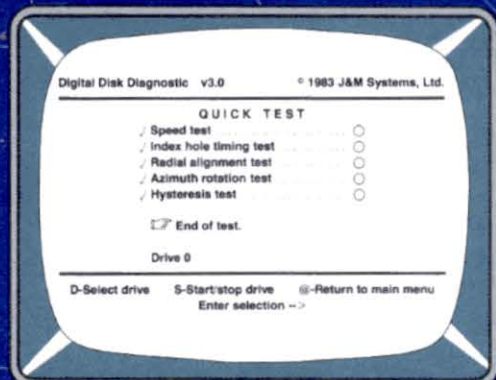
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```

100 REM * A TALK WITH SANTA * TRS-80 LEVEL II BASIC
110 REM * FUN HOUSE * DEC. '83 * RICHARD RAMELLA
120 CLS
130 CLEAR 1000
140 N=0
150 FOR A=1 TO 3
160 PRINT "R";
170 FOR B=1 TO RND(30)
180 PRINT "-I";
190 NEXT B
200 PRINT "NG"
210 FOR T=1 TO RND(1000)
220 NEXT T
230 NEXT A
240 PRINT STRING$(60,"*")
250 PRINT "HELLO... THIS IS THE NORTH POLE: LEON THE ELF HERE..."
260 PRINT
270 INPUT "TO WHOM DO YOU WISH TO SPEAK";A$
280 IF LEFT$(A$,5)="SANTA" GOTO 380
290 N=N+1
300 IF N=5 GOTO 350
310 PRINT A$ " IS NOT HERE";
320 IF N>1 THEN PRINT " EITHER." ELSE PRINT "."
330 INPUT "ANYONE ELSE YOU MIGHT WANT";A$
340 GOTO 280
350 INPUT "THERE'S A GUY NAMED SANTA CLAUS HERE. WANT TO TALK TO HIM";A$
360 IF LEFT$(A$,1)="Y" GOTO 380
370 PRINT "THEN YOU MUST HAVE A WRONG NUMBER. TOO BAD... IT'S SO NEAR"+STRING$(6,"")+ "CHRISTMAS...": END
380 CLS
390 PRINT "HANG ON. I'LL GO GET HIM."
400 GOSUB 810
410 CLS
420 PRINT @ 480,"HEY SANTA, IT'S FOR YOU."
430 GOSUB 810
440 CLS
450 PRINT "HE WILL BE RIGHT HERE."
460 GOSUB 810
470 CLS
480 GOSUB 810
490 PRINT "HELLO -- HO-HO-HO -- THIS IS SANTA CLAUS SPEAKING."
500 INPUT "WHO IS CALLING ME";A$
510 CLS
520 PRINT "GOOD TO HEAR FROM YOU, "A$". WHERE DO YOU LIVE?"
530 INPUT B$
540 CLS
550 PRINT "MY MY! CALLING ALL THE WAY FROM "B$"! "
560 PRINT
570 PRINT A$; ", HOW OLD ARE YOU?"
580 INPUT Z
590 IF Z>12 THEN PRINT "AND YOU... ER... STILL BELIEVE IN ME. I'M HAPPY TO HEAR THAT."
600 PRINT "I SUPPOSE YOU WANT TO TELL ME WHAT YOU WANT FOR CHRISTMAS."
610 PRINT
620 N=1
630 INPUT "WHAT WOULD YOU LIKE";C$(N)
640 D=RND(5)
650 IF D=1 PRINT "HMM... "; ELSE IF D=2 PRINT "I SEE... " ELSE IF D=3 PRINT "SO... "; ELSE IF D=4 PRINT "INTERESTING... "; ELSE PRINT "WELL WELL... ";
660 PRINT C$(N)
670 PRINT
680 N=N+1
690 IF N<6 THEN PRINT "AND NOW... ": GOTO 630
700 CLS
710 PRINT "I MUST GET BACK TO WORK NOW, BUT LET ME RECORD YOUR LIST."
720 GOSUB 810
730 PRINT
740 FOR X=1 TO N-1
750 PRINT C$(X)
760 NEXT
770 PRINT
780 PRINT "SANTA CLAUS CANNOT EVER PROMISE, BUT I WILL SEE WHAT I CAN DO. GOODBYE TO YOU, "A$"."
790 PRINT "AND VERY HAPPY HOLIDAYS!"
800 END
810 FOR T=1 TO 1000
820 NEXT T
830 RETURN
840 END

```

A Talk with Santa—Level II.

Computer (MC-10), I see it's a losing battle.

As *80 Micro* phases out coverage of the Color Computer, I must do the same. And as *80 Micro* invites CoCo owners to make the switch to sister publication *HOT CoCo*, I'm happy to do the same. For *HOT CoCo* I write a column called Elmer's Arcade, and its arcade games are a mix of Extended Color Basic, Color Basic, and Micro Color Basic.

Now let's go to the auditorium for the Christmas pageant.

Yule Greeting

This greeting has separate listings for Level II and Color Basic. What is the Yule Greeting? It's one word, and that's all I'm saying.

The only instructions for this program are to type RUN and tap the enter key. Then you watch. The secret greeting forms slowly.

If you want to trim the tree while you wait, you have plenty of time. If you want to make this into a game, a group of people can watch. The winner is the first to recognize the greeting.

In Level II Basic, the word is black on a white background. In Color Basic, it's red on a white background.

A Talk with Santa

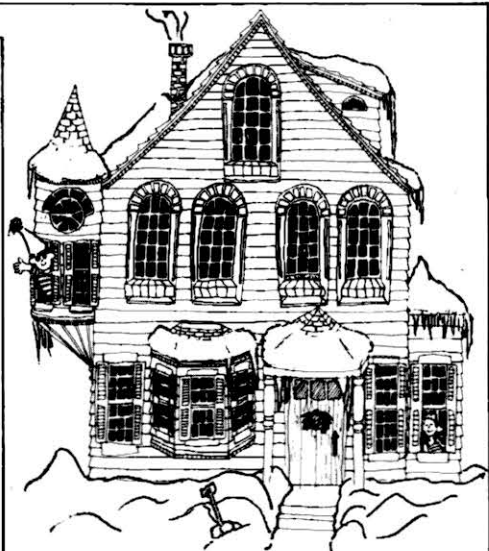
Again, I have separate Level II and Color Basic listings. Look closely at line 100 to make sure you're entering the one for your computer.

In both versions, the program starts with a ringing telephone. In Color Basic you

A Talk with Santa—Color Basic.

```
100 REM * A TALK WITH SANTA * TRS-80 COLOR BASIC 4K
110 REM * FUN HOUSE * DEC. '83 * RICHARD RAMELLA
120 CLS(0)
130 CLEAR 250
140 DIM B(22)
150 DATA 193,3,193,3,193,6,193,3,193,3,193,6,193,3,204,3,176,3,1
85,2,193,10
160 FOR A=1 TO 22
170 READ B(A)
180 NEXT A
190 N=0
200 FOR A=1 TO 3
210 FOR B=1 TO RND(15)+10
220 SOUND 215,1
230 NEXT B
240 FOR T=1 TO RND(1000)
250 NEXT T
260 NEXT A
270 CLS
280 PRINT "HELLO, THIS IS THE NORTH POLE. LEON THE ELF HERE."
290 PRINT
300 PRINT "TO WHOM DO YOU WISH TO SPEAK?"
310 INPUT A$
320 IF A$="SANTA" OR A$="SANTA CLAUS" THEN 440
330 N=N+1
340 IF N=5 GOTO 400
350 PRINT A$ " IS NOT HERE";
360 IF N>1 THEN PRINT " EITHER." ELSE PRINT "."
370 PRINT "ANYONE ELSE YOU MIGHT WANT?"
380 INPUT A$
390 GOTO 320
400 PRINT "THERE'S A GUY NAMED SANTA CLAUS HERE. WANT TO TALK TO
HIM?"
410 INPUT A$
420 IF LEFT$(A$,1)="Y" GOTO 440
430 PRINT "THEN YOU MUST HAVE A WRONG NUMBER. TOO BAD... IT
'S SO NEAR CHRISTMAS...": END
440 CLS
450 PRINT "HANG ON. I'LL GO GET HIM."
460 GOSUB 920
470 CLS
480 PRINT @ 480,"HEY SANTA, IT'S FOR YOU!";
490 GOSUB 920
500 CLS
510 PRINT "HE WILL BE RIGHT HERE."
520 GOSUB 920
530 FOR A=1 TO 21 STEP 2
540 SOUND B(A),B(A+1)
550 NEXT A
560 CLS
570 GOSUB 920
580 PRINT "HELLO -- HO-HO-HO -- THIS IS SANTA CLAUS SPEAKING."
590 INPUT "WHO IS CALLING ME";A$
600 CLS
610 PRINT "GOOD TO HEAR FROM YOU,"
620 PRINT A$". WHERE DO YOU LIVE?"
630 INPUT B$
640 CLS
650 PRINT "MY MY! CALLING ALL THE WAY"
660 PRINT "FROM ";B$
670 PRINT
680 PRINT A$", HOW OLD ARE YOU?"
690 INPUT Z
700 IF Z>16 THEN PRINT "AND YOU... ER... STILL BELIEVE IN ME. I
'M VERY HAPPY TO HEAR THAT."
710 PRINT "I SUPPOSE YOU WANT TO TELL ME WHAT YOU WISH FOR CHR
ISTMAS."
