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March 1984 USA \$4.00

80micro

A WAYNE GREEN PUBLICATION

the magazine for TRS-80* users

TRS-NUKE Build Your Own Power Plant Simulator

The Tandy 2000:
What MS-DOS
Can Do for You

Model 4 I/O:
A Port-by-Port Account

Graphically Speaking:
Pie Charts Made Simple

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C-Notes
For the Model 100

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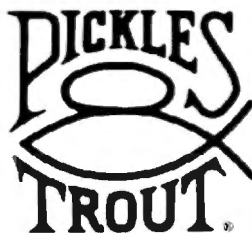
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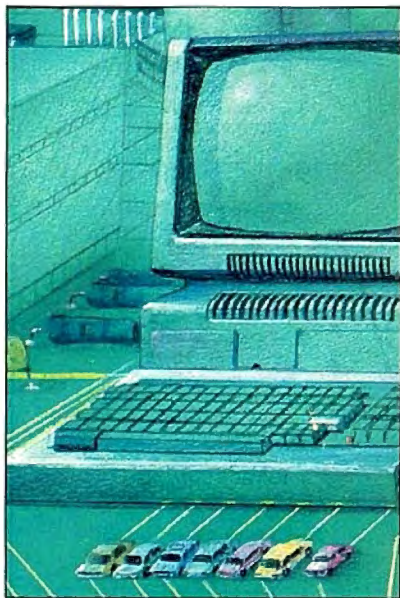
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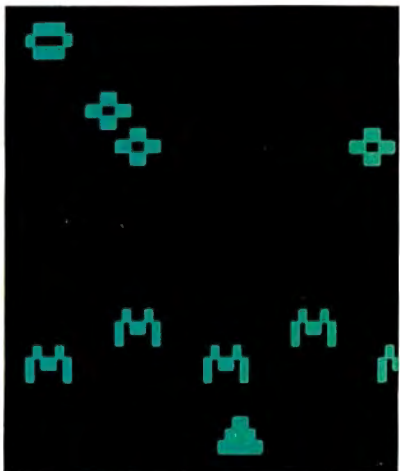
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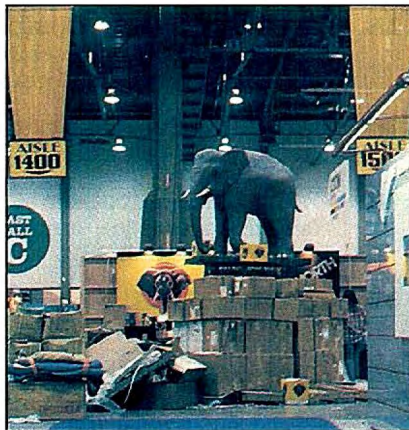
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The Model I/III Market Comes of Age

I've been getting a lot of phone calls and letters lately from readers who want to know what the hell is going on with the TRS-80 market. They're wondering why third-party manufacturers are disappearing in droves. Many readers are worried: they don't want to be stuck like dinosaurs in the primordial swamps while everyone else heads for the green, green grass of IBM.

I have a tough time being reassuring. The simple fact is that the Model I/III's halcyon years are over. They ended on Nov. 30, 1983, the day Tandy announced the Model 2000.

Nevertheless, the situation isn't hopeless, and TRS-80 owners should think twice before chucking their micros into the nearest river.

The Bottom Drops Out

The downward trends have been apparent for a while. Dozens of companies are dropping out of the TRS-80 market. Many that remain are struggling, and soon they, too, will disappear. Here at *80 Micro*, we've noticed a significant increase in complaints against mail-order firms that provide inadequate service or don't deliver goods promised, a sure sign of trouble.

This slump is reflected in the amount of advertising in TRS-80 magazines. In December 1982, *80 Micro* alone ran over 240 pages of ads, while *80 Micro* and *80 U.S.* combined for over 300 pages. In December 1983, three magazines—*80 Micro*, *Basic Computing*, and *Computer User*—had a total ad count of only 250 pages.

I don't have any objective data to explain why the Tandy market is bogged down. But I have some hunches.

First, the market—particularly that



for the Model I—has matured. Many people have all the peripherals and software they're going to buy. This means dwindling sales for established manufacturers, and a smaller potential market for new ones. Companies without a solid line of products, or with only one product, aren't surviving.

Second, many manufacturers are moving to other markets. This is particularly true among companies that specialize in games. They've discovered that they can make a lot more money selling games for the Commodore 64, Atari, or Apple computers than for the Model I.

Third, the Tandy market is, more than any other, a mail-order business. And many TRS-80 users have found ordering by mail to be a snake pit. Companies don't deliver their products. Others deliver late—sometimes by more than a year. When the product arrives, it might not work as described—or it might not work at all. Getting a refund can be a tortuous experience taking months, assuming that the company doesn't go out of business in the meantime. And after-sales support is often the

exception rather than the rule.

It's no surprise, then, that TRS-80 owners have become selective about who they buy from, and quickly abandon those companies that provide inadequate service.

So there you have it: fewer companies selling fewer products to fewer people.

Remember, too, that these developments began long ago, before the Model 2000. If Tandy's super-machine is successful, a lucrative new market will open up to software, add-on, and peripherals manufacturers, and the Model I/III third-party market will further deteriorate.

Now, the Other Side

There is a positive side to all of this, however, and TRS-80 owners have many blessings to count.

For starters, the TRS-80 world has developed an extensive support system for Tandy computers. Clubs, bulletin board systems, and periodicals offer a bounty of software and information.

Also, losing many of the smaller, fly-by-night outfits will ultimately strengthen the market. The survivors will be the companies that can provide quality products and adequate support.

Finally, TRS-80s are rugged machines. Many new and powerful systems have overshadowed the Model I/III, but few will outlast it. And the Tandy owner is a tenacious, resourceful person; he's invested a lot of time upgrading and refining his computer, and isn't about to junk a system that still does the job.

So if you're a Model I or III owner, you've got some reason to be optimistic. Just don't expect the Good Old Days to return; they're gone forever. ■

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Softcomm Smart Terminal

Thanks to Mel Patrick for his review of the Softcomm Smart Terminal (November 1983, p. 48). I would, however, like to make the following comments.

First, Table 4 did not mention that Command I also configures word bits. Also, keys one through eight transmit the programmable buffers, not one through nine, as shown in Command X.

I did not make an oversight in including the disassembly provision in my manual. Part of my licensing agreement with Tandy requires that I include the disassembly prohibition.

Mr. Patrick connects the information given about patching in your own printer driver in place of my spooler with this disassembly prohibition. You need not disassemble Softcomm to get the information needed to write a patch to your printer driver.

The manual clearly identifies the start and end addresses of my spooler so you know how much room you have. It also identifies the register setup on entry to my spooler. This lets you know how to handle matching up your driver.

Debug, supplied on the TRSDOS disk, lets you see what bytes exist at any point in the driver into which you want to patch so you know the Find string for your patch command.

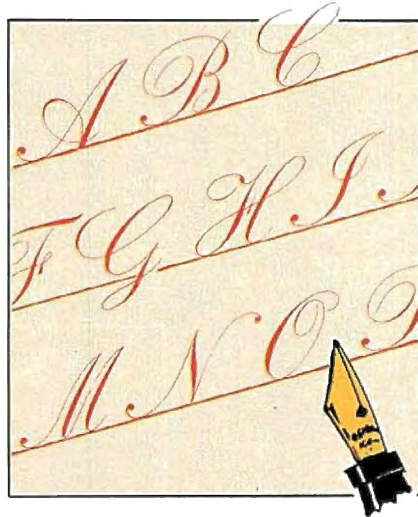
Finally, Softcomm is now available for the Model 4 under TRSDOS 6.0.0. The 24-hour telephone number for Softcomm's software support bulletin board is 901-761-5018.

*Bill Stewart, Owner
Stewart Software Co.
Memphis, TN*

Patrick Responds

I did omit the words "bit parameter" from the examples in my review.

Also, Command X is used to execute a DOS command with return to Softcomm, and has nothing to do with



the programmable buffer transmission. Numbers one through eight are separate and work in conjunction with the control key.

The manual gave me the impression that you can't disassemble any of the supplied software. Since you're limited by the size of the spooler, you need to know what the other registers are doing to see if you need to save their contents.

Without disassembly, you stop the learning process. How many machine-language programmers would we have if books such as Microsoft Basic Decoded & Other Mysteries were never published?

*Mel Patrick
Surrey, B.C.*

Drawing Influences

Thomas L. Quindry did an excellent job of reviewing our Draw and Kwik-draw programs (November 1983, p. 86). I have, however, rectified two of Quindry's concerns regarding Draw.

First, you no longer have to set memory size when you first enter Basic. Also, the program listed in the instruction manual for using displays in your own Basic programs is now included on disk.

However, I disagree with Quindry's implication that the method of changing the printer mode is inconvenient. I deliberately put this option in the

menu to keep it out of normal program operation. Normally, the user sets the switches when he first sets up the printer and doesn't change them unless he adds Graftax or Graftrax Plus.

I am pleased to hear that Quindry found the manuals easy to understand. A major part of our programming effort went into making these programs user-friendly.

*Phil Franzoi
President, Lichen Software
Spokane, WA*

MX-80 Micro

Since the invention of the Epson MX-80 printer, we Tandy loyalists have been thrown into the dark. C'mon guys, if you insist on printing programs for the TRS-80 and Epson, print fixes for the DMP series printers. I missed a lot in the October issue on bar codes.

If this is the way you run your magazine, why don't you call yourselves "The Magazine for TRS-80 Users Who Don't Own Radio Shack Printers."

*Larry St. George
Gross Pointe Woods, MI*

Rave Review

The "Basic, Faster and More Readable" series, by John Corbani, is splendid, and I hope that more of the series is forthcoming. The information is just right for someone who writes his own programs.

You have a fine magazine—one that seems to be improving as it ages. Congratulations.