720 PRINT
730 N=1
740 INPUT "WHAT WOULD YOU LIKE";C$(N)
750 D=RND(5)
760 IF D=1 THEN PRINT "HMMM "; ELSE IF D=2 THEN PRINT "I SEE...
"; ELSE IF D=3 THEN PRINT "SO... "; ELSE IF D=4 THEN PRINT "INTE
RESTING... "; ELSE IF D=5 THEN PRINT "WELL... ";
770 PRINT C$(N)
780 PRINT
790 N=N+1
800 IF N<6 THEN PRINT "AND NOW... ": GOTO 740
810 CLS
820 PRINT "I MUST GET BACK TO WORK NOW, BUT LET ME RECORD YOUR L
IST."
830 GOSUB 920
```

Listing continued



hear the ring, but in Level II Basic you see the word R-I-I-ING! a few times. Then an elf named Leon answers the phone at the North Pole and asks you to whom you wish to speak.

If you don't know who to ask for after spending all that money on a long-distance call to the North Pole at Christmas time, I'm afraid this program ends.

If you reach the right North Pole personality (S***a C***s), you get to tell him your Christmas wish list.

St. Nick Portrait

This part of the big yule show is only for people with Extended Color Basic machines. It draws a picture of Santa Claus. It's a fairly good likeness, although I can't draw hands.

And there's more. You see Santa drawn on the screen and you have a few moments to admire his pudgy form. Then a green text screen appears that asks you to wait a moment.

Behold, on comes a picture of Leon, who had a brief speaking part in A Talk with Santa. In this program he gets a nice closeup but has no lines to speak.

Listing continued

```
840 PRINT
850 FOR X=1 TO N-1
860 PRINT CS(X)
870 NEXT
880 PRINT
890 PRINT "SANTA CANNOT EVER PROMISE, BUT IWILL SEE WHAT I CAN D
O. GOODBYE TO YOU, "A$".
900 PRINT "AND VERY HAPPY HOLIDAYS!"
910 END
920 FOR T=1 TO 1000
930 NEXT T
940 RETURN
950 END
```

```
100 REM * ST. NICK PORTRAIT * TRS-80 EXTENDED COLOR BASIC
110 REM * FUN HOUSE * DEC. '83 * RICHARD RAMELLA
120 PCLS
130 PMODEL,1
140 SCREEN 2,1
150 CIRCLE(128,96),40,,1.5
160 CIRCLE(141,155),15,,1.5
170 CIRCLE(116,155),15,,1.5
180 CIRCLE(160,60),30,,.4
190 CIRCLE(100,60),30,,.4
200 LINE(110,134)-(135,164),PRESET
210 LINE(135,164)-(135,100),PRESET
220 LINE(80,60)-(166,60),PRESET
230 PAINT(129,96),4,4
240 CIRCLE(129,60),20,3,2
250 PAINT(128,60),1,3
260 FOR Y=20 TO 48
270 LINE(112,Y)-(146,Y),PRESET
280 NEXT Y
290 CIRCLE(128,35),25,3,.8
300 FOR X=112 TO 145 STEP 4
310 LINE(X,40)-(X,60),PRESET
320 NEXT X
330 CIRCLE(128,56),6,6,.5,.0,.5
340 LINE(126,40)-(130,46),PSET,BF
350 LINE(110,22)-(150,27),PSET
360 LINE(160,0)-(110,22),PSET
370 LINE(160,0)-(150,27),PSET
380 PAINT(125,20),4,4
390 CIRCLE(122,34),6,,.6,.5,1
400 FOR X=122 TO 124
410 PSET(X,36,3)
420 PSET(X+11,36,3)
430 NEXT X
440 CIRCLE(135,34),6,,.6,.5,1
450 CIRCLE(72,60),8,3
460 CIRCLE(188,60),8,3
470 PAINT(74,60),5,3
480 PAINT(188,60),5,3
490 FOR Y=108 TO 116
500 CIRCLE(128,Y),40,3,.5,1,.5
510 NEXT Y
520 FOR Y=111 TO 115
530 CIRCLE(128,Y),38,5,.5,1,.5
540 NEXT
550 FOR Y=170 TO 190
560 CIRCLE(114,Y),8,3
570 CIRCLE(142,Y),8,3
580 NEXT
590 FOR X=95 TO 112
600 CIRCLE(X,190),7,3
610 CIRCLE(X+48,Y),7,3
620 NEXT X
630 CIRCLE(163,3),4,3
640 FOR T=1 TO 5000
650 NEXT T
660 CLS
670 PMODE 4,1

680 PRINT "WAIT JUST A MOMENT MORE AND YOU WILL SEE ONE OF SANTA
'S ELVES... LEON."
690 LINE(0,96)-(255,191),PSET,BF
700 FOR T=1 TO 1000
710 NEXT T
720 SCREEN1,1
730 GOTO 730
740 END
```

St. Nick Portrait.

FUN HOUSE

If you want to see only Santa and not Leon, put a new line (655 GOTO 655) into the program.

Next month is 1984. I wonder how many days each of us has been alive. We'll try to figure that out an easy way. Next month's programs will work on any TRS-80 model. ■

Do you have a question about a Fun House program? Write me, Richard Ramella, 1493 Mt. View Ave., Chico, CA 95926. You must include a 20-cent stamped, self-addressed envelope. From other countries, send a self-addressed envelope and your nation's coin equal to postage.

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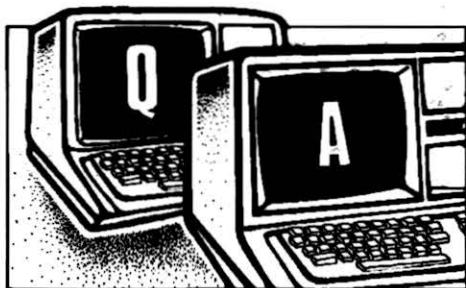
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FEEDBACK LOOP

by Terry Kepner



Send any questions or problems dealing with any area of TRS-80 microcomputing to Feedback Loop, 80 Micro, 80 Pine St., Peterborough, NH 03458.

The July 1983 column had three letters concerning problems with the Smith-Corona TP1 and SuperScript. I, too, have a TP1 printer, as well as a DMP-2100.

I tried the DW2 driver and had the same difficulties as the other people. Using your ideas, I located the place in the DW2 driver program where initialization occurs, address BEOF hexadecimal (hex).

Instead of using an editor/assembler to change the code, I used the F function (file patch utility) of Debug on my Model III disk system. The procedure is: Enter Debug at the TRSDOS READY prompt, press the F key, enter DW2/CTL for the file specification, page through the file until line number 3F00 appears on the screen, press the M key, place the cursor over the byte at 3F03 (19), enter 00 and press the enter key, and exit Debug.

I enjoy 80 Micro very much. I am a relative newcomer to computing and appreciate the hints and advice in your column.

W.C.
Tampa, FL

Thanks for the modification instructions and your kind comments. For a "relative newcomer" you sound as if you're doing pretty well.

First, I would like to add CP/M to my 48K single-disk Model I. Where can I get the hardware and software to do this, and how hard is it to do?

Second, I want to add a modem to my computer. Since I don't have an RS-232 board, where can I get one? Or should I buy a modem with a built-in RS-232? And could I use the RS-232 for other purposes if I did this? Is there a local CompuServe number in the Champaign/Urbana, IL area?

And finally, what have you heard about the new Banana printer from Leading Edge Products? At \$249.95 it sounds like a good buy.

T.D.
Mascoutah, IL

Several dealers sell CP/M upgrades for the Model I computer. For a list of them, see last month's column. All are fairly simple to install.

If you want a Radio Shack RS-232 board for your computer, you can still buy one from Radio Shack. If your local R/S doesn't have any in stock, you can buy one from Rider Radio in Peterborough, NH 03458. The problem with the Radio Shack unit is that it tends to make poor contact with the expansion interface (EI) main circuit board and is prone to glitching while in use. Several weeks ago mine started having problems and ended up getting me thrown off the CompuServe network three times in 15 minutes. The only real solution to the poor contact problem is to solder the RS-232 to the EI connection (not a job for amateurs).

Getting a combination RS-232/modem unit for your computer would make it easier to use and would eliminate most of the contact problems (especially if you use Gold-Plug 80s on the EI extension port). The disadvantage is that the RS-232 ends up being dedicated to the purpose, although at least one manufacturer gives you an extra edge connection for the RS-232.

Your final choice is to buy an external RS-232 board that plugs into the expansion port of the RS-232. This is the most common approach used by people unwilling to put up with the Radio Shack RS-232.

Both of the last two choices have one problem; they don't use the same address ports as the R/S board and this causes some difficulties finding software. If you decide to buy an outside

RS-232 board, check with the manufacturer about which software will or won't work with their board.

I've heard nothing about Leading Edge's Banana printer except that it's available. The September 80 Micro has some information in the New Products section (p. 349).

What jumper changes are required when upgrading a Model III or 4 with 64K to 128K?

T.K.
Julian, CA

You don't need any jumpers. You must replace the DIP (dual inline package) shunt in socket U72 with a Programmable Logic Array (PLA). The ones used by Radio Shack are made by Monolithic Memories Inc., and are called PALs (a registered trademark).

The PLA used with the Model 4 comes with the 128K upgrade kit. I have no information on the serial number or specifications of Radio Shack's PAL.

We just purchased a new Model 4, and I want to know if anyone has written any drivers to use the 80-column screen and 4 MHz clock speed with Model III programs? I currently have DOSPLUS 3.5 for the Model III but am unaware of any drivers or patches to use the Model 4 features.

Second, I'm going to be writing some estimating programs on the Model 4 requiring continuous calculations and comparisons with large indexed numeric data files. I want to know what languages you feel best suit my needs. I'm using Basic, but it's time-consuming and the file handling is too complex.

J.R.F.
Huntington Beach, CA

No one has as yet written a driver to use the Model 4 features in the Model III mode, but it won't be long before the DOS manufacturers have fixed their DOSes to optionally use those features.

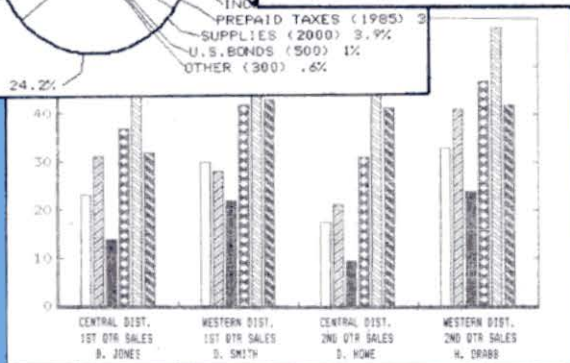
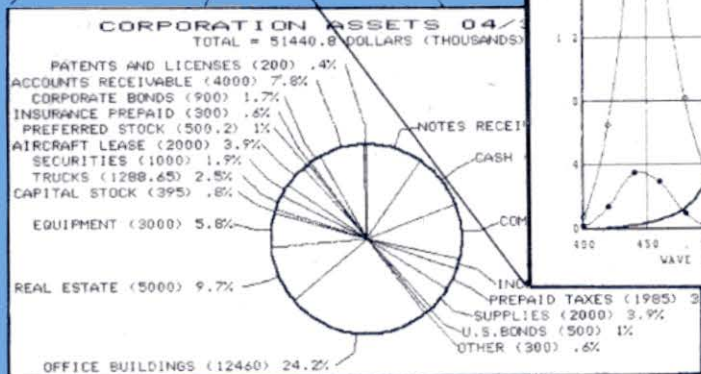
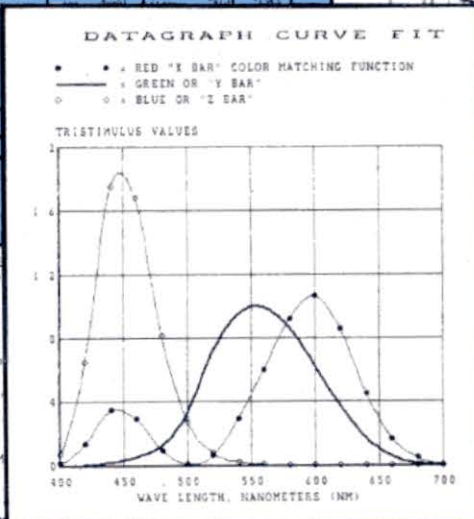
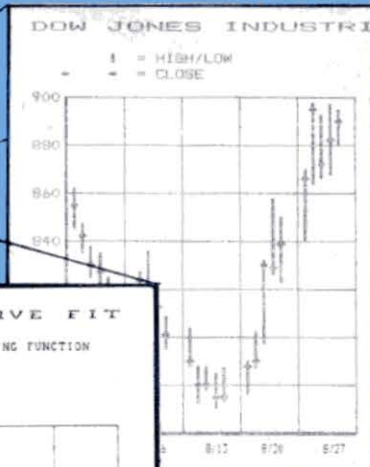
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1202	78.26	972.78	421.43	115.12	136.31	1042	495	17.272	0.405		
1203	78.98	972.85	426.77	115.281	137.39	1044	432	41.197	14.669		
1204	79.14	1004.69	460.89	117.16	138.12	1049	540	28.163	23.709		
1207	77.29	980.28	371.17	115.19	135.58	1014	1555	2.984	25.844		
1208	76.20	945.71	328.79	114.27	133.51	978	1020	11.757	19.793		
1209	76.44	963.69	354.82	112.20	133.45	997	620	28.723	15.131		
1210	76.82	968.77	388.34	112.88	133.57	978	433	23.813	19.192		
1211	76.25	945.10	337.10	112.49	133.47	978	993	17.407	24.531		
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1230	74.27	941.27	402.22	112.82	130.25	727	776	16.777			

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SP	WPC1	WPC2	BIT	CSI	SP	500	Shares	Declines	W	W	W
1201	41.20	77.23	447	15792							
1202	26.87	24.12	547	1025							
1203	28.74	33.79	891	132							
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I know it's possible because Holmes Engineering has several DOSes patched to use their 80-column board upgrade for the Model III. Once the DOSes are ready, the Basic programs can easily use the features and software will be developed that takes advantage of the Model 4 options in the Model III mode.

Languages are always a problem. Cobol was designed for business, and is used to manipulate large numeric arrays as in inventories and data bases, but its I/O routines are as weak as Basic's. Fortran was designed as a scientific language for extremely fast and accurate numeric calculations. Basic was intended as a good beginner's language, with good string handling capabilities (Cobol and Fortran's weak points), moderate calculation accuracy, and easy-to-program I/O routines (which become complex as they get larger).

If you want a fast calculating language and I/O routines that you can customize and optimize for speed, I suggest you investigate Forth. Forth is a bit unusual in that it is totally flexible. As a Forth programmer you can define new Forth commands to do whatever you want done, much like defining a new Basic command in Basic. For example, you could define a command to clear the screen, load the next record into memory, and display it on the video by assigning a name to the sequence of Forth commands that do the same action.

Forth uses a syntax that's radically different from all other languages, but it's highly efficient. This syntax difference is the most difficult part of learning Forth. A page of Forth commands (defined as one display screen) looks like a scrambled-code message. One common complaint is that a few days or weeks after writing Forth code, not even the programmer can figure out exactly what he did.

Once you learn Forth, you'll love it for its programming ease. If the command isn't there, just define your own new command. In fact, asking a Forth aficionado how to do something (such as writing a custom disk I/O routine) can be frustrating because he'll usually tell you to just write it. Currently, the best Forth available for the TRS-80 computer is from Miller Microcomputer Services (61 Lake Shore Road, Natick, MA 01760, 617-653-6136, \$129.95).

I have a Model I with an LNW Expansion Interface and a Teac disk drive. On power-up, the disk comes on for about three seconds and then shuts off. Reset doesn't do anything differently. After the drive shuts off, the keyboard goes dead and I get no response.

I checked all the connectors, solder joints, proper parts in sockets, etc., and everything seems in order. Now what?

K.T.
Salem, NH

I need more information. Does the unit work as a 16K Level II machine? Does the unit work as a Level II machine with the interface attached and turned on? Does the interface have memory? If it does, can you get it in Level II mode (does it power-up as a 32K or 48K machine)? If there's no memory in the interface, are you sure your DOS will operate in only 16K? Some DOSes require a minimum of 32K to work right. What DOS are you using? Have you called or written the LNW trouble desk for help? Is your interface a kit you built, or did you buy it?

If you get full memory from the interface and the computer works fine as a Level II machine, something is wrong with the disk drive controller circuitry or with the disk drive itself. Find someone who has a working Model I disk system and use your keyboard on it. If it works, your keyboard unit is OK. Have your friend use your drive on his system. If it works, the problem is not with the drive. If the keyboard unit and the disk drive test out OK, the trouble is with the interface.

As you know, the PRINT #1 instruction on the Model III is very slow because it always writes the header first. I would like to know if there's a buffer I can fill before writing to cassette. I know the Color Computer PRINT #1 works like that.

I also want to upgrade my system to 32K. I bought one 4116 chip and inserted it in my computer as you described in your column. It didn't work; I still get 15314 as the memory available. Does the computer read blocks of 16K, or is the chip bad?

I need a good memory map of my computer, can you recommend a good book?

J.P.
Berchem, Belgium

The design of the cassette I/O routines of the Model III and Color Computers are totally different. The only way you'll get the Model III to buffer cassette I/O in the manner of the Color Computer is to write your own machine-language cassette routines.

You upgrade the memory of all the microcomputers made by Radio Shack (except their pocket computers) in blocks of 16K. The computers address each chip in the 8-chip block as 16K by 1 bit. Installing only one chip activates only 1 bit of the 8-bit words in the 16K block. To upgrade, you must use all eight chips.

Soft Sector Marketing sells the book *Model III ROM Disassembled*, which includes a memory map of the machine.

I read D.J.'s question concerning the installation of new characters in the Model I character generator (August 1983, p. 316). Enclosed with this letter is some literature on a character generator ROM that I manufacture. Note that besides having true lowercase descenders, you can also program the ROM to contain a second character set custom designed by the user.

T.W.
Bainbridge Is., WA

Now that's an interesting development. According to the literature, the EC-1 is a pin-for-pin replacement ROM for the MC M6670 used by the Model I as a character generator. In addition to replacing the TRS-80 character set with one containing true descenders, the EC-1 has room for a complete alternate character set. The characters are 5 by 8 matrices, so you can custom design any character you want.

If you want to use the alternate character set and the normal set, you can install a toggle switch to let you pick the one you want. Or you can fix the ROM to use only one of the two sets available. The EC-1 is also inexpensive, retailing at \$11. If you want a custom character set, the EC-1 costs \$19.

Of course, to use the upper-/lower-case generator, you'll have to have modified the video RAM so that it displays the additional characters. You can do this easily by soldering a 2102 RAM on top of the video RAM chip, as explained in the April 1981 issue of *80 Micro*.

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I ran the MEMTEST program that came with TRSDOS on my computer. The checksums for the A and B ROMs were OK, but the ROM C checksum was different from the ones listed for it. My Model III ROM C has a checksum of 2F84. Is there a reason for concern about the difference? My computer has worked flawlessly since I bought it.

L.L.
Bronx, NY

Worry not, the latest ROM C has the checksum you have. It's just that the program is an older version and doesn't have all the correct checksums for the ROM C versions available. Happy computing.