*Herbert W. Neumann
Fort Myers, FL*

*Send correspondence to Input, c/o
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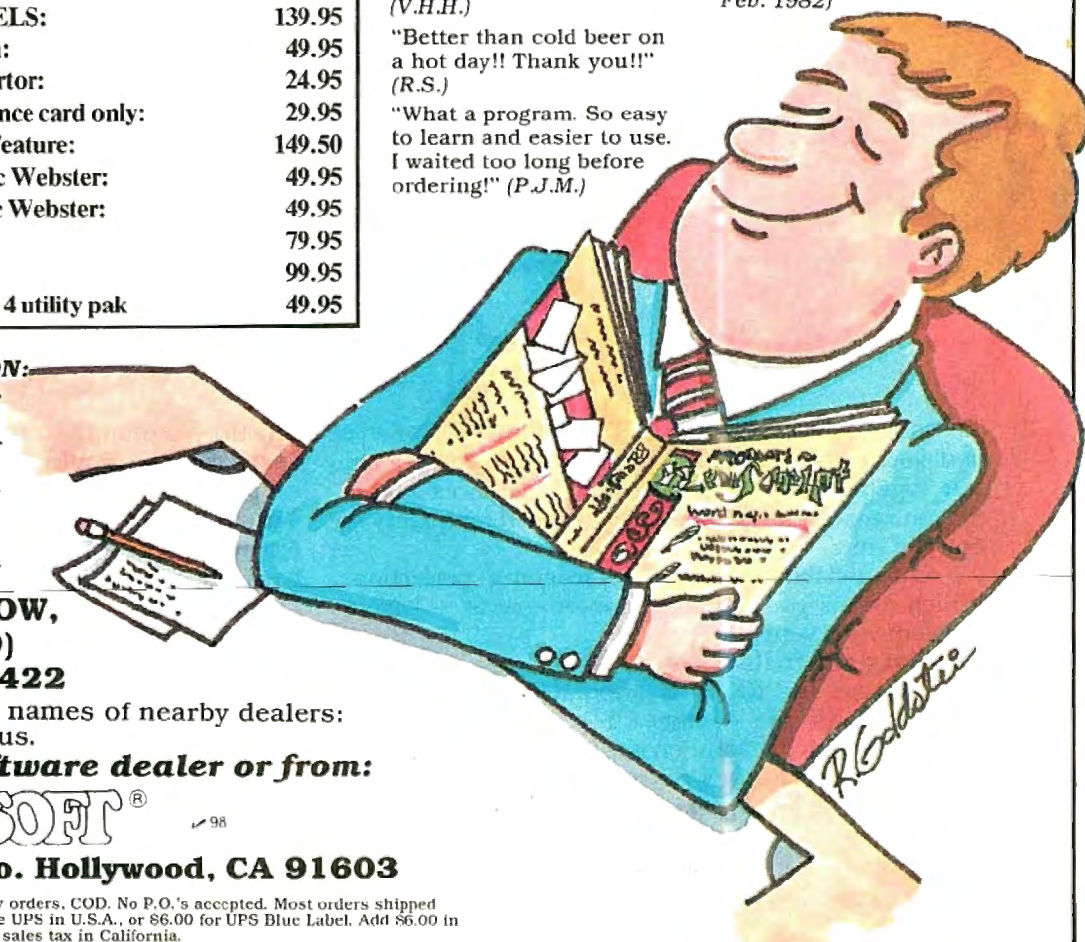
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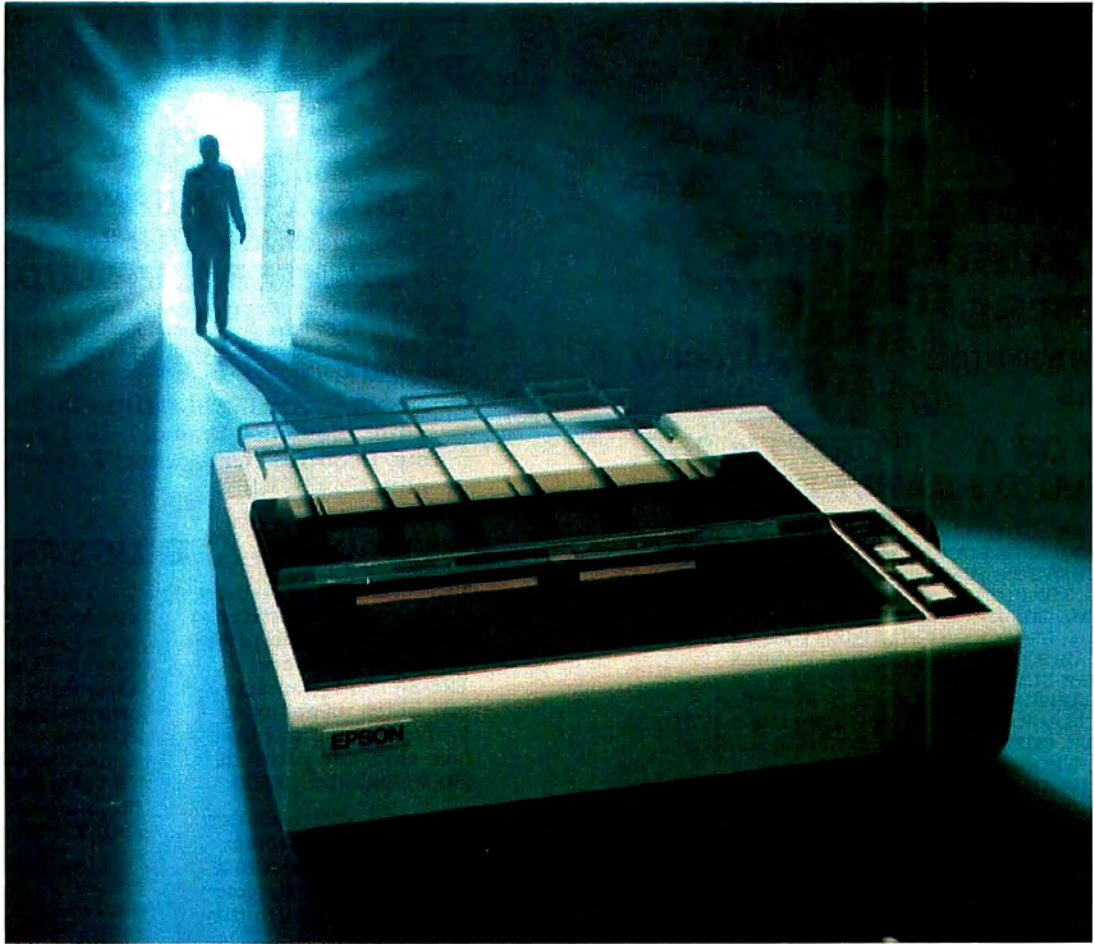
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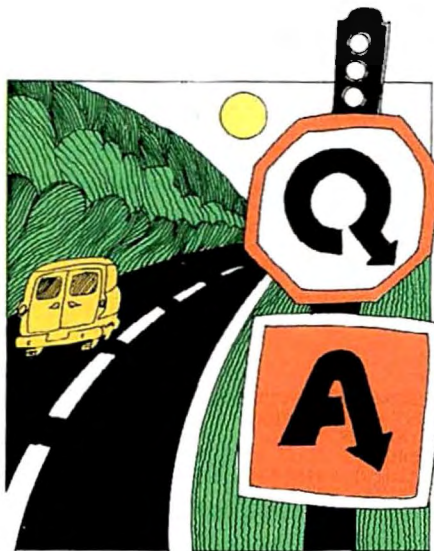
Send any questions or problems dealing with any area of TRS-80 microcomputing to Feedback Loop, 80 Micro, 80 Pine St., Peterborough, NH 03458.

Q: My Model III is about two years old, purchased complete from Radio Shack. I've always had a problem rebooting without a disk in drive zero; The Diskette? prompt appears and the drives don't stop running. For the first year the drives would only run three seconds, then stop.

The problem started about a year ago, after I returned from a two-month vacation: the drives would run continuously after a cold start. A discussion with an instructor at a Radio Shack computer store suggested a possible problem with the write-protect switch. Apparently cigarette smoke can clog the switch. He's a heavy smoker, as am I, and he had a similar problem with his computer. He fixed it by working the switch with his finger. That didn't help me.

I purchased the technical manual and looked over the diagrams for the disk drives. I noticed that the present Model III was running through the index-sector LED and wondered if mine could be burned out. To my knowledge the LED isn't used by TRSDOS, but might be used somewhere else (as in determining if there's a disk in the drive for instance?). I took apart the code from zero hexadecimal and then found that I needed disk-controller information provided in the Model II technical manual (but not in the Model III manual).

I never went any further with the ROM investigation, and still don't know what the index sector LED does. I did make one discovery though: on a cold start without a disk in the drive and with a flashlight shining on the



phototransistor, the drive stops running. The flashlight has no effect when the Diskette? prompt appears on the display. I've never opened up the computer, but I did find a Radio Shack notice regarding the possible misplacement of resistor R4 which may account for my continuously running drives.

Now for my most recent problem. I can no longer format a disk in drive 1 using either TRSDOS 1.3 or DOS-PLUS 3.3. I get too many flawed tracks and the operation aborts. I can, however, format in drive zero and then back up data on drive 1 by moving the newly formatted disk to drive 1. Do things go downhill from here? Is the current to the LED excessive and are they burning out? Is drive 1 more likely to go on the blink due to the higher temperature at which it runs? Any help would be appreciated. (Don Shenbarger, Clarendon Hills, IL).

A: The index-sector LED does just that: it tells the disk drive every time the index sector passes. This tells the drive whether the disk is spinning, and at what speed. It also tells the drive controller and DOS when sector zero of your disk is under the drive head. Without this informa-

tion, TRSDOS would never know which sector it was writing/reading, or even if the disk was turning. If the LED is burnt out, the drive won't work at all.

I don't know why your flashlight turned off the drive, except perhaps by falsely indicating to the drive that there was a malfunction, forcing the drive to shut itself off. With the Diskette? prompt on the screen, TRSDOS was waiting for the drive to start shipping information, and the drive had already completed a brief verification of operation. The flashlight on the phototransistor merely indicated the absence of a disk in the drive (since the light wasn't interrupted as it would be if there was a disk in the drive and it was spinning).

Most likely, the problem is that your drive needs cleaning and service. As with all electronic components, the disk drives drift out of alignment with the passage of time and require periodic fine-tuning to return them to peak performance. Overheating does affect drive performance by speeding up the rate of drift, but does little else unless they reach excessively high temperatures (120-150 degrees). Drive 1 does not intrinsically run hotter than drive zero; it's just the reverse. The reason drive 1 seems hotter is that drive zero is directly below it and makes drive 1's environment warmer (a good reason for computer drives to be mounted side-by-side).

As far as the current through the index sector LED is concerned, I don't think that's a problem since it is well within the LED's specifications. I would definitely check out resistor R4 and see if it's properly placed on the circuit board.

Q: I enclose my versions of Double Precision Routines (see Program Listing) that are more conve-

FEEDBACK LOOP

nient than Radio Shack's. The routines were written on a Model I and are now on an LNW-80. All commands and functions are the same for all Level II and disk versions of the Model I and III computers.

Every equation used is a series expansion (except for the square root), and is taken from pp. 243 and 244 of the *Handbook of Chemistry and Physics*. Program Listing 1 has 14 lines (six subroutines, 825 bytes), and

starts with line number 9000. Unlike the Radio Shack routines they are all stand-alone and modular so you can use only the routine(s) you need for your program.

The main program is set up as a calculator. Select the function you want from the menu and key in the argument. The program displays a single-precision ROM routine answer first, then the double-precision routine answer, and then a complementary routine is called to verify the answer by regenerating the original argument. The program prints the number of iterations on the left. Note that all angular arguments (variable WA) are in radians. To get degrees, multiply the answer by 180/pi. A to the X is included using LN and EXP, but isn't checked. And the program checks all but the square-root loop until the difference between two successive iterations is zero.

The square root is found by Newton's method: $WY = (WO + W/WO)/2$, where W is the input argument, WO is the first estimate, and WY is the next and closer approximation. This algorithm is so fast that if you let WO equal the result from the ROM routine, the algorithm repeats only twice to achieve 16 digits of accuracy (see line 9000).

The program implements the series expansion of the natural logarithm in line 9010, and E to the X power (EXP) in lines 9020 and 9021. It combines sine and cosine to force the input angle to within 2pi radians (lines 9030 and 9032). Tangent calls the sine/cosine routine, and then divides (SIN/COS).

Arc tangent is difficult because different series are needed for $X > 1$ and $X < 1$ (see lines 9042 and 9043). The program calculates arcsine in lines 9050 and 9051.

To use the routines, DEFINTI: DEFDBL W:W = WP = 3.141592653 5897932. The program uses I as a counter and you can use it elsewhere since it's redefined each time you call a routine. Error-trap your inputs before calling these routines, as inputting LN(0) or ArcSin (1) will loop forever until you press the break or reset key.