I'm confused about the sound routines for the Model III computer. I would like some information about the way people work with them. I've tried to put their routines on the end of my programs and all I get is a Cass? prompt.

I tried to modify the Memory Size?, PEEK, and POKE. I also tried four different kinds of sound routines; they all work as long as the routine is by itself. Does it have anything to do with POKE 16526,n and POKE 16527,n?

T.R.W.
Southern Pines, NC

There are several things that could be wrong. First, where are these sound routines going in memory? If they're located at a particular place in memory, moving them around will make them malfunction. If the routines reside at the top of memory, only one can be there at a time without fouling up the others.

If a given routine is located at the top of memory, you have to use the Memory Size? prompt to protect the routine from being stepped on by Basic when it tries to run your program. You also have to tell Basic that there is a machine-language routine located at the top of memory, and that you want to use the routine. This is done with the two POKEs you mention. These place the address of your sound routine in a location reserved by Basic for the USR function, which passes control from a

Basic program to a machine-language program and back.

So, if you want to use the sound routines in your programs, you first have to determine where the routines are located. If more than one routine is located there, you have to make sure that the routines don't overlap, or you'll ruin one or all of them. Similarly, cassette-based systems support only one USR function at a time, so if you have several routines, you'll have to develop a method to switch between the routines when you call the USR routine (perhaps use a GOSUB, before the USR command, to jump to lines that POKE the starting address of the particular routine you want into the USR address location).

Start with a routine that you know works; modify the program to do what you want. If it no longer works, you'll have to contact the author for more information on what the routine does and how to modify it. If it does work, start on the next routine.

I have a 48K Model I with three disk drives and a Model 33 teletype for a printer. I have also acquired another Model I, which is a 16K Level I computer. I intend to upgrade it to Level II, and have it as a spare CPU for the first computer.

Can I hook up the two units so that I can control the main unit with the spare? I'd like to have the spare keyboard and monitor upstairs in the livingroom so I can write code, letters, or whatever. I'd also like to be able to load programs into the main unit, alter them, and then save the results on disk. I have an interface that lets me turn the printer on and off without commands.

As I see it, the new keyboard will control the old computer, printer, and drives, and the new monitor will report what's happening. I have no need for the paths to be reversed.

J.C.
Wayne, NJ

In other words, you want to be able to make the older computer a slave to the new one.

The only method I know of for such an application requires the use of RS-232 boards. You load a host terminal program that treats all RS-232 incoming data as if it were typed on the

computer's keyboard. All video display is simultaneously echoed out the RS-232. The other computer would have a terminal program loaded in memory that simply sends every keystroke to the RS-232 and takes incoming data and places it on the video display. Nothing is stored or kept in the remote computer's memory, except the program itself.

This method works the way you want. The disadvantage to this system is that you'd have to load the terminal program into the remote machine by cassette tape, and load the host program from disk. Every time you wanted to use the entire system, you'd have to make sure the host computer has the host program in memory and runs correctly before loading and using the remote computer.

If you wanted to get fancy, you could buy BBS software for your disk computer and leave the computer permanently turned on. Whenever you wanted to use the system, just call it up with the remote program (go on-line with the RS-232 terminal program) and start using your computer. Or leave the BBS on drive zero with Auto engaged to load and execute the BBS program. Then you would just have to turn the computer on when you want to use it.

The disadvantage to this system is that you have to buy the additional hardware for the two RS-232 boards, and run an RS-232 cable between the two machines (maximum length without an intermediate amplifier is about 25 feet). For your remote computer, you would have to buy a non-Tandy RS-232 board that lets you attach directly to the keyboard unit without an expansion interface. The disk-based computer would likewise require a non-Tandy board (if you want reliable operation for long periods of time).

I have a strange problem that I hope you can help me with. I have a 48K, dual-disk Model I computer that randomly reboots when in Disk Basic. The computer works fine in DOS, Level II Basic, and when running machine-language programs. I have cleaned all the connectors and resoldered everything that looked flakey. I'm using NEWDOS80, but I'm sure that isn't the problem.

G.S.
Danbury, CT

FEEDBACK LOOP

You didn't mention the age of your computer. If you have one of the older expansion interfaces, you may need to have it modified for increased reliability. The first step is to use the buffered cable; the EI-to-CPU cable has a black box in the middle of it. This helps stabilize the data line and makes it more resistant to electrical noise. If the problem persists, you have to direct-wire the RAS, CAS, and MUX lines inside the keyboard and EI units, from the origination points to the edgcard connections.

If you still have problems, you have to make the pregnant cable (MUX) modification. The three previously mentioned bus lines are cut from the EI-CPU cable and placed in a separate, twisted wire pairs, DIN cable. This cable has a male and female six-pin DIN connector in the middle to let you unplug the CPU unit from the EI unit (hence the bulging, pregnant look to the cable).

These modifications are required on most old model expansion interfaces, which were poorly designed. If you already have these modifications, remove the two power supplies from the EI case; the fluctuations of the magnetic fields induce interference with your EI RAM chips. If you're still having problems, check the FDC chip for poor connection to the circuit board.

I would like to learn Assembly language, but all I know is that it's faster than Basic. I have the book Inside Level II, but I don't understand it. Please tell me the best way I can learn about Model I Level II Assembly language, without having to spend lots of money.

T.K.K.
Chico, CA

First, the Model I computer is a Z80 CPU-based computer, so any book teaching the theory of Z80 programming will help you. However, I suggest that you get either *TRS-80 Assembly Language Programming* (Radio Shack #62-2006, \$3.95) by William Barden, or *TRS-80 Assembly Language* (Prentice-Hall, Englewood Cliffs, NJ 07632, \$9.95) by Hubert S. Howe Jr. Both books deal specifically with the Model I. Howe's book is easier to understand, while Barden's book gives instructions

on using Radio Shack's T-Bug and Editor/Assembler.

A year ago, I purchased a Microtek Byewriter-1 and their interface board for my Model I. Everything worked fine until I added the chips for 48K operation. Level II recognizes the full 48K when first powered up, but after a variable time the computer reboots to the Memory Size? prompt, or some other apparently random spot.

I thought the problem was interference until I discovered that responding to Memory Size? with 32767 or less prevents the problem while still allowing machine code to run in high RAM. What's up?

K.H.
Livermore, CA

Basic stores program variables, arrays, and program operation tables starting at the top of RAM and working down. You use the top 2 bytes constantly. Since the dividing address between the keyboard unit and the expansion memory is 32767, your difficulty is with the high 32K RAM bank.

First, make sure that the connection between the keyboard unit and the expansion box is clean and solid (use isopropyl alcohol and cotton swabs to clean off the dirt, and a pink rubber eraser to remove any tarnish off of the cable contact; the connectors should fit tightly).

If the problem persists, try swapping the top 16K bank with the memory in the keyboard. Next, check to see if the R/S black box power supplies are too close to the memory or the interconnecting cable. And finally, is the RAM and printer circuitry being driven by the keyboard's power supply? If so, the interconnecting cable could be interfering with itself, although that's not too likely. What's more likely, if the expansion unit uses the keyboard power supply, is that the added memory is overtaxing the power supply and causing your trouble. In this case you'll have to get a separate power supply for the expansion box.

If the problem still doesn't go away, contact the manufacturer of your expansion box and ask for help.

I have a 48K, three-drive Model I with the Radio Shack doubler installed.

My problem is with TRSDOS 2.7DD. When attempting to copy from single-density to double-density, TRSDOS 2.7DD won't read anything above track 35 on the single-density disk.

It appears that this problem could be corrected by a very simple patch, but Fort Worth won't say when or if the patch will be available, nor will they release the file specification, password, sector location, or any other data on how to access TRSDOS 2.7DD.

Do you know of a patch for this problem, or must I start looking for a new double-density DOS?

R.K.
Clovis, NM

You'd better start looking, because I don't have that patch in my bag of tricks. Can anyone else help?

My 48K, single-disk Model I has several problems: spontaneous disk reboots, inability to reboot a disk using the keyboard reset button, DOS message CANNOT BOOT or something similar while the disk spins in the drive, and occasional screwy behavior while using VisiCalc (i.e., the left arrow key moves the cursor down one line).

Just recently I had to replace the keyboard-CPU cable to get the computer to function as a 16K computer.

I can feel a slight wiggling of the connector at the EI—perhaps the original Radio Shack plug is getting old (I tried replacing the keyboard-CPU cable, but got no improvement). Right now, I haven't had a reboot since I started this letter. Apparently if I get the cable connectors just right, proper contact is made and no rebooting occurs.

I'm thinking of soldering the EI and CPU together with a 40-conductor cable, but feel I might regret it later on. Now what should I do?

S.D.
East Lyme, CT

Things are never simple. First, the keyboard-CPU cable is a very weak point in the system. When you get strange results after typing on the keyboard, this cable connection is almost always the problem. This cable can also cause spontaneous system reboots, and prevent proper disk-booting action.