Unfortunately, some of the routines take quite a while to converge on a solution: LOG and EP for arguments far from one; and ArcTan and ArcSin near one. To speed them up you might

```

0 CLS:PRINT"6/14/83 DOUBLE PRECISION ROUTINES (Angles in Radian
s) (C) Jim E King, 1980, Permission to Use & Copy, NOT to Sell":
PRINT:GOTO90
8 Z=INKEY$:IFZ=" "THEN8ELSEIFZ="/"ORZ=CHR$(31)THEN8ELSEIFZ="@ "T
HEN99ELSERETURN
10 INPUT"For DSquareRoot(W>0),R=";W:U=SQR(W):PRINT"SQROOT("W")="
UTAB(40)"R[2="U*U:RETUR
11 INPUT"For DLn(X>0),X=";W:U=LOG(W):PRINT" Ln("W")="UTAB(37)"e
[("U")="EXP(U):RETUR
12 INPUT"For De[(X<87.337),X=";W:U=EXP(W):PRINT"e[("W")="UTAB(37
)"Ln("U")="LOG(U):RETUR
13 INPUT" For DSin(a) & DCos(A),A=";WA:V=SIN(WA):U=COS(WA):PRINT
" Sin("WA")="V;TAB(30)"Cos="UTAB(48)"Tan="V/U:RETUR
14 INPUT" For DArctan(x),X=";W:B=ATN(W):PRINT" Atn("W")="B Sin/
Cos("B")="SIN(B)/COS(B)+1E-8):RETUR
15 INPUT" For DArcSin(-1<x<1),X=";W:V=ATN(W/SQR(1-W*W)):PRINT"
ASin("W")="V Sin("V")="SIN(V):RETUR
30 PRINT"DSqr("W")="WY:RETUR
31 PRINT(I-3)/2"DLn("W")="WY:RETUR
32 PRINT"De[("W")="WY:RETUR
33 PRINT(I/2"DSin("WA")="WYTAB(38)"DCos="W:PRINT"DSin[2+DCos[2-1=
"W*W+WY*WY-1:W=WY/W:PRINT" DTan("WA")="W":RETUR
34 PRINT(ABS(I)-1)/2"DArcn("W")="WA:RETUR
35 PRINT(I-3)/2"DASin("W")="WA:RETUR
40 INPUT"A[X A=";W:INPUT"X=";WX:W=ABS(W):PRINT"A[X="W[WX]:GOSUB9
010:W=WY*WX:GOSUB9020:PRINTTAB(30)"DA[X="WY:GOTO99
80 PRINT"Line "ERL":;:IFERR=20THENPRINT"/0:Divide by 0":RESUME9
9
81 IFERR=8THENPRINT"FC:Illegal Function Call":RESUME99
82 IFERR=10THENPRINT"OV: Overflow or Underflow":RESUME99
88 PRINTERR"Error, See error codes in manual":RESUME99
90 DEFINTI=N:DEFSTRZ:DEFDBLW:WP=3.1415926535897932:ONERRORGOTO80
99 PRINT" Sqr<r>oot <L>og <e>[X Sin<C>os Arc<T>an Arc<S>in A<[>X
":GOSUB8
100 IFZ="R"ORZ="r"THENGOSUB10:GOSUB9000:GOSUB30:PRINT"R[2="WY*WY
110 IFZ="L"ORZ="l"THENGOSUB11:GOSUB9010:GOSUB31:W=WY:GOSUB9020:G
OSUB32
120 IFZ="E"ORZ="e"THENGOSUB12:GOSUB9020:GOSUB32:W=WY:GOSUB9010:G
OSUB31
130 IFZ="C"ORZ="c"THENGOSUB13:GOSUB9030:GOSUB33:GOSUB9040:GOSUB3
4:W=WY:GOSUB9050:GOSUB35
140 IFZ="T"ORZ="t"THENGOSUB14:GOSUB14:GOSUB9040"gosub34:gosub903
0:?:i/2"D SIN/COS("wa")="wy/w
150 IFZ="S"ORZ="s"THENGOSUB15:GOSUB9050:GOSUB35:GOSUB9030:PRINTI
"DSin("WA")="WY
170 IFZ="|"THEN40ELSE99
9000 WY=SQR(W):WY=WY/2+W/WY/2:WY=WY/2+W/WY/2:RETUR:REM WY=SQR(W)
9010 W2=(W-1)/(W+1):W3=W2*WY:W3=1-I*WY:WY=LOG(W)
9011 W1=WY:W3=W3*W2:W2=WY+W3/I:I=I+2:IFWY<W1THEN9011ELSEWY=
2*WY:RETUR
9020 W2=W:W=ABS(W):W3=1:WY=1:I=0:REM WY=EXP(W)
9021 W1=WY:I=I+1:W3=W3/I*W:WY=WY+W3:IFWY<W1THEN9021ELSEIFW2<0TH
ENWY=1/WY:RETURNELSERETUR
9030 WA=WA/2/WP:WA=WA-FIX(WA)+1:WA=(WA-FIX(WA))*2*WP:WY=WA:W=1:W
8=1:W9=WA:I=1:I2=1:RE

```

Program Listing. Double precision routines.

WY = Square root (W)	GOSUB 9000
W <= 0 results in FC or /0 errors	
WY = Natural Log	GOSUB 9010
W < 0 results in overflow or endless loop	
WY = EXP(W), e to the W power	GOSUB 9020
ABS(W) > 87.336 results in overflow	
WY = SINE(WA), W = Cosine(WA)	GOSUB 9030
WA = ArcTangent(W)	GOSUB 9040
WA = ArcSine(W)	GOSUB 9050
ABS(W) >= 1 results in overflow or endless loop	

Table. Working notes.

From Computer Plus to YOU...

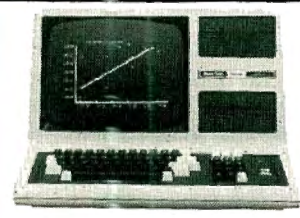
PLUS after PLUS after PLUS



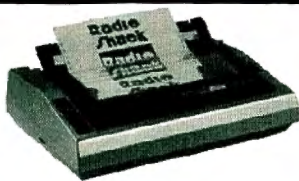
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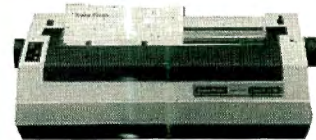
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use the ROM routines as a seed, use faster algorithms, compile them, or re-write them in machine code. See the Table for a few work notes. (Jim King, Topanga, CA).

A: Your routines have made the day for many people. Thanks for making them available. In addition to being able to work on the Models I and III, they should also work on the Models II, 12, and 16. They aren't needed for the Model 100 as its routines are more accurate than those used on the other computers.

Note to readers: These are available for personal use only, not for sale or use in commercially sold programs! Also, if you want to send me listings of programs or routines, please include duplicates of the programs on standard magnetic media (i.e., Model I single-density TRSDOS disk; Model III tape, 500 baud; etc.). Trying to typeset them for publication introduces all kinds of typing errors and is time consuming. If I have them on magnetic medium, the editors can just run the programs off on a letter-quality printer set to the correct line length for reproduction in the magazine. Thanks.

Q: After reading James Schaefer's article, "More Memory For Peanuts" (Anniversary Issue, p. 216), I upgraded my computer to 48K. Unfortunately, I plugged the chips in upside down and burned up four of them. Two weeks later, when the new chips arrived, I finished the upgrade, loaded a 32K program, and rejoiced that there were no problems. Ten minutes later, I tried to PEEK and POKE the new memory, but all I received was an OM error. No matter what I tried, I couldn't get into that area of memory, even though 32K programs loaded fine. Has my computer turned against me? What can I do?

I would also like to ask about disabling the end paper switch on my RS LP VIII without using sticky tape to hold it down. I want to disable it while using Scripsit. Can you help? (Andrew Tsintsof, Curtin, Australia).

A: No, your computer hasn't turned against you. You need to read your manual on the PEEK and POKE commands a little more thoroughly. Both are limited to addresses in the range of -32768 to +32767, where the negative addresses refer to

all memory locations from 32768 to 65535. That is, -32768 is actually addressing memory location 32768, and -1 is addressing location 65535. If anything were wrong with the memory, 32K programs wouldn't load, and the response to ?MEM would be far below the 48338 that you should get.

About the Paper Out switch, the only alternative to sticky tape is to solder an on/off switch in line with it. This will disable the Paper Out switch by shorting the wires together.

Q: Has anyone come up with a video pagination feature for Scripsit or the Acorn SuperScripsit modification? What I need is a patch that will place the cursor on the first letter of the next consecutive page as sent to the printer.

It would probably work similarly to the Find feature, except send the text through the print formatting steps and place the cursor at the beginning of each page. QWERTY will do this, but I prefer SuperScripsit.

Also, are there Russian or Spanish language character generators for the Model III or 4? (Eugene Priddy, Randolph, NJ).

A: I don't know of any patch to either program that will give you the type of pagination you want.

I/O Ware ([formerly Instant Software] Peterborough, NH 03458, 603-924-9261) used to have a Russian language tutor for the Model I that also worked on the Model III. You'll have to write to them for information about its current availability and cost.

Q: I've recently been getting a lot of Directory Read Error messages when I use disks that I've used without difficulty a day or so before. Sometimes I can get a partial or complete directory by repeatedly typing DIR. When I go to a back-up disk, copied from the "bad" disk, it loads successfully. This has happened to a number of different disks and programs.

Checking the drive speed reveals that the average speed is 299.898 for drive zero and 298.860 for drive 1. For 10 consecutive trials, the drives' slowest and fastest average speeds are 299.849 and 299.931 for drive zero, and 298.718 and 299.007 for drive 1. Each successive trial has a slightly

higher speed for both drives.

After checking the speed of each disk drive 10 times, I found that a "bad" disk that wouldn't work when the computer and drives were initially turned on would now work perfectly. My system is a Model I, Radio Shack Expansion Interface, lowercase modification, two Aerocomp drives, and an Epson MX-80 printer.

Is this a problem with rotational speed? If so, what do I do? If not, what's wrong? (Warren Howe, M.D., Oak Harbor, WA).

A: Do you mean that all disks fail when you initially power up your computer system, or that only disks you were using the day before fail? If all disks are failing until after an adequate disk drive warm-up time, the problem is probably in your disk drives. When was the last time they were cleaned and serviced? You say that, after warming up the drive by continuously trying to get a directory, some disks "fix" themselves. This seems to indicate that the drives are just not working correctly when you initially turn them on. I suggest you take the drives to a technician for a technical checkout and cleaning (maybe the heads are dirty and that's what's crashing the disks).

If the problem is only with certain disks, I would still suspect that the drive is at fault. Something happens when you use those disks that gives your drives indigestion.

In either case, I suggest you get a Data Separator for your expansion interface: it won't hurt and it might improve your system's performance by making data transferral between the computer and the disk drives more reliable. It's even possible that that's the entire problem, but I can't tell for sure. (If that is the problem, you should also have difficulty with Data-Lost-During-Read and Data-Lost-During-Write errors while your applications programs are running.)

Q: I have a Radio Shack Line Printer I. When I bought it, the printer didn't have a tractor-feed device. Where can I get one? (John Engelhardt, Lexington, KY).

A: First, call National Parts (see their address at the end of this column) and ask if they still have one available. If that fails, call Centronics

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(Hudson, NH 03051, 603-883-0111), the original manufacturer of the LP I, and ask if they have any left. If that fails, advise me with a postcard and I'll see if any of our other readers have an extra they'd like to sell.

Q: To W.K. of Kent, WA (see July 1983 Feedback Loop, p. 368): it requires neither a machine-language programmer nor an awful lot of work to alter TRSDOS to 80-track operation. Soft Sector Marketing's book *Model III TRSDOS Commented* outlines the procedure on p. 9, Section 1.

Basically, it consists of a series of patches to the DOS and the use of a disk zap program to change the last byte in the bootstrap. Once you've done this, you should be able to use the TRSDOS Backup utility to get it to an 80-track disk. (T.G.K., Altadena, CA).

A: If you already have the patches, then of course it doesn't require a machine-language programmer and lots of work to convert to 80-track operation. Unfortunately, SSM is out of business and no one seems to know how to get hold of their TRSDOS book.

By the way, it's not clear from your letter whether the book includes patches for all the TRSDOS utilities (Format, Backup, etc.). Does it?

Q: I have a 48K Model I with a disk drive and an Epson MX-80 printer. I recently wrote a short program that stores and prints 375 names and addresses.

After I print the first 100 or so names, the computer freezes up for a half-hour, prints another 100 or so names, freezes again, and repeats this sequence until the list is completed. Is this what's called garbage collection? What can be done to minimize those delays? The number of records printed varies as I change the Clear statement.

By the way, my letter to you in the March issue stated I had trouble with a video ripple on my screen. Since I've moved from Indiana to Florida the problem has disappeared. So, to solve video ripple, move to Florida! (Harold Leyes, Cape Coral, FL).

A: Yes, the problem is garbage collection. The ROM uses a dy-

namic string allocation routine during string manipulations, which simply assigns new strings to the blank areas of memory (blank being the next address above the last string in memory). The computer doesn't store the old string location address; it replaces it with the new one. Thus, the old string is still in memory, but the computer doesn't have the address. When the new string address reaches the highest location your computer allows, the computer goes through the string area and eliminates the wasted space between valid strings. The larger the area cleared, the longer the time before such a clean-up is needed again (and the longer it takes to do when it's started).

The algorithm Microsoft uses is quite simple. A better one would have been to initiate the collection at more frequent intervals, before it becomes a necessity. If it were done after every string manipulation and if better record keeping were maintained, you wouldn't even notice it happening, and the total time used wouldn't be overly wasteful.

Not everyone can afford your video ripple solution, but it does show that nothing was wrong with your computer and that the problem was interference caused by another electrical device (you wouldn't believe the number of people who refuse to believe that the problem exists—they insist that the problem is with Tandy's Model I/III design).

Q: I purchased an LNW 5/8 Doubler from a local dealer and installed it on a late-model R/S interface (no buffered cable). The system works fine in single-density, 40-track format using NEWDOS40. Usually, my double-density master disk, DOSPLUS 3.4D, won't boot up. If it does, you can't back it up because it won't read the master. Either this doubler is faulty or it won't work on Radio Shack's Expansion Interface. I have another Model I with an LNW Expansion Interface and doubler that works just fine.

I note, by the magazine's advertisements, that AeroComp claims that the WD1771 chip in the Radio Shack EI shouldn't be used for reliable data transfer. Any comments? (Robert Hoffmann, Indianapolis, IN).

A: I'll answer the last question first. The WD1771 chip has a small RAM register in it for storing information. The designers of the chip say you can use it for data transfer, but suggest that an outboard RAM be used for this purpose instead. This is because the 1771 also uses the inboard RAM for control, and data stored there is subject to being wiped out before the CPU can read it. All doublers currently on the market use outboard RAM chips for data storage.

With the 5/8 doubler installed, did you try another double-density DOS? Did you try your DOS on another computer, your other Model I? It could be that the problem isn't with the board, but with a flawed DOS. If the DOS checks out OK, I'd call LNW and ask for the customer support desk.

The last step would be to have the Radio Shack EI checked out—something could be wrong with it.

Q: I'm trying to solve a problem on my Model I system with two MPI drives, Percom data separator, and EAP Gold Plugs. During random access, the system reports back an error of "Data Record Not Found During Read" (and sometimes write). Examining the offending sectors with Trackcess I found that the ID pack has been damaged in some fashion. I've put the computer into the shop several times, but still have the problem.

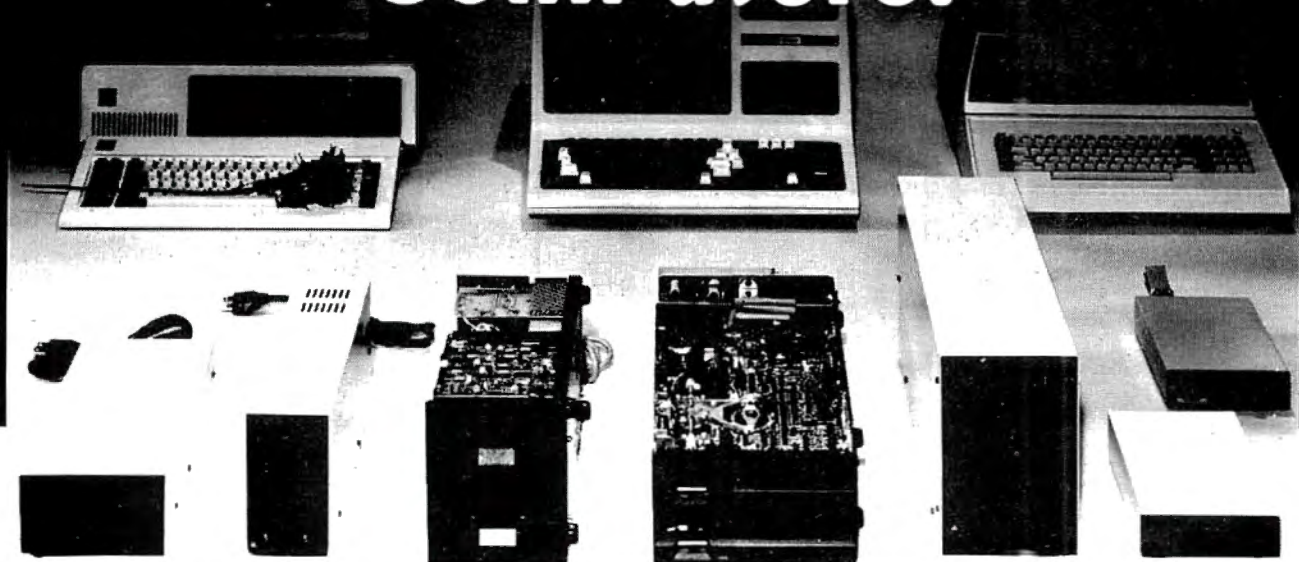
I have two TRS-80s, and I've switched parts at various times (keyboards, EIs, drives), but still have the problem. And switching from NEWDOS Plus to LDOS didn't help.

The computer does this only during random access, and only to one applications program, which I rewrote from sequential access to random access (that's when the problems first started). Most puzzling is that the system seems to eat the sectors containing certain job order numbers, even though they are all within the ASCII numeral range (0-9).

When I switched disk drives, the problem stopped, so I switched back to see if the problem would reoccur. It eventually did. Can you tell me what's happening? (Robert Konigsberg, Sunnyvale, CA)

Continued on p. 228

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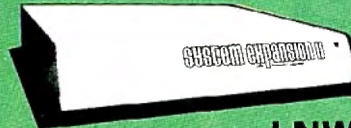
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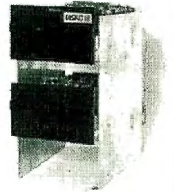
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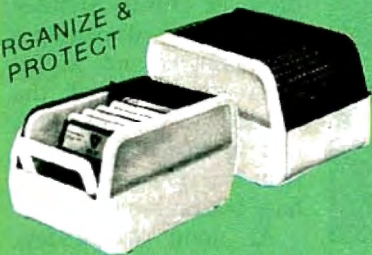
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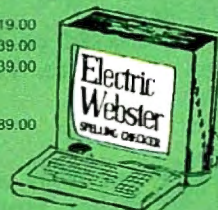
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No one really enjoys Comdex. From its trade-show beginnings (156 exhibitors at the MGM Grand in 1979), Comdex/Fall has grown to be Las Vegas' biggest annual convention, and the obligatory event of the computer industry: everyone, whether or not they attend the National Computer Conference, the Consumer Electronics Show, the West Coast Computer Faire, Comdex/Spring, or the hundred smaller shows, goes to Vegas.

The result makes the U.N. look like a clandestine gathering. From Monday, Nov. 28 to Friday, Dec. 2, 1983, the Las Vegas Convention Center, the Convention Center's West Hall, and the Hilton, Riviera, and Sahara hotels strained to accommodate 1,400 companies exhibiting in 5,700 booths seen by 83,000 people—nearly every one of whom, by week's end, would agree that it was just too much.

Even Comdex's sponsor, Needham, MA's The Interface Group, couldn't exult in its gargantuan success. The firm's director of show operations, 55-year-old Mitchell Halperin, suffered a heart attack and died at the Convention Center Thursday evening.

Besides sore feet, the attendees' lack of enthusiasm could be blamed on the large number of mediocre products

edited by Eric Grevstad



Exhibitors prepare for Comdex/Fall.

among the few exceptional ones. As the organizers vigorously pointed out, the horde of exhibitors rebutted talk of an industry shakeout; on the other hand, a look at the crowd of competing IBM clones made a shakeout seem inevitable.

Except for Apple Computer Inc., some Apple and a few Commodore software companies, and exhibits from minicomputer and multi-user office vendors, Comdex/Fall belonged to PC compatibles and MS-DOS software. Everywhere you looked, someone had taken an Intel 8088, 128K of RAM, two disks, and a keyboard, and thrown together an MS-DOS micro.

Some clones looked better than others—Sperry and ITT, for instance, seemed likely to join TI, Compaq, and a handful of others as successful personal computer makers. There were several intriguing new portables and integrated MS-DOS software packages. But, with unremarkable machines on one side and tacky tinsel and gimmicks on the other, Tandy had little competition. The Model 2000, introduced on Wednesday, was the star of Comdex/Fall '83.

"Have you heard Tandy's back in the micro-computer business?"

—overheard at dinner, Desert Inn, Wednesday, Nov. 30

The Radio Shack booth drew fair crowds Monday and Tuesday, displaying a few printers and Model 100s, one each of the Models 4, 12, and 16B, and so many Model 4Ps that two fewer wouldn't have been missed.

At noon Wednesday, Tandy roped off the booth and removed two portables; by 12:30 p.m.,

drawn by curiosity or by news of the Model 2000's press debut that morning at Caesars Palace, people were standing four deep watching workers set up two machines under dropcloths. The veils came off and ropes came down at 1 p.m., and you couldn't turn around in the Tandy booth until Friday.

"It's the talk of the show," Radio Shack's Gary Lackey, an OEM sales representative, said Thursday of the Model 2000. "Our stock went up three points yesterday and three points today and IBM's went down. I have so many calls about it at my office I can't begin to answer them all."

The 2000 effectively upstaged IBM, which in turn upstaged nearly everyone else. Big Blue had set up its own Comdex, occupying the Convention Center's Gold Wing off the Rotunda, where attendees lined up for tickets to PCjr demonstrations and hands-on tutorials.

There were PCs and XTs and software, but—if not for the Model 2000—Junior would clearly have been Comdex's main attraction. The crowds around IBM's home computer never let up, even though few had any



Radio Shack sets up shop

You couldn't turn around in the Tandy booth until Friday.

kind words for PCjr's chiclet keyboard. One Peanut, hooked up to a wide-screen TV set for demonstrations, spent the week broadcasting skeptics' typing tests while IBM salesmen tried to make the best of it.

"This is a tet of thow the pc junior tye. These keys are very difficult to use."

—typical PCjr user's reaction at the IBM display, Thursday, Dec. 1

Of course, there was more to Comdex than the Model 2000 and the PCjr. The following stories look at some of the other highlights—two significant trends in system architecture, the continuing boom in MS-DOS hardware, and tidbits ranging from Miss Nevada's dress to a field of daisy-wheel printers. All told, there were few real standouts, but there was a lot at Comdex to encourage industry watchers.

And exhaust journalists. Comdex/Fall '84 will expand to Caesars Palace and the MGM Grand, adding a sixth and seventh show location to accommodate the expected 7,000 exhibit booths. ■

—E.G.

80186 and 16 by 80

Two Comdex trends: Intel's new chip and big-screen portables.

If Comdex was largely an MS-DOS symphony, there were many variations on the theme. In addition to versions of the IBM PC (Intel 8088-based desktops, some with hard disks, some in suitcases, some both), quite a few firms tried different paths. Notably, 11 other companies joined Tandy in using Intel's new 80186 (see *80 Micro*, February 1983, p. 26).

According to Pronto Computers Inc.'s vice president for engineering, Skip Hansen, Durango Systems' Poppy was the first 80186 micro—an honor several showgoers attributed to Pronto, as Durango hasn't stressed the 80186 in its advertising.

Meanwhile, Hansen said, Pronto has been shipping 80186 micros since last August. At Comdex, the Torrance, CA, firm offered both desktop and transportable versions of a 256K, two-disk system, priced at \$3,950 and up—and, Hansen told *80 Micro*, faced the job of reassuring customers confused by rumors of 80186/MS-DOS incompatibility.

Describing his job at the Pronto booth, Hansen said, "I'm here to tell

people that the 186 is MS-DOS compatible, despite what they've heard." The truth, he explained, is what Tandy has stressed in introducing the Model 2000—that the newer chip runs MS-DOS programs perfectly, but won't run programs that address IBM PC hardware.

Once that's fully understood, Hansen said, the 80186 might replace the 8088 as the industry standard: "I think it will. I think some of this naysaying about incompatibility is because of that."

Whether, as Hansen implies, some companies that use older chips might have an interest in spreading gossip to discourage the move to new ones, you can't accuse Mad Computer Inc. of such slander. The Santa Clara, CA, manufacturer, which announced its Mad-1 a year ago, revealed one reason for its delay in reaching the market: a switch from an 8086 to an 80186 CPU.