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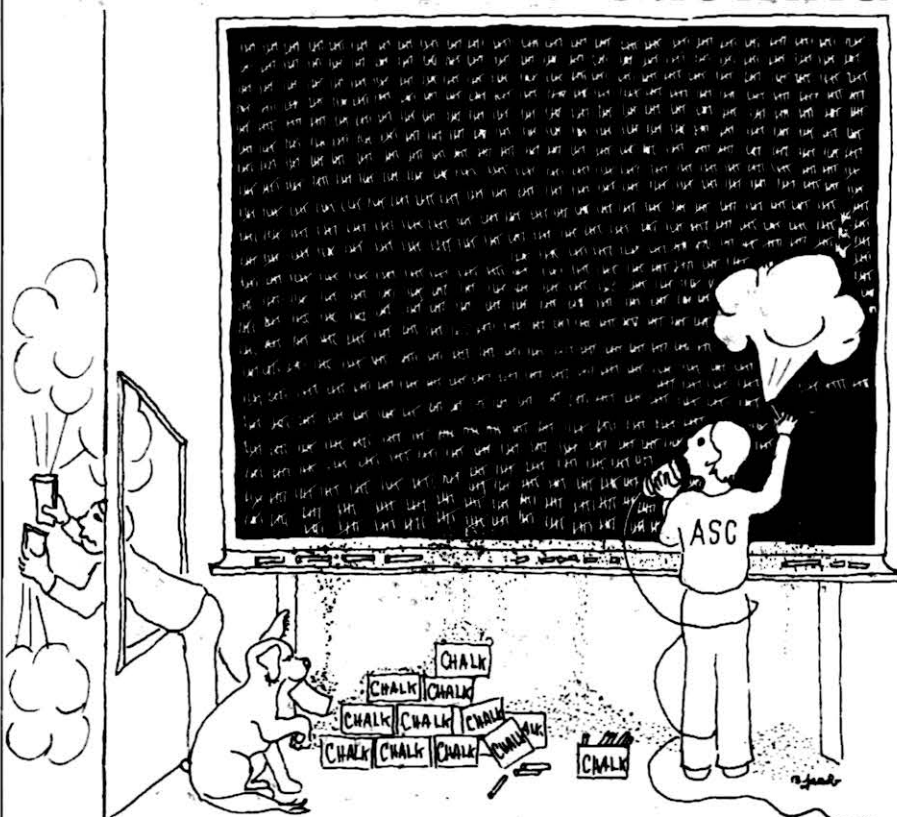
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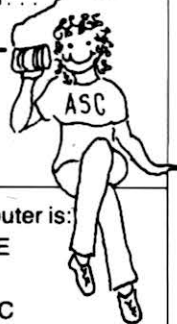
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FEEDBACK LOOP

Check it carefully for lifted traces on the edgecard, cold solder joints, or intermittent solder bridges.

Next, check the power connectors where your power supplies attach to the circuit boards; they may be loose and causing reboots. Also, check and clean the contacts on the FDC chip in the EI (that's right, clean the FDC chip pins).

The disk booting problem has several possible sources: The edgecard connection to the disk drives may need cleaning, the disk drive logic card's edge connector may need cleaning, the head may need a slight realignment and cleaning, or the motor speed may need adjusting.

Start with the easiest: clean the edgecard connectors, then use a disk drive cleaner for the head (or alcohol and long cotton swabs).

The reset button sounds as if it's broken. As a Level II machine, does Reset work? It may also be suffering from cold solder joints, lifted traces, and other mechanical problems. Let me know if you're successful in correcting the problem.

I have a problem with my Model I speed-up kit. My system comprises: Model I (board #1700069D, Satellite ROMs, 16K RAM from Exatron, Cerdat's The Patch, Programma 80-Grafix board, and Exatron Speedup Kit); Radio Shack Expansion Interface (board #1700077D, 32K RAM from Exatron, Percom Doubler II); Aerocomp's 80-track disk drive (MPI 91); Exatron Stringy Floppy; Epson MX-80 printer; and DBLDOS from Percom.

I bought the keyboard in 1978 as a Level I machine. When Level II was released, I ordered it the next day. The same goes for the expansion interface, which works fine without a buffered cable or other reliability modifications.

Everything worked fine until I increased memory to 32K (the speed-up kit supports 50 and 100 percent speed increases, both of which function fine in a 16K system). When I try to use the system with 48K, the 50 percent mode works for everything except machine-language programs; the 100 percent mode locks up everything.

Is there a way to have the expansion interface support the high speed operation? Exatron suggested replacing the CPU with a Z80A, and said I might have slow memory. I removed the memory from the expansion interface and tried it in the keyboard. Everything

worked fine, so slow memory can't be the problem.

I borrowed a copy of Tandy's Dynamic Memory Test program from a friend and ran it at normal speed with no problems. At the 50 percent speed increase, everything checked out until the 16K/32K boundary, when the system crashed. The 100 percent speed increase immediately locked up the computer.

P.L.
Lawrence, KS

Yes, you can make the expansion interface operate at high speed. You have several points where problems could foul up your high-speed modification. First is the memory. The expansion interface is much more critical of timing constraints than the keyboard unit. Remember, the expansion interface is farther away from the CPU than the keyboard RAM.

Electrons in metal move at about 3×10^{10} centimeters per second. There are 1×10^9 nanoseconds (ns) in a second. So in one nanosecond, the electrons move about 30 centimeters (almost 12 inches). This may not seem like much, but if you're using RAM rated at 250 ns (time required to respond to a signal from the address bus and put the addressed byte's data on the bus) in the EI, the added distance may be just enough to cause problems.

In other words, RAM that performs flawlessly in the keyboard can fail in the expansion interface. You can see the same problem occur at normal speed by using 400 ns memory in the EI instead of the standard Radio Shack 300 ns memory.

Furthermore, at 3.54 MHz, each clock pulse defines a 282 ns window. If you slow down the signal too much by the address-decoding integrated circuits (ICs) and support chips, the RAM won't get the information on the data bus until it's too late.

The best solution is to use the fastest memory possible; 150 ns is great, 100 ns is the best (but very hard to find, and expensive). That takes care of memory.

Remember that the Model I was an experiment, designed for the tinkerer. It wasn't designed for clock speeds of over 1.77 MHz. This means that the digital components weren't designed for faster speeds either. That is, the units can't respond to the orders from the CPU fast enough to deliver or process the re-

quired information within the amount of time allocated by the clock frequency. Result: system lockups.

Some of the components are capable of operating at 5 MHz, but many begin to fall behind the CPU at that speed. Even some Z80 CPUs can't operate at the higher speed and have to be replaced. And for the EI, the greater distance to the EI, plus the additional memory-decoding ICs, can make the difference between high speed operation or a locked up computer.

Also, you say you don't have any of the EI reliability modifications. Well, Radio Shack didn't come up with those modifications for the fun of it. They were developed as a solution to the common complaint of Model I owners about EI memory problems. The reason you've never had to make the modifications is that you didn't have the memory in the EI to cause the problems. All the modifications were made to correct memory problems. If I were you, I would seriously consider having those modifications made.

If you want better explanations about speed-up problems, and instructions on what you can do to correct them, call Holmes Engineering. ■

Terry Kepner is a freelance writer and programmer, and the vice president of Interpro. He's been writing about microcomputers since 1979.

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Radio Shack, National Parts Division, 900 East Northside Drive, Fort Worth, TX 76102, 817-870-5662, M/C and Visa accepted, each order has \$1.50 handling charge. IJG Inc., 1260 West Foothill Blvd., Upland, CA 91786, 714-946-5805. Publisher of *TRS-80 Disk and Other Mysteries* (\$22.95), *Microsoft Basic Decoded and Other Mysteries* (\$29.95), *The Custom TRS-80 and Other Mysteries* (\$29.95), *Basic Faster and Better* (\$29.95), *Machine-language Disk I/O and Other Mysteries* (\$29.95), *TRSDOS 2.3 Decoded and Other Mysteries (Model I)* (\$29.95), *How to do it on the TRS-80* (\$29.95), and the *Electric Pencil Word Processor* (\$89.95).

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With every turn of its drives, your computer's floppy disk controller (FDC) is on the lookout for errors. The Cyclic Redundancy Check (CRC) safeguards the accuracy of your data by performing a quick calculation on a full sector of data. The CRC byte, the expected solution to the CRC calculation, is just one kind of information encoded on your disk by the disk drive.

To help you better understand how this works, I'll explain disk drive and disk technology. Demystifying the disk operating system's cosmos may make your computing life a little happier.

The Disk Drive

A disk drive does three things: it spins a disk, positions a read/write mechanism, and communicates with the floppy disk controller (FDC) chip. When these processes happen correctly, your computer reads from or writes to your disk. It's something we take for granted until an error message appears on the screen.

Your stomach turns, you pound the reset button praying that it isn't so, and you begin to wonder just what HIT the table or where that sector could have gone. The real question is just what is the drive doing wrong?

Spinning the disk is technology with which everyone who owns a record player is familiar—a motor turns a platter on which you place a disk. Your disk drive spins at 300 rotations per minute (rpm), a speed that could make The Beatles sound like mosquitos. Just as a speed variation on your turntable makes your records sound bad, a speed variation on your drive means bad disk input/output (I/O).

While most manuals suggest that a speed deviation of plus or minus 5 percent is permissible, I get nervous at anything greater than plus or minus 1.5 percent. By the time you've got a 5 percent deviation, you'll also notice plenty of disk I/O problems. Many programs are available that measure the drive's spin speed. Owning one is vital for diagnostic purposes, although actually adjusting the speed requires the derring-do to try open heart surgery on your computer (thus voiding your warranty) and infinite patience. I suggest you let a professional do it.

A stepper motor (stepper motors move discrete distances one step at a

The heartbreak of CRC errors

time) positions the read/write head. Locating and relocating the tracks on your disk depends on the accuracy with which the stepper motor moves the read/write head. Like the tone arm on your turntable, the stepper motor can position the read/write head to 'play' any track; unlike a record player, the read/write head, as the name implies, also records data onto the disk.