Mad's redesigned micro impressed Comdex attendees with its Museum of Modern Art styling, but was no rival to the Model 2000 in the affordable 80186 sweepstakes: The 128K Mad-1, with single- instead of double-sided disks, costs \$4,195 compared to Tandy's \$2,999.

The 80186 is already showing up in portables, too. Australia's Dulmont Electronic Systems came to Comdex to find a U.S. manufacturer and distributor for its 256K, 10-pound



The Dulmont Magnum: Put an 80186 in your briefcase.

Magnum; by week's end, Marketing Manager Terry Crews had not only gathered a foot-thick stack of inquiries, but the Magnum had grown a 16-line by 80-column (instead of 8 by 80) LCD screen.

"We've had so many [distribution] offers we're just going to have to go away and sort through them," Crews said. "We'll be shipping some units from Australia for orders we've already taken, and be in production here by January or February."

Compared to the Model 100, the Magnum is uncomfortably heavy in one's lap. Otherwise, the machine—which has MS-DOS and several applications programs in its 128K ROM—looked like a winner, particularly if Crews' prediction of a price "a little over \$2,000" is accurate.

The Magnum, in fact, displayed both of Comdex's new hardware trends: the 80186, and a bigger screen for lap- or briefcase-sized portables. Gavilan Computer Corp. upgraded its 8088-based, \$3,995 Gavilan to a 16 by 80 display, and reduced the price of its 8 by 80 model to \$2,995. Sharp's PC-5000 has an 8 by 80 screen, but 128K RAM and optional bubble memory cartridges in contrast to Gavilan's 64K RAM and 3½-inch disk drive; with a built-in thermal printer, it's \$2,394.

And Teleram Communications Corp., seeing MS-DOS machines pass its pioneering Z80-based portable, offered 8- and 16-line models as well as selling its original 4 by 80, bubble-memory-equipped unit for \$1,595. However, Teleram Vice President Richard Hohmann noted, liquid crystal technology hasn't caught up with the demand for larger displays: "The bigger the screens get, the worse the resolution. That's something the manufacturers will have to work out over the next year."

Dulmont's Crews foresees Magnum-style micros eclipsing desktops in market penetration—" [This] will account for 60 percent of all machines sold by late '84, portable or desktop. Who needs a desktop? This is more powerful, and it's portable." A few other entries muddied today's distinctions between desktops, transportables, and portables. Several companies displayed "portables" that were, in effect, desktops with the monitor removed.

Visual Computer Inc.'s Commuter (\$2,490) is a 16-pound IBM clone (8088 chip, 128K, one 5¼-inch drive) with a 16 by 80 LCD screen that folds down to cover the keyboard. It can be connected to a full-sized monitor, as can STM Electronics' model—which offers an 80186 processor, 256K

RAM, two double-sided disk drives, a 40-column thermal printer, and a direct-connect modem in a 17-pound, \$3,000 package, if you don't mind a 16 by 84 display.

Finally, there was Xerox Corp.'s 1810, a 64K briefcase machine with a built-in microcassette recorder similar to the Epson HX-20's. It uses a maverick CPU, the NSC 800 (although a plug-in base station adds both Z80 and 8088 processors, as well as 128K RAM), and also breaks new ground in LCD screens: a 3-line by 80-column display. ■

More MS-DOS Machinery

There's life in the 8088 yet.

It would be nice if every product at Comdex was as new as the Model 2000 or the Dulmont Magnum, but most exhibitors preferred to play it safe. While such hopeful IBM clones as Tava and Handwell received little notice, plenty of bigger names climbed on the PC/8088 bandwagon. Companies like Sanyo, TeleVideo, Eagle, Compaq, and TI attracted attention with IBM compatibles, and even CP/M holdouts like the Kaypro II and Epson QX-10 sprouted 8088 add-on boards.

Two of the new compatibles would deserve attention for their producers' reputations alone. Sperry Corp., dropping the historic Univac name in favor of the telltale "Personal Computer," announced an 8088-based desktop with a few non-clone features, and communications giant ITT, whose PC look-alike lacked innovations, hinted that the machine was only the first of many personal computer products.

For the most part, the Sperry PC is indistinguishable from other 128K, 8088-based MS-DOS compatibles; its price for models with various storage options (one, two, or hard disk drives) is about 10 percent under IBM's, and Sperry consultant Denis O'Donnell's words—"We're just trying to get our fair share of the market"—might have come from any booth at Comdex.

Sperry spokesman Steve Marrinan, far from bristling at the word "clone," shrugged it off: "It's an



Visual's Commuter: A PC for people with large laps.

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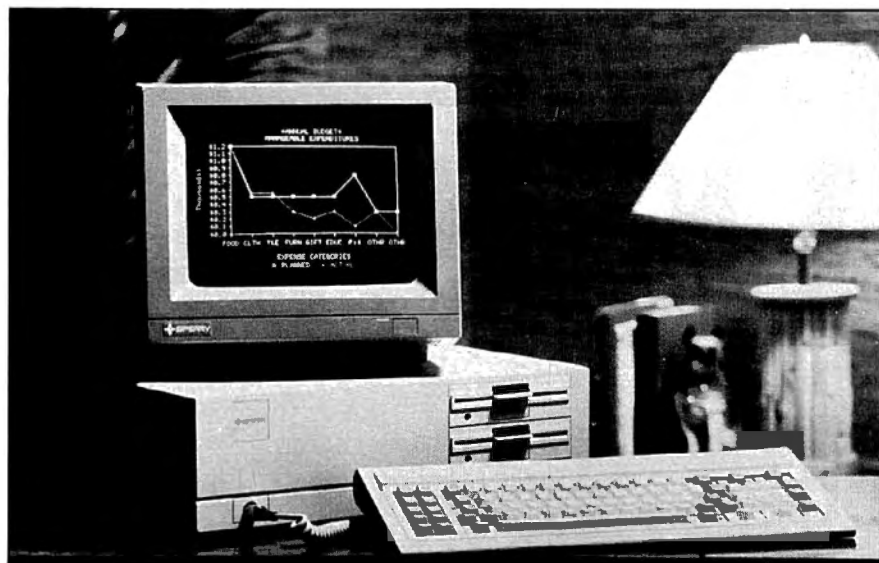
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Sperry's high-speed 8088 PC.

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Sperry is, however, proud of its "turbo switch," which shifts the 8088's clock rate from 4.77 MHz (IBM's speed) to a faster 7.16 MHz. In addition, Sperry boasts better graphics than other PCs: 640- by 400-pixel resolution with up to 256 on-screen colors compared to IBM's 16.

Those specs approach the Model 2000's, which may be why Marrinan was optimistic about the prospect of Tandy's raising MS-DOS performance standards: "I think it's a great idea. Tandy is Tandy; they're going to grab some market share. How much remains to be seen."

By contrast, ITT seemed determined to out-IBM IBM in technical and marketing conservatism. The ITT Xtra costs about 5 percent less than a comparable PC; its specifications (128K, 8088, identical keyboard) are nothing new, and it can't match Sperry's or Tandy's speed or resolution.

On the other hand, ITT is planning to stress its own library of Xtra software, including "ITT DOS 2.0" rather than the ubiquitous MS-DOS 2.0. And, if the firm's strategy—total compatibility at a slightly lower price with an equally big name—pays off, ITT may build a large enough installed base to begin introducing proprietary designs.

Asked about Xtra's role as a PC clone, ITT's David Rigg said, "My

only comment on that is that IBM has set the standard, and we're following that standard. This is our first product of many, so the first product out of the chute is standard."

Rigg refused to comment on Tandy's 2000, but ITT/England's Stewart Goldberg dismissed it as a mistaken step out of the mainstream: "I looked at the keyboard, and it's not an IBM-compatible keyboard. If you're going to run Lotus, you've got to have [PC function keys]."

Reminded that the 80186 offers more speed and power for MS-DOS software, if not for every IBM program, Goldberg said, "So it's not compatible. So what's the point? I don't think people want high tech. They want security. I don't know the American market, but in Europe, I know, people want to go into the Softsels of this world and pick out software and run it. If you can't pop in a Lotus disk and run it, you're in trouble."

Two products support MS-DOS, but neither one uses the established 8088 nor the racy new 80186. Britain's ACT (Applied Computer Techniques) hopes to sell 20,000 U.S. copies of its Apricot, a "fourth-generation" micro with attractive specifications—Intel's 8086, the true 16-bit (bus as well as processing) brother of the 8088, coupled with 256K of RAM, two Sony 3½-inch disk drives, a built-in calculator, and a keyboard featuring a 2 by 40 LCD "MicroScreen" mounted above

six accompanying soft keys.

The soft keys serve different functions, identified on the LCD display, depending on the Apricot's application; the same key, for instance, might delete paragraphs in word processing and load spreadsheets in SuperCalc. The screen also lets the \$3,190 Apricot serve as a portable if no CRT monitor is available.

Finally, there's Polo Microsystems' \$3,995 bonanza: In addition to Intel's 80188 (the 8-bit-bus version of the 80186), MS-DOS, and CP/M-86, the 128K Polo offers CP/M-80 under its Z80 coprocessor, as well as two disk drives, a built-in modem, bundled software, and a 120-cps dot-matrix printer. ■

Ziggy, Flashdance, and CP/M Bombs

Other Comdex attractions.

Ashton-Tate had a Model 2000 Arunning dBase II on display by show's end, but most software companies hadn't had time to react to Tandy's MS-DOS machine; Pulse Train will look at the 2000's place amid 1984's new software next month. Meanwhile, to close the Comdex/Fall file, short notes on a few other sights of the show:

Optimem: Shugart, the disk drive veterans, gave this name to their latest storage device: one gigabyte on one side of a removable, nonerasable 12-inch laser disk. The 3¼-inch microfloppy isn't catching on, but high-density 3½- and 5¼-inch floppies, smaller and transportable hard disks, bubble memory, and *Star Wars* optical disks are all jockeying for position in the next generation of micros.

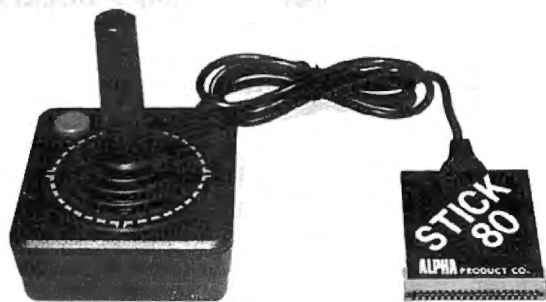
Burnout and boredom: By Friday, most of the people in the Convention Center could have auditioned for ABC's "The Day After." Showgoers' sympathy went to such people as the Great Plains Software cowboy, who spent the week lassoing a sawhorse, or New York actors Joyce Nolen and Ray Cox, who played smart Susan Sperry and hapless Irwin B. Michaels (note his initials) nine times a day in Sperry's rather tacky PC skit.

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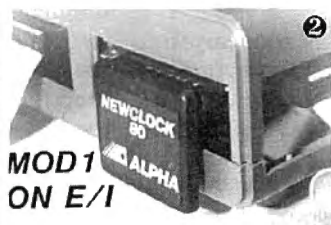
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The Software: Newclock-80 is as easy to use as it is to install. "SET", a Basic program, is used only once to set the time and date and select 12 or 24 hour format. "TIMESTR", also in Basic, patches your computer "TIME\$" function to read Newclock-80. It also adds "TIMES\$" to keyboard-only systems, a short routine is simply "poked" into low memory.

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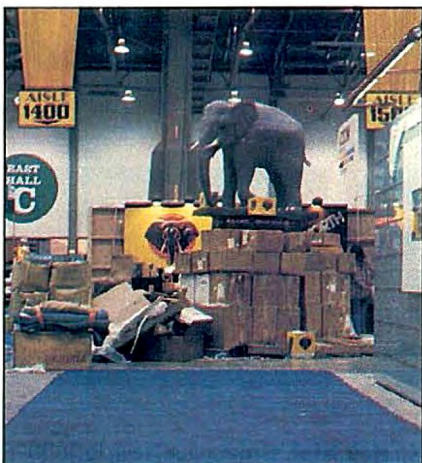


at the PC Telemart stand, who watched an 80 editor trigger the company's software demo with the words, "Now you've done it. That demo's really boring and long."

Printers: Word of a letter-quality dot-matrix from Epson drew crowds, but the 60-cps LQ-1500 seems intended for OEM vendors rather than end users. It'll cost between \$1,200 and \$1,500.

Three matrix printers joined the TP-II daisy wheel in Smith-Corona's lineup, but other companies went the other way, with a host of new, inexpensive daisies: the Juki 6100, the Transtar 120, the Star Micronics Power Type, the NEC 2050, the Silver-Reed 500 and 550, and the Daisy M20, to name just seven.

Apple: No McIntosh, but a big



The first thing you unpack is the elephant.

push for Lisa software. And AppleWorks—a \$250 integrated word processor, spreadsheet, and data base manager for the IIe.

Sex: Zenith Data Systems had the cartoon character Ziggy, but dozens of exhibitors resorted to cheesecake to lure passers-by. Evergreen Software's model, in running top and track shorts, might have been dressed for a jog but for her gloss stockings and high heels; Perkin-Elmer exhibited 18-year-old Christa Daniel, Miss Nevada, who looked thoroughly bored and wore the same gown all week.

Computone, makers of "Turnkey Systems with Multi-User Muscle," won the sexism contest by putting a series of women on a platform 10 feet above their booth to perform aerobic

exercises and *Flashdance* routines in skimpy leotards.

Least successful exhibitors: Many small companies got lost in the shuffle, but a few were nearly booted out of Comdex. Probably the most ignored hardware debut was Royal's new 64K, Z80-based, CP/M Alphasonic PC, \$695 with no disk drives or monitor. Similarly up-to-date, MicroStandard Technologies launched a 64K Z80A transportable, offering CP/M Plus for \$2,995—a fierce competitor to Tandy's \$1,799 TRS-80 Model 4P.

And, if not for its announcement of IBM support, the show's most ignored software would be VisiOn—announced almost a year ago, finally available, requiring a DEC VAX minicomputer to write applications, and totally upstaged by Microsoft's MS-DOS Windows. People were looking at Visi-Corp and muttering the dread phrase, "one-product company." ■

—E.G.

The Software Census

If counting sheep is too easy for you, you might want to imitate Sofsearch International and count programs. As of Oct. 27, 1983, the San Antonio, TX, software information service declares, there were 18,795 microcomputer software products on the market—far outnumbering the 9,641 programs available for minis and 3,805 for mainframes, and dominating the total of 32,341 computer programs offered in 90,000 operating versions.

Home and hobby programs accounted for 42 percent of the micro packages, followed by education (22 percent) and business software (21 percent). System and utility programs made up 10 percent of the catalog, and engineering and scientific applications added the final 5 percent.

Programmers could choose among 511 language products, 257 operating systems and DOS enhancements, and 472 system utilities. There were 495 data base managers and filers, not to mention specific programs for such businesses as real estate (228), medicine and dentistry (337), and insurance (177).

Even while tracking down such niceties as the 115th oil and gas exploration package, Sofsearch noted the

software market's biggest trend: The number of IBM PC and PC-compatible products more than doubled in eight months, going from under 2,000 to over 4,000 by October.

All of this, of course, was before Comdex and its scores of new products, with integrated packages that count as anything from one to six programs apiece. A software counter's work is never done.

Software that Sells

It's a novice computer buyer's dream: a sales clerk who takes the time to ask what the customer wants a computer to do, who'll clearly explain the pros and cons of dot-matrix versus daisy-wheel, and who can suggest applications without dropping phrases like "DBMS" and "spreadsheet." On the other hand, it's not human.

The latest trick in the micro store manager's bag is Gina, a CP/M or MS-DOS tutorial and questionnaire program that takes customers through a half-hour course in micro buying, finishing up with a printed purchase recommendation. From there, it's the salesperson's job to discuss Gina's proposal with the customer and close the sale.

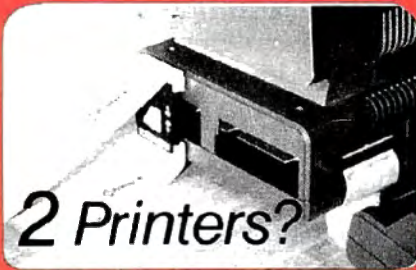
For the most part, System Vision Corp.'s program alternates screens of tutorial information with questions about the prospective buyer's needs. A simple chart, for example, shows the relative speed, capacity, and cost of cassette, floppy, and hard disk storage; users with small budgets and files will be steered toward tape, while Gina recommends hard disks for those who anticipate major data base work.

The course, punctuated with elementary graphics and game-style words of encouragement ("You're doing great!" or "Almost done!"), covers most factors involved in buying micros and peripherals. After Gina finishes the quiz—would you like access to on-line services, do you anticipate heavy use (in other words, do you need a modem or service contract)?—there's a message of congratulation and a printout describing your ideal system, either in generic terms or with brand-name recommendations.

From a dealer's point of view, Gina is extremely cheap sales help, saving clerks' time and managers' paying for that time. From buyers' point of view,

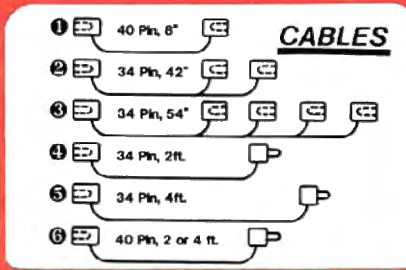
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GREEN SCREEN WARNING

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

- Several are just a flat piece of standard colored Lucite. The green tint was not made for this purpose and is judged by many to be too dark. Increasing the brightness control will result in a fuzzy display.
 - 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.
 - Many companies have been manufacturing video filters for years. We are not the first (some think they are), but we have done our homework and we think we manufacture the best Green Screen. Here is why:
 - It fits right onto the picture tube like a skin because it is the only **CURVED** screen **MOLDED** exactly to the picture tube curvature. It is cut precisely to cover the exposed area of the picture tube. The fit is such that the static electricity is sufficient to keep it in place! We also include some invisible reusable tape for a more secure fastening.
 - The filter material that we use is just right, not too dark nor too light. The result is a really eye pleasing display.
 - We are so sure that you will never take your Green screen off that we offer an unconditional money-back guaranty: try our Green Screen for 14 days. If for any reason you are not delighted with it, return it for a prompt refund.
- A last word: We think that companies, like ours, who are selling mainly by mail should list their street address, have a phone number (for questions and orders), accept C.O.D.s, not every one likes to send checks to a PO box, offer the convenience of charging their purchase to major credit cards. How come we are the only green screen people doing it? Order your **ALPHA GREEN SCREEN** today. \$12.50



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is Gina an impersonal snub, a store's way of saying "You're not worth our attention"?

According to System Vision President Virginia Tormey, absolutely not. "The reaction from the customers is one of great excitement," Tormey told *80 Micro* in an interview at the Millbrae, CA, firm's Comdex/Fall exhibit. "They get very excited that they, without any training, have been able to interact with computers and produce a document."

A store manager, Tormey admitted, "does have to be a little bit cautious about spending time with someone who isn't ready to buy. Having an expensive salesperson chat with people and hold their hand while they try the keyboard and all is really a waste of time."

With Gina, on the other hand, a manager "can have them both—all the browsers he wants, and serious buyers for the salespeople [to handle]."

Also, she said, Gina isn't gospel: "Gina makes a map of a purchase. Every item that Gina recommends should at least be discussed with a salesperson. ...Unfortunately, computers can't be sold by computers yet. There really has to be some human interaction."

Turning from Gina's function of replacing humans to its function as a first-time computer tutor, Tormey stressed its success in overcoming keyboard anxiety: "There is an incredibly steep learning curve associated with computers. When people buy a program like Lotus or WordStar, they hit the wall; sometimes they just give up. What happens when they actually bite the bullet and go ahead, they soon not only learn the program but say 'That's too slow.' They become experts."

"To get people started, there is a need for a throwaway program, and that's what Gina is." For instance, Tormey said, Gina users learn to type Y or N and press the return key: "That's very simple, but these are things that, when you boot up WordStar, you're going to need to know. Programs like Gina get people over the hump, and a major portion of that hump is just fear."

And, if you don't miss the human touch, Gina works well—with occasional glitches. An *80 Micro* staffer tested a forthcoming version, aimed at

the home market; except for minor mistakes (1,000 instead of 1,024 bytes for 1K) and an overly cute narrator ("Professor Chips"), the program asked sensible questions and gave helpful lessons.

However, Gina's final recommendation, which can be customized by

individual store managers to reflect their stock, missed the mark. The user said that price was a factor and word processing would be his major application; Gina suggested an IBM PCjr—the most expensive home computer, and the one with the worst keyboard for extensive typing. ■

END BYTES

Revised Standard Version

- After 20 years and 200-odd versions for different machines, authors John Kemeny and Thomas Kurtz feel it's time to straighten out **BASIC**. The Dartmouth College professors are preparing True Basic, a standard implementation of the language for 128K IBM PC-compatible micros. True Basic promises better graphics, editing, and screen management functions; its first version, intended for schools and colleges, will be available this fall.

- Radio Shack, according to a press release, is now "the exclusive retail sales agent for the nation's first direct-to-home **SATELLITE** television service." United Satellite Communications' orbiting antennas bring five 24-hour channels to viewers in 26 Eastern states, mostly in areas without local cable TV companies; by year's end, service should expand to the western U.S. as well.

- The Machine that Wouldn't Die: Thanks to massive support from Apple and a host of third parties, the aging **APPLE IIe** is beginning to give "kludge" a good name. There's Rana Systems' IIe add-on box (two drives and an Intel 8086), and Apple and two other firms are planning 68000 upgrades. And GTE Microcircuits, Western Design Center, and Hayden Software have announced two 16-bit chips, the 65816 and 65802, that are hardware- and software-compatible with the Apple's 8-bit 6502. The latter will plug directly into an existing 6502 socket.

- Apple's **LISA** is due for improvements, too. Gossip predicts a new internal hard disk, a switch from 5¼- to 3½-inch floppies, and a faster operating system for Cupertino's flagship.

- Eastman Kodak Co., which recently got into the disk business, has signed a licensing agreement with Drivetec Inc. to manufacture its own **DISK DRIVES** as well. Kodak's drive can read conventional 48- and 96-tpi (tracks per inch) disks, but offers 2.62 megabytes of formatted storage on one of the firm's 192-tpi Isomax floppies (see *80 Micro*, September 1983, p. 300).

- Two independent dealers have sued **COMMODORE**, claiming that the low-end lion violated federal laws by charging small dealers more than mass merchandisers for C64s. An anonymous retailer told *Micro Market-World*, "They threw their dealers in the garbage. Their game plan was to hell with the small dealer." Stephen Robbins, president of Cyprus, CA's SCR Electronics, said Commodore billed him \$357 for machines sold by large department stores at \$199.

- Press release headline of the month: "**RAGING BEAR** Commits to Servanthood." The facts: Raging Bear Productions Inc., sponsors of last October's National Software Show in San Francisco, cancelled a sequel scheduled for early February in Miami, citing "a commitment to service" to the micro industry. "There are too many [computer shows]," President David Russell admitted, without mentioning Softcon, the Feb. 21-23 software show drawing big-name exhibitors to New Orleans.