If your disk I/O problems are unpredictable, that is they come and go, watch for a pattern. Does the computer read and write fine when you turn it on but become undependable after it's been working awhile? Suspect your head alignment. A head that's marginally aligned may read fine when you first turn on the computer, but as the machine heats up, the alignment shifts. Again, the easiest solution is taking it to a professional.

Information exists on a disk in the form of magnetic pulses. The head reads more magnetically positive bits as logical ones, the less positive bits as logical zeros. The read/write head picks up

these bits in a series, that is, one after another. The Z80 microprocessor at the heart of your TRS-80 computer reads information 8 bits at a time, a method known as parallel. One of the FDC's jobs is collecting the serial input and sending it to the Z80 in parallel.

The FDC navigates the disk by first using the index hole and then using markers written on the disk by the disk operating system (DOS). The FDC looks for two kinds of markers, sector headers and clock bits. Both are written when you format a disk.

The Disk

When you look at a disk, a few things are apparent. First, a floppy disk is made of two parts, one sandwiched inside the other. The inside is a shiny, metal-oxide-coated, circular piece of mylar plastic (the disk) that slides freely inside the square piece of plastic (the shell) that envelops it. Six asymmetrical holes are cut into the disk's shell.

The large hole in the center gives the disk drive a place to grab the disk. To spin the disk in its shell, stick two fingers through the center hole, spread them to apply pressure to the inside rim of the disk, and turn. Do not touch the disk's surface! A small hole in the disk will appear in the round window to the right of the center hole. This is the index hole, which the FDC uses as the absolute landmark of its location on the disk.

The two small half circles punched in the bottom of the disk are alignment notches. They help insure that the disk is set securely in the drive. The square notch cut into the side of the disk is the write-protect notch. If this notch is filled in (by taping a label over it), the FDC will not let the read/write head write on that disk. To get your computer to write on a write-protected disk, remove the label.

The oval window cut at the bottom of the disk's shell is the place where your drive reads the disk. When you see how small this head access window is, you appreciate how finely tuned the disk drive is. It adjusts the read/write head to find between 35-40 (and on some drives 80) separate positions (tracks) in an area less than 1½ inches long!

The disks you're familiar with are soft-sectored, which means that the

TRSDOS Model I
 5 sectors = 1 gran
 2 grans = 1 track
 10 sectors = 1 track

TRSDOS Model III
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 6 grans = 1 track
 18 sectors = 1 track

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Table. Some examples of different track allocations.



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space on their surfaces is partitioned by the DOS software, rather than through a "hard," or permanent, manufacturing process. Because the sectors aren't created in the manufacturing process, DOS designers can divide the disk space arbitrarily.

The DOS

The smallest unit of information a DOS reads or writes is called a sector. Sectors are clumped together as granules or grans, and grans are gathered into tracks. Different DOSes use different patterns of space allocation; some divide a track into two grans with 10 sectors per gran, another uses three grans of six sectors per track. This is why some DOSes can't read disks written by other DOSes. (See the Table for some examples of common DOS allocations.)

Information contained in a sector is of two types, the information you write (data) and the information the DOS writes (sector header). System information includes an identifying address mark (a sort of flag saying "Here's some location information"), the track number, the sector number, the sector length, and the CRC bytes. Combined, this information creates a heading for your data that lets the computer retrieve it when you need it.

In addition to these sector headers, the DOS writes another kind of marker on the disk. Called clock bits because they're written by the FDC's 1 MHz

clock, they create spaces between them that hold data. They are, in a sense, the carton; your pieces of data are the eggs.

Using the index hole on the disk, the FDC finds the beginning of a track. Using the clock bits, the FDC locates the spaces where the data resides. When it reads an I.D. address mark (the number FE hexadecimal coming after a gap), the FDC knows it has found a sector. Reading the sector header tells it what track and sector it has found. A lot of space on your disk is taken up just defining and identifying the space you wish to use.

Every time it reads a sector, the FDC comes across 2 bytes of information that are directly related to the accuracy of its last write. These are the CRC bytes. Their value, as mentioned earlier, is determined by a calculation performed on the value of all the other sector bytes. When the FDC reads a sector, it performs this calculation on the data it has just read.

If the value matches the value of the CRC byte on the disk, all's well. If the values don't match, the computer prints an error message on the screen and quits. Depending on the software controlling the disk I/O, the error message says either "CRC error" or "parity error." Either way, it's bad news.

Utilities are available that might straighten out a problem disk: Debug on TRSDOS, SuperZap on NEW-DOS80, and Super Utility Plus, to name a few. But honestly, the best medicine

for any disk problem is preventive.

Preventive Medicine for Your Disks

Make a back-up copy of every important disk! At *80 Micro*, we use only third-generation copies of our DOSes. The original sat in the disk drive long enough to make a copy of itself, our working master. The working master comes out of its envelope only to create a back-up, the copy we actually use. This policy sounds neurotic—until somebody does one of those ten thousand things that trash disks. But, when that happens, we don't get stuck sitting around waiting for the manufacturer to replace our disk.

The same holds true for data disks; unless you love typing, keep up-to-date back-ups on your data files. It takes time, but ten minutes a week now may save you hours trying to reconstruct a blown disk later.

The rule to remember is, if it doesn't have a back-up, it will develop an error. Back up your disks!

The second great preventive measure is to keep your drives well maintained. Invest in a diagnostic disk and test your drives once a month. If the disk speed varies more than 5 rpm in either direction (faster or slower), get it fixed before it causes problems.

Buy a disk drive cleaning kit and use it. Dirt on your read/write head acts like sandpaper on your disk, an undesirable condition.

Finally, a reminder of stuff you already know. Open and close your disk drive's door gently. If you slam it around day in and day out, it will break. Since the door is part of the mechanism that holds your disk in place, a loose or crooked door will result in disk I/O errors. In a worst-case scenario, a door off its hinges renders the drive inoperable.

Store your disks in their envelopes, away from dust and magnets. Remember, the telephone and the speaker in your cassette recorder have magnets. Keep your disks away from them. The top of your video display screen is also a bad place for disks. It generates enough radio frequency interference to garble your disks.

Your disk drive, disks, and DOS work together in a complex system designed to guard against errors, but, as with any sophisticated technology, it requires care on your part to keep it working. ■

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†Source code not available on cassette.
*EDTASM is a trademark of Radio Shack.

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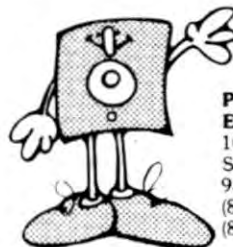
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The Over-The-Top Sheet Feeder from Gradco Systems Inc.

Cassette Sheet Feeder

A unique over-the-top sheet feeder for daisy wheel and matrix line computer printers is being sold by Gradco Systems Inc., 3421 West Segerstrom Ave., Santa Ana, CA 92704, 714-549-9175.

The unit features a single-cassette, 500-sheet capacity feeder. To operate, place the loaded cassette under the printer, and when printing begins, paper automatically feeds over the top of the printer directly into the printer's platen. The mechanism is completely enclosed, with no frames or holders located above the printer's profile to obstruct your view.

The feeder accommodates a wide range of paper sizes and envelopes, as well as business forms, and automatic stacks of printed material. You can easily change from sheet to fan-fold feeding. An indicator light and button located at the front of the unit provide auto-stop and jam-release functions.

You can install this over-the-top sheet feeder on many printers, including those from C. Itoh, Diablo, Qume, NEC, and Brother, among

others. Pricing ranges from \$600-\$700 depending on your printer model.

Reader Service ✓ 551

Hamming Around

All you ham operators out there can now receive and transmit Morse code on your Model I, III, or 4 with this software-only Morse Code Interface. This 12K machine-language program has special routines that check incoming signals to make sure that they are valid code and not noise. Bursts of noise are ignored and only valid code is processed and displayed on the video screen.

Another routine lets you view the incoming signal to aid in optimizing the receiver control settings. The program samples the received code bits and automatically adjusts them to the proper speed.

The transmitter mode features five programmable buffers (200 characters total), a type-ahead (working buffer), and user-selectable sending speeds up to 70 words per minute.

Comp-Code 1.0 costs just \$26.95 from Gary Woodall Software, P.O. Box 284,

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Reader Service ✓ 579

Project Planning Program

Project managers can attest to the work and time involved in getting a project on to the drawing board and then setting it in motion. Now you can reduce those headaches with Plantrac, a comprehensive, menu-driven planning and control system.

It guides you through network creation and amendment (up to 12,500 activities), time resource and cost analyses, scheduling, updating, and reporting (including a user-designed report format). Plantrac generates bar-charts, I/J, and Precedence networks on your screen, printer, or plotter with critical path activities highlighted.

A key feature of this program is the resource scheduling (levelling and limiting) component that allows different schedules based on resource requirements and availability. In addition, you can generate progress out of

sequence that can be undone if necessary.

Plantrac operates under TRSDOS 2.0 on the Models II, 12, and 16. It costs \$3,000 from Computerline Limited, 755 Southern Artery, Quincy, MA 02169, 617-773-0001.

Reader Service ✓ 562

Floppy Pockettes

If you've been stuffing your notes concerning a particular disk in an envelope, or have written cryptic notes on the disk label only to have them smear the next day, Floppy Pockettes may be of some use to you. With these special vinyl disk envelopes, you can store a 3- by 5-inch card in the clear pocket, giving you plenty of room for notes.

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Yes! String compression is what's been causing all those intolerable delays. The keyboard won't work, and until all the strings have been collected, you just have to sit and wait. Then things run for a while, until string compression is needed again. And again.