- If Stewart Brand can do *The Whole Earth Software Catalog*, **ART LINKLETTER** can update his act, too. The TV and radio veteran's newest work, published by HomeComputer Software Inc. of Sunnyvale, CA, is "Kids Say the Darndest Things—to Computers." ■

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"Fantastic piece of hardware!!! Great price, great software. You have done it again; come up with something great for the TRS-80 computer. THANK YOU." --J.Y. South Carolina

"It's easy to use and sounds as good as \$400 units." -- S.C. Ohio

"As you will notice by the enclosed letter, I am placing an order for two more VS-100's for friends who have heard it and can't wait to obtain one." --R.F. Australia

"Well done -- a nice piece of equipment at a reasonable price ; encourage product reviews with 80-Micro and Computer User magazines."
--A.S. Canada

"I am very surprised and pleased with the performance of the VS-100."
--V.G. Pennsylvania

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"Impressive device at excellent price."
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--A.O. Maryland

"Interesting, Arresting, worth the price."
--K.M. North Carolina

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"...love the VS-100 overall"
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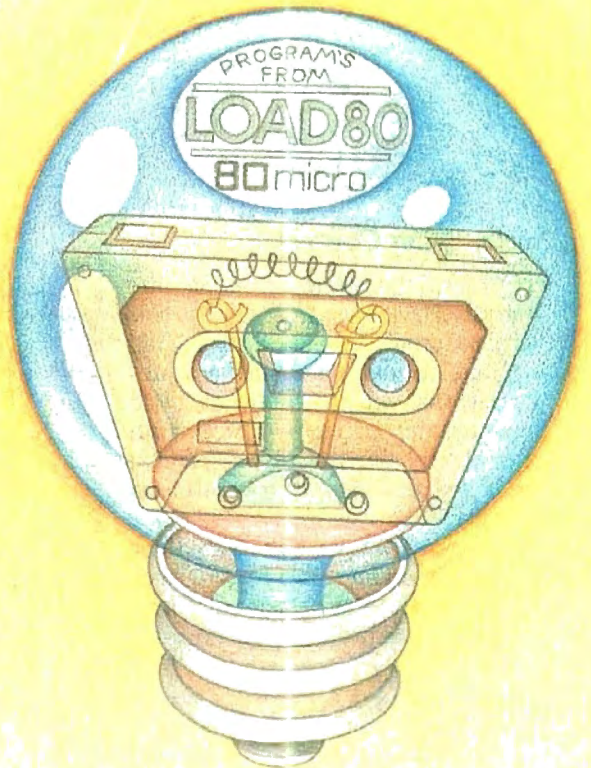
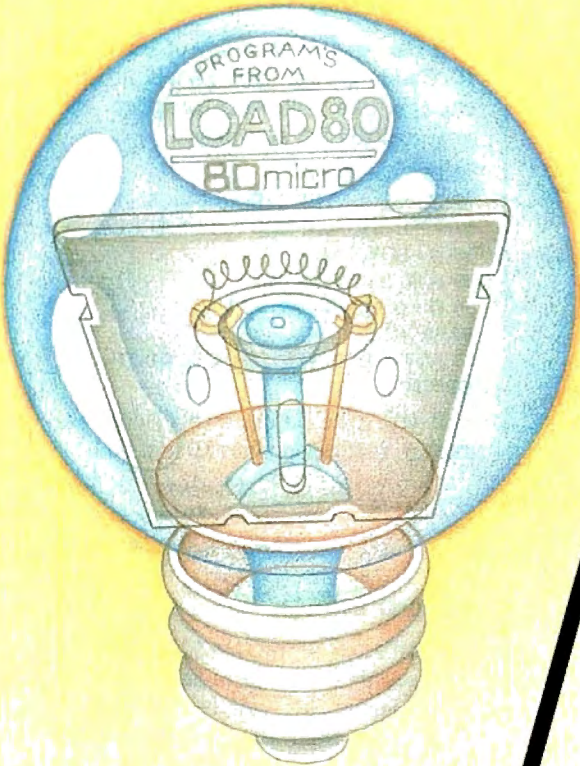
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Light Beam Control

I found the steering routine that Donald David used in his article "Light Cycles" (August 1983, p. 268) too hard to use. I modified his program so that you can control the light beam with just two keys. The A and S keys control the left player's cycles; the L and semicolon keys control the right player's.

You should note that with these changes, it is impossible to turn back into yourself. Novice players found this to be a real problem in the original program.

```

110 SQ$=INKEY$
120 IF SQ$="A" AND P1<>CZ THEN
P1=CZ:Q1=CN:GOTO 200
130 IF SQ$="S" AND P1<>CZ THEN
P1=CZ:Q1=CP:GOTO 200
140 IF SQ$="A" AND Q1<>CZ THEN
Q1=CZ:P1=CN:GOTO 200
150 IF SQ$="S" AND Q1<>CZ THEN
Q1=CZ:P1=CP:GOTO 200

510 IF SQ$="L" AND R1<>CZ THEN
R1=CZ:S1=CN:GOTO 600
520 IF SQ$=";" AND R1<>CZ THEN R1
=CZ:S1=CP:GOTO 600
530 IF SQ$="L" AND S1<>CZ THEN
S1=CZ:R1=CN:GOTO 600
540 IF SQ$=";" AND S1<>CZ THEN
S1=CZ:R1=CP:GOTO 600
    
```

Joe Lynds
P.O. Box 22
Plymouth, VT 05056

TRSDOS 6.0 Utility Passwords

I found another way to change the protection of or to access TRSDOS 6.0-protected utilities ("Take It Off," December 1983, p. 177). The *Model 4 Technical Reference Manual* (p. 190) lists the passwords for all TRSDOS files.

Charles Kunz
4938 Wagonmaster Drive
Colorado Springs, CO 80917

Let It Hum

I recently discovered how to get sound on my Model III without hav-



ing to buy any hardware. Simply use port 236 instead of port 255. The following listing produces a buzzing sound from the inside of my computer (possibly due to the back-and-forth switching of a relay).

Assembly-language code produces a more pure tone, and experimenting with the first number output can produce some interesting effects.

```

10 OUT236,3:OUT236,0:GOTO10
or:
10 OUT236,6:OUT236,0:GOTO10
    
```

Anonymous

Speed-Up Program

A friend of mine gave me a neat one-line program written in Basic that accesses the Model 4's clock and runs almost all Model III programs at Model 4 speed. To date, a few machine-language programs (primarily games) don't work with this routine; Profile III Plus does, however, and effectively doubles access and sort speeds.

```

10 X=PEEK(16912):X=XOR64:POKE
16912,X
    
```

Bill Martin
2544 Bottomridge Road
Orange Park, FL 32073

Good Roots

If the six-digit accuracy of the Level II Basic square root function isn't enough, the following program will give you 16-digit accuracy:

```

10 DEFDBL D
20 INPUT"ENTER THE NUMBER
WHOSE SQUARE ROOT IS DESIRED";DN
30 D=SQR(DN)
40 FOR T=1 TO 3
50 D=D-(D*DN-DN)/2/D
60 NEXT T
70 PRINT D"IS THE SQUARE ROOT
OF"DN
    
```

If you'd be happy with 13-digit accuracy, just delete lines 40 and 60.

Robert Caldwell
1590 Peacock Ave.
Sunnyvale, CA 94087

Record Labels

Here's a program that handles up to 100 records of five lines each and that prints labels for each record. If you want more than 100 records, change the value of the X variable on line 10.

```

10 CLEAR15000:X=100:DIMAS(X,5):
FORL=1TOX:CLS:PRINT"LABEL #"
L:FORK=1TO5:PRINT,"LINE"K;:INPUT
A$(L,K):IF A$(L,K)<>"END"THEN
NEXTK,L:ELSECLS:PRINT"SET LABELS
ON PRINTER":INPUT"HIT ENTER TO
START";A:X=L-1:FORL=1TOX
:FORK=1TO5:LPRINTA$(L,K):NEXTK:
LPRINT:NEXTL
    
```

Miguel Diaz
P.O. Box 8475
Ponce, Puerto Rico 00732

Prime Changes

In reference to Jeffrey Fisher's Prime Mission program (November 1983, p. 256), I'd like to point out that the numeral 1 is not a prime number. A prime number is an integer that has only two divisors: itself and 1. The following modifications make the program use fives instead of ones. It also results in higher scores!

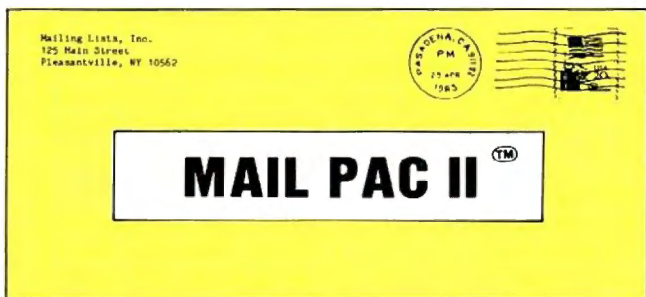
```

10 DIM KS(3):KS(1)=2:KS(2)=3:KS(3)=5
    
```


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READER EXCHANGE

```
320 O=P:FORJ=ITOC:N=N+1+KS  
(RND(3)):IFN>61THEENN=N-62  
330 IFP(J)<0ANDRND(R)=1THEN  
PRINT@N,"7";:O(J)=N:P(J)=N:ELSE  
PRINT@N,KS(RND(3));
```

Keith Sawyer
26 Kevin St.
Lewiston, ME 04240

One-Liner

I was inspired by the November 1983 Gamer's Cafe to share my one-line game. Although it's not a game, some of you might find it useful to communicate with a local bulletin board. This is a minimum terminal program for the Models III and 4.

```
10 CLS:PRINT15,"A SHORT TERMINAL  
PROGRAM BY DON MOORE":POKE  
16890,0:DEFUSR0=90:DEFUSR1=80:  
DEFUSR2=85:X=USR0(0):FORI=  
1TO2STEP0:X=USR1(0):PRINT  
CHR$(PEEK(16872)AND127);:CS=  
INKEY$:IFCS=""THENNEXTELSE  
POKE16880,ASC(C$):X=USR2(0):NEXT
```

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

Editing Fortran

I recently installed all of Richard Koch's suggested modifications for Radio Shack Model I Fortran on my Model III, only to find out that the Edit command wouldn't work. When I tried to load a file to make changes, Edit accepted only a few lines of the file.

I thought my Fortran package was useless, but then I got the idea of using SuperScript to create the file, and the ASCII-to-Text routine to convert to the proper source code. To set up Script, do the following:

- Open the document with 10 characters per inch.
- Set the left margin to 0.0, right margin to 6.3, a tab at 0.7, and then lock in the capitals.
- Type in the document. When you're finished, use the Quit command.
- Select the ASCII-to-Text conversion and convert from Script to ASCII:

Script file: File name
ASCII file: File name/For

- The text will display once more. After that, just quit and exit to the DOS Ready level.

At this point, with the Script file converted to ASCII, just follow the

remaining steps as stated in the Fortran manual. Now the Model I Fortran has the editing features of SuperScript.

Also, it's important to remember that disk I/O won't work.

John McMichael Jr.
Pcs Box 178
Miami, 34001 Panama Canal

Perplexing Problems

I'm going nuts! For the last year I've been trying to get past that mean ghost on the second floor of Radio Shack's Haunted House game. Somebody out there must have gotten past it—please write and tell me how you did it.

Dennis Rodgers
9810 26th Ave.
Adelphi, MD 20783

I recently bought an almost-new printer for my Model III, but am unable to find an instruction book for it. The only identification on the printer is the label Star DPX510F.

Can anyone tell me where I can get more information or, preferably, a user's manual for this printer?

John O'Connell
1512 S. Arlington Ridge Road
Apartment 203
Arlington, VA 22202

I've written a word processor that can print both Chinese and English text. I assigned a number to each Chinese character, but the assignments are very arbitrary with no standard.

Assigning numbers to alphabetic characters has been standardized with the ASCII and EBCDIC standards. Does anyone know if there's a similar standard for Chinese characters?

Victor Lee
342 Palace Road
Kingston, Ontario K7L 4T3
Canada

I'm looking for a way to make my Model III an alarm system for my home. Does anyone know of a company where I can buy wireless control accessories for the windows and doors

so that when contact is made, the computer sets off an alarm and turns on the lights?

I'd also like the system to have an auto-dial modem and a smoke alarm. Can anyone help?

Terry Rubin
2928 Rockingham Circle
Orlando, FL 32808

I have a cassette-based 48K Model I with Electric Pencil and a C. Itoh Pro-writer parallel printer. The problem is that in order to change fonts on the printer, I have to print CHR\$(27) plus a letter. The user's manual said to make a file that contained as many codes and load it, thus putting that code on the screen.