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As soon as you start using TRASHMAN, those delays will almost disappear. The program is very easy to use, so you don't have to be a computer programmer to take advantage of it. It's written in "machine language" and uses only 578 bytes of memory for itself, plus two bytes for each "string" in your program. It works with other machine language programs and all the major operating systems.

HOW WELL DOES IT WORK?

If you use it with a BASIC program that has only a few strings, very little time is wasted in string compression, and TRASHMAN will be only slightly helpful. But, in programs that use hundreds or thousands of strings, including large string arrays, TRASHMAN is just what you need. If you have any remaining doubts, just look at the chart, and then get yourself a copy as fast as possible.

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500	45.8	1.6	96.5
1000	179.6	3.5	98
2000	713.2	7.8	98.9

(All timings done on TRS Model I. Model III 15% faster, but pct improvements identical. Listing of timing program available on request.)

TRASHMAN is available on disk for just \$39.95.

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The Mini-T-Switch lets your peripherals share a common component of a CPU I/O port.

ettes alone are \$5.95. Samples, two Floppy Pockets, are available for \$1. They are sold by CDC Serious Software, 13715 Vanowen St., Van Nuys, CA 91405, 213-997-9692, 213-780-2958.

Reader Service ✓ 559

Hi! What's Your Name?

Now you can produce customized name tags, table tents, and labels for any occasion with NAMETAGR. The program's data entry routine is highly efficient. It lets you skip, back-up, or ditto. You can select your name tag format from the file or customize your own. The program takes full advantage of the dot-addressable feature of dot-matrix printers by letting you design and print your own logo.

The package includes two 5¼-inch disks, 30 bulldog holders, 400 pin-feed name badge stock, 240 labels (3½ by 1 inch), 120 labels (4 by 2 inches), and a manual. Available for Models I and III, it costs \$79 from ETS Center, P.O. Box 651, Willoughby,

OH 44094, 216-946-8479.

Reader Service ✓ 561

Mini Switch

The ABS Mini Switch ends the hassle of plugging and unplugging your data cables for different operations. It provides push-button switching between any two ports (A and B) and a common port. Typical applications include two terminals switching between one modem, one terminal switching between two computers, and a computer switching between two printers.

Available from Western Telematic Inc. (2435 South Anne St., Santa Ana, CA 92704, 714-979-0363), the ABS Mini Switch costs \$89.

Reader Service ✓ 568

Shot Heard 'Round the World

Minuteman is a new uninterruptible power supply from Para Systems (2409 D Ave. J, Arlington, TX 76011, 817-640-0837). It is designed to protect your microcomputer from power failures, brown-outs, and voltage surges. When a power fluctuation does occur, Minuteman immediately switches from A/C power to its own emergency battery power for up to 15 minutes. This gives you time to save your data and shut down your system without losing valuable input and programming hours. The unit automatically switches back to A/C when power is restored.



Minuteman: An emergency power supply and voltage regulator.

NEW PRODUCTS

Minuteman also features voltage regulation and surge protection as well. The unit provides standby power for microcomputers and word processors with a power rating of 200 watts or less. It sells for \$395.

Reader Service ✓ 563

Bringing It All Together

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Reader Service ✓ 565

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Reader Service ✓ 556

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It has casters for easy maneuverability, and you can use the desk as a student work center or typing desk as well. It is priced at \$69.95. For further information, contact Felderman/Sharp Communications Inc. at

216-464-7252.

Reader Service ✓ 558

Model 100 Memory

The IM-100 is an 8K RAM memory module that plugs directly into the existing sockets of your Model 100 with no modifications to the system. You can add up to three of these plug-in modules to upgrade the portable computer to a total of 32K RAM memory.

Each memory module sells for \$75. If you buy two or more units, the price is reduced to \$70 each. For further information, contact Holmes Engineering, 5175 Green Pine Drive, Murray, UT 84107, 801-261-5652.

Reader Service ✓ 554

Raiders of the Lost Pyramid

An adventurer, you are looking for the hidden buried entrance to a pyramid that holds priceless treasures hidden for thousands of years. Your only tools are a crude map (a cube with ancient markings), a partial hieroglyphics dictionary, and a special navigation box. After you discover the entrance, you'll meander through rooms and chambers filled with one death trap after another. You are to unravel all the mysteries of this ancient pyramid and find all the treasures. The catch? Get out alive!

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The slipcase package contains a spiral-bound 236-page manual with the sealed disk affixed to the inside front cover, and a command reference card. The Model III version has a suggested retail price of \$59.95. It is sold by Little, Brown and Company, 200 West St., Waltham, MA 02154, 800-343-9204, 617-890-0250.

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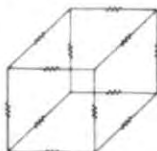
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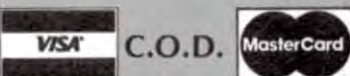
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The program also handles text. An alphanumeric mode lets you place text anywhere on the screen. This is helpful when you generate reports and graphs. You can store screens on either cassette or disk. The package includes a sample program to retrieve the screen from disk or cassette for use with your own program.

Creative-Art is available for the Model III for 16K, 32K, and 48K cassette systems, and for 32K and 48K disk systems. Both the 32K and 48K versions store more pages and handle more points. All versions cost \$30 for cassette and \$40 for disk. Contact Creative Software Enterprises, Route 1, Box 222-A, Ana, IL 62906, 618-833-7797. All registered owners receive free updates for one year.

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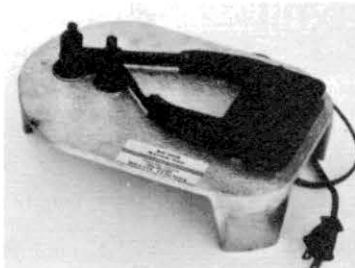
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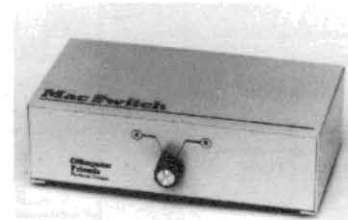
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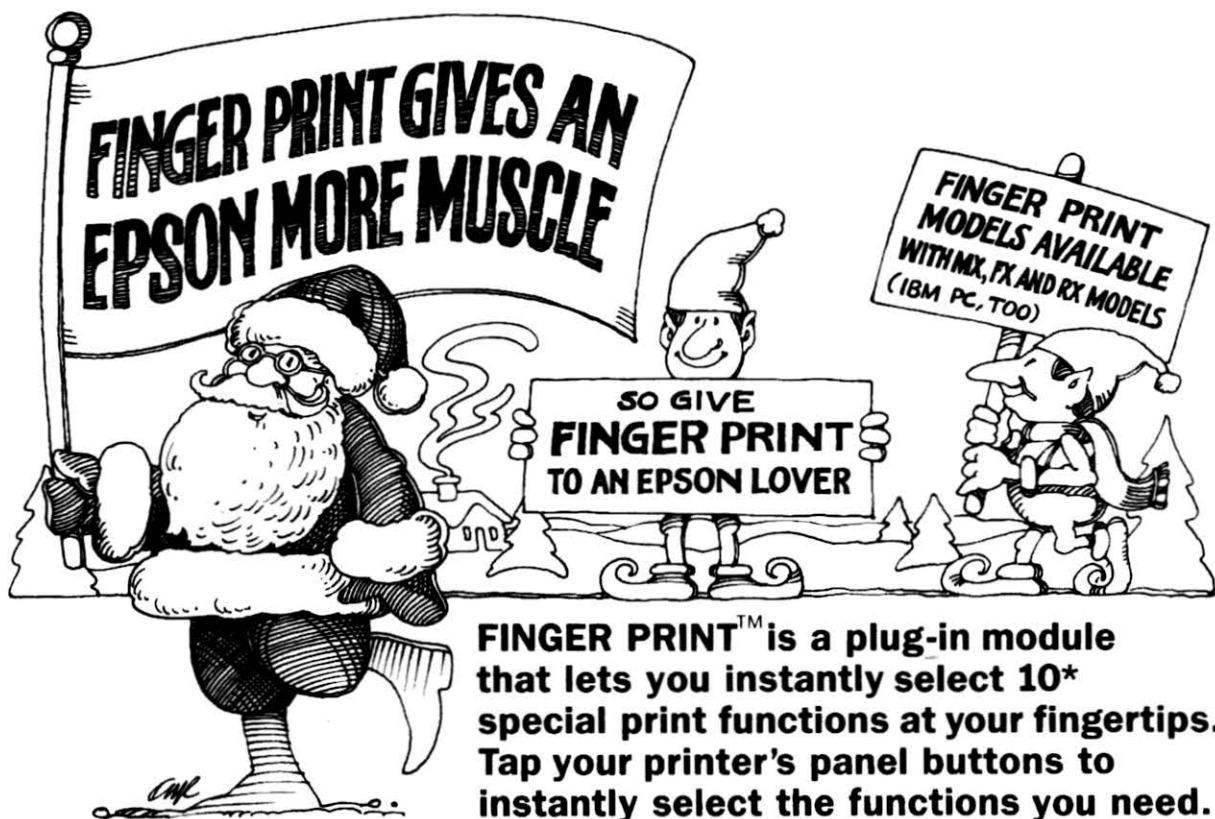
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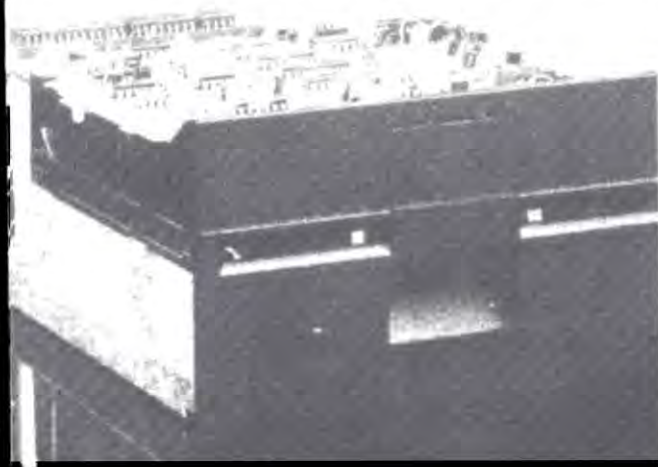
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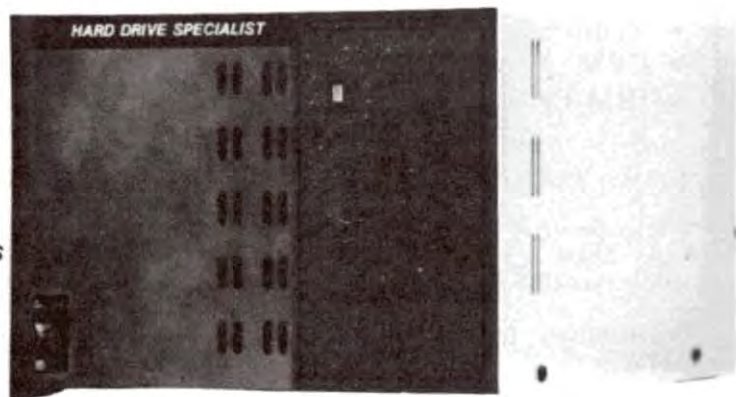
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NEW PRODUCTS

Continued from p. 312

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Reader Service ✓ 566

Computer Talk

Modems have been placed on a diet at Universal Data Systems! Their new LP modem series is entirely powered by your telephone line, eliminating the need for bulky, heat-producing power supplies or plug-in power modules. This results in a functional and attractive low-profile design that provides full modem features in a sleek, under-telephone package.

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from voice to data communications.

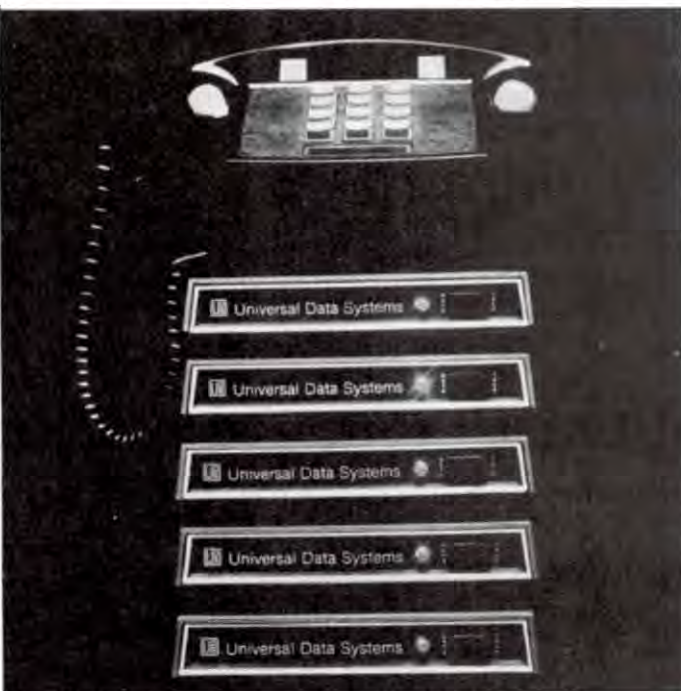
Prices for the LP modem series range from \$145 for the 0-300 baud modem to \$445 for the 1200 bits per second model. All are available from Universal Data Systems Inc., 5000 Bradford Drive, Huntsville, AL 35805, 205-837-8100.

Reader Service ✓ 578

More Memory

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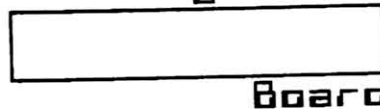
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Broaden your imagination by creating three-dimensional views on your Model III with Surface Plot. The program lets you enter an equation of the form $Z = F(X, Y)$ where Z is the height above the surface for a given X, Y coordinate (e.g., entering the equation $Z = 10 - X * X$ draws a hill). You can view the final picture from any position in space so you can see an image from underneath, above, or even inside a hill or valley on the plot surface. You can also specify the size of the resulting image.

Surface Plot automatically removes hidden lines for best results. You can save finished plots on disk or print them on any of 20 popular printers. The program requires the use of Grafyx Solution in order to work (Grafyx Solution is a plug-in, clip-on board that gives you 98,304 points in a 512 by 192 matrix).

The program, 12 hi-res pictures, and manual cost \$39.95 from Micro-Labs Inc., 902 Pinecrest St., Richardson, TX

Getting Through the Paperwork

Use Paperwork, a word-processing package, to get through your paper work quickly and easily. The package consists of a Line/Screen Editor that offers global replacement, searches, text line movement, and line insertions without having to position the cursor within the desired lines; a Mailing List Address data base that lets you merge name and address information into letters, envelopes, and mailing labels; and a System Output capability that provides you with hard copies of letters, documents, envelopes, labels, address data base lists, phone lists, and text file copies with assigned line numbers.

This well-rounded word-processing system is available for the Models II, 12, and 16 operating under CP/M. It requires 64K of RAM and costs just \$69.95 before Christmas, \$99.95 afterwards. For more information, contact Harris Micro Computers Inc., 2560 North 560 East St., Provo, UT 84604, 801-373-1605.
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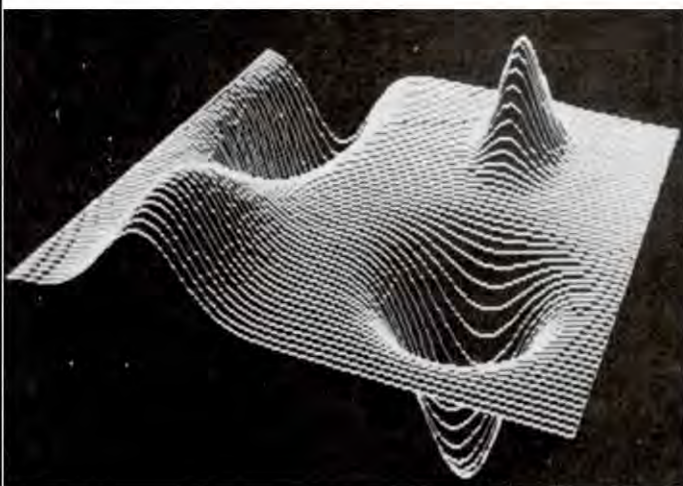
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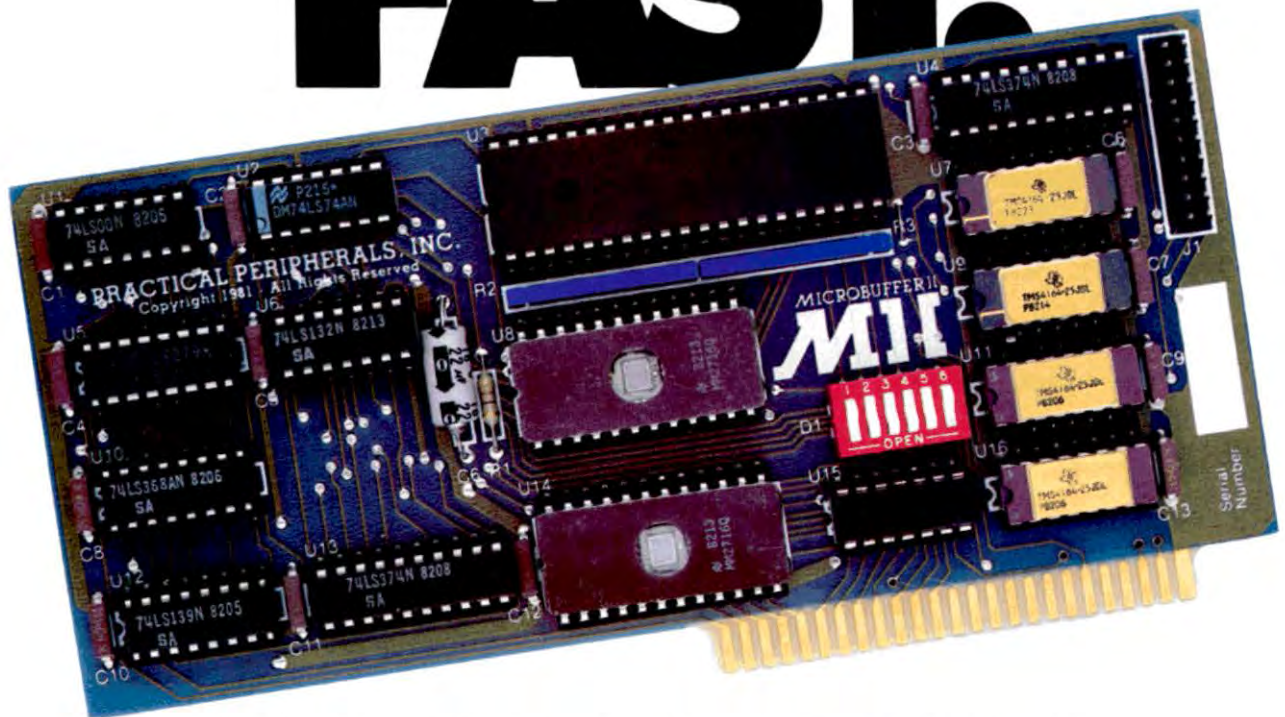
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