I did this, but the character that appeared on the screen changed into a marker code when I printed it. Does anyone know of a way to correct this problem? Perhaps a patch exists?

Jay Baltisberger
710 N. Columbia Road
Grand Forks, ND 58201

Our company determines the Flesch scores for written documents (a measure of readability based on the average number of syllables per word and the average number of words per sentence). An algorithm called GM Star scores documents according to the Flesch analysis. I am unable to find an adequate version of this algorithm to use with our Script 2.0-produced documents. Does anyone know of a good version of the GM Star that we can use with our Model IIs and Script 2.0?

Robert Fruit
G.T.L.
1275 Milwaukee Ave.
Glenview, IL 60025

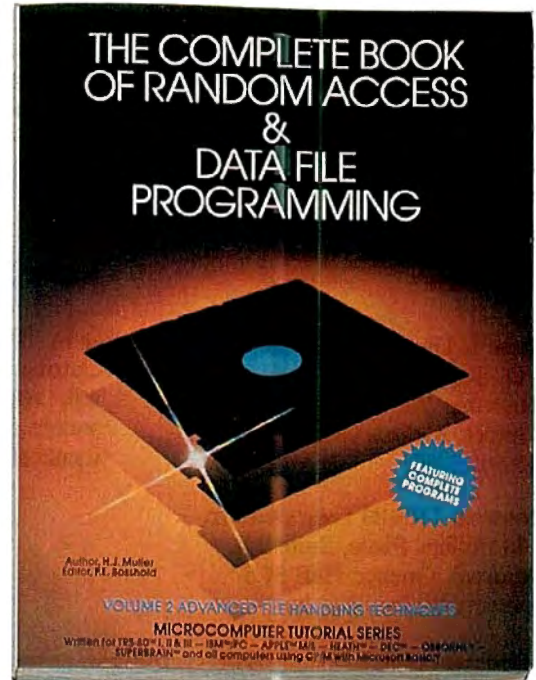
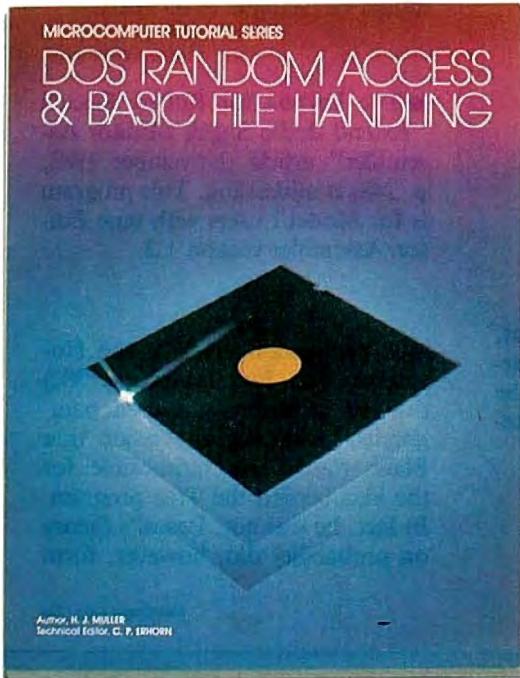
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Johnson City, TN 37614
Contact: Thomas Huang
615-929-4367

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Mountain View, CA 94042
Contact: Melissa Gray
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Montreal, Quebec H3B 3C8
Contact: Willem Bagchus

Omaha TRS-80 Club
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Omaha, NE 68138
Contact: Morgan Iler
402-339-5646

The TRS-80 Computer Society of Diablo Valley
P.O. Box 23438
Pleasant Hill, CA 94523
Contact: Betty McBride,
Membership Director
415-939-5285 or 415-932-8856

Error Trap

● In "Pascal-80 Cribbage" (Input, October 1983, p. 18) by J.B. Harrell, asterisks were omitted in the source file statements. These statements should read:

```
(*$ CRIBBAGE/P1*)
(*$ CRIBBAGE/P2*)
(*$ CRIBBAGE/P3*)
(*$ CRIBBAGE/P4*)
(*$ CRIBBAGE/P5*)
```

● A typographic error was made in David Lantis' program listing for "The Password Is..." (December 1983, p. 179). In lines 100, 120, 140, and 160 the values listed as 68 should be changed to 65 instead.

● The keybox for Robert Fleck's "Extend Radio Shack's Editor Assembler" article (November 1983, p. 248) is misleading. This program is for Model I users with tape Editor/Assembler version 1.2.

● A production error in the November 1983 Fun House (p. 300) resulted in some transposed paragraphs, giving the impression that Blaise Pascal was responsible for the idea behind the Tree program. In fact, he was not. Pascal's theory on probability did, however, form

Continued on p. 226

DEBUG

Color Interference

I found a problem with James Cole's "The 80 Goes Color" (May 1983, p. 93). The text says that the Model III needs a 74LS08. This is incorrect. The Model III requires a 746508, because it must pull 150 ohms of resistance to ground.

Michael Ray
Box 352B, Ft. Plaines
Howell, NJ 07731

Where's the Sun?

Several readers have pointed out an error in my Sunfinder program for "Catching Rays" (October 1983, p. 256) that results in erroneous readings for azimuths around noon when you use an interval of under 15 minutes in the first part of the program. To correct this problem, delete lines 1010, 1040, 1050, and 1060, and make the following line changes:

```
830 SI=INT(S):SM=(S-SI)*.6:
    SH=SI+SM:IF INT(SM*10+.5)=
    6 THEN SM=0:SI=SI+1
```

```
835 SH=SI+SM
860 C=(12-S)*15*DR+MR+ER
990 IF LA-Z<0 THEN AZ=INT
    (A*RD-MX-ED-MG+.5)
    ELSE AZ=INT(A*RD+MX+
    ED-MG+.5)
1030 IF LA-Z>0 THEN 1070
1045 IF S>12 AND CC<0 THEN
    AZ=AZ+180
1180 IF LA-Z<0 THEN T=INT(360+
    ED+MX-MG+.5) ELSE T=
    INT(180-ED+MG-MX+.5)
    'AZ OF SUN, DEG.
1425 IF LA-Z<0 THEN 1435
1430 LPRINT ";;LPRINT USING P$;
    SU;;LPRINT" @ "INT(AZ+ED
    +MX-MG+.5);;LPRINT
    USING P$;SD;;LPRINT" @ "INT
    (360-AZ+ED+MX-MG+.5),
    AL;"@ "T
1432 GOTO 1440
1435 LPRINT";;LPRINT USING P$;
    SU;;LPRINT " @ "INT(AZ-
    ED-MX-MG+.5);;LPRINT
    USING P$;SD;;LPRINT " @ "
    INT(360-AZ-ED-MX-MG+
    .5),AL;"@ "T
```

Fun House Mistake

I erred in the November 1983 Fun House (p. 300) by using a Timer command in the Color Basic

version of the program, The Fourth Power. Timer works in Extended Basic but not in Color Basic. To fix the program, delete line 350. And please accept my apology.

Richard Ramella
1493 Mountain View Ave.
Chico, CA 95926

Plus or Minus What?

There's a problem in calculating the standard deviation in the program listing for my article titled "The Business of Planning" (September 1983, p. 74). Line 8880 calculates the standard deviation; it uses the variable ME(X), the mean, in its calculations. However, it doesn't calculate ME(X) until the following line, 8890.

To fix the problem, place line 8880 after 8890. You can delete it and retype as line 8895, or move it using a utility such as the DI command in NEWDOS/80.

Ronald Cangro
7628 Regina Drive
Fort Wayne, IN 46815

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1 RULE78	Interest Apportionment by Rule of the 78's	59 WACC	Weighted average cost of capital
2 ANNU1	Annuity computation program	60 COMPBAL	True rate on loan with compensating bal. required
3 DATE	Time between dates	61 DISCBAL	True rate on discounted loan
4 DAYYEAR	Day of year a particular date falls on	62 MERGANAL	Merger analysis computations
5 LEASEINT	Interest rate on lease	63 FINRAT	Financial ratios for a firm
6 BREAKEVN	Breakeven analysis	64 NPV	Net present value of project
7 DEPRSL	Straightline depreciation	65 PRINDLAS	Laspeyres price index
8 DEPRSY	Sum of the digits depreciation	66 PRINDPA	Paasche price index
9 DEPRDB	Declining balance depreciation	67 SEASIND	Constructs seasonal quantity indices for company
10 DEPRDDB	Double declining balance depreciation	68 TIMETR	Time series analysis linear trend
11 TAXDEP	Cash flow vs. depreciation tables	69 TIMEMOV	Time series analysis moving average trend
12 CHECK2	Prints NEBS checks along with daily register	70 FUPRINF	Future price estimation with inflation
13 CHECKBK1	Checkbook maintenance program	71 MAILPAC	Mailing list system
14 MORTGAGE/A	Mortgage amortization table	72 LETWRT	Letter writing system-links with MAILPAC
15 MUI.TMON	Computes time needed for money to double, triple, etc.	73 SORT3	Sorts list of names
16 SALVAGE	Determines salvage value of an investment	74 LABEL1	Shipping label maker
17 RRVARIN	Rate of return on investment with variable inflows	75 LABEL2	Name label maker
18 RRCONST	Rate of return on investment with constant inflows	76 BUSBD1	HOME business bookkeeping system
19 EFFECT	Effective interest rate of a loan	77 TIMECLCK	Computes weeks total hours from timeclock info.
20 FVAL	Future value of an investment (compound interest)	78 ACCTPAY	In memory accounts payable system-storage permitted
21 PVAL	Present value of a future amount	79 INVOICE	Generate invoice on screen and print on printer
22 LOANPAY	Amount of payment on a loan	80 INVENT2	In memory inventory control system
23 REGWTH	Equal withdrawals from investment to leave 0 over	81 TELDIR	Computerized telephone directory
24 SIMPDISK	Simple discount analysis	82 TIMUSAN	Time use analysis
25 DATEVAL	Equivalent & nonequivalent dated values for oblig.	83 ASSIGN	Use of assignment algorithm for optimal job assign.
26 ANNUDEF	Present value of deferred annuities	84 ACCTREC	In memory accounts receivable system-storage ok
27 MARKUP	% Markup analysis for items	85 TERMSPAY	Compares 3 methods of repayment of loans
28 SINKFUND	Sinking fund amortization program	86 PAYNET	Computes gross pay required for given net
29 BONDVAL	Value of a bond	87 SELLPR	Computes selling price for given after tax amount
30 DEplete	Depletion analysis	88 ARBCOMP	Arbitrage computations
31 BLACKSH	Black Scholes options analysis	89 DEPRSF	Sinking fund depreciation
32 STOCVAL1	Expected return on stock via discounts dividends	90 UPSZONE	Finds UPS zones from zip code
33 WARVAL	Value of a warrant	91 ENVELOPE	Types envelope including return address
34 BONDVAL2	Value of a bond	92 AUTOEXP	Automobile expense analysis
35 EPSEST	Estimate of future earnings per share for company	93 INFILE	Insurance policy file
36 BETAALPH	Computes alpha and beta variables for stock	94 PAYROLL2	In memory payroll system
37 SHARPE1	Portfolio selection model-i.e. what stocks to hold	95 DILANAL	Dilution analysis
38 OPTWRITE	Option writing computations	96 LOANAFFD	Loan amount a borrower can afford
39 RTVAL	Value of a right	97 RENTPRCH	Purchase price for rental property
40 EXPVAL	Expected value analysis	98 SALELEAS	Sale-leaseback analysis
41 BAYES	Bayesian decisions	99 RRCONVBD	Investor's rate of return on convertible bond
42 VALPRINF	Value of perfect information	100 PORTVAL9	Stock market portfolio storage-valuation program
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 queueing (waiting line) model		
49 CVP	Cost-volume-profit analysis		
50 CONDPFOT	Conditional profit tables		
51 OPTLOSS	Opportunity loss tables		
52 FQJQO	Fixed quantity economic order quantity model		
53 FQEOVSH	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 CAPI	Cap. Asset Pr. Model analysis of project		

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The Model 4P: Love at First Sight

by Terry Kepner

edited by Lynne M. Nadeau

I fell in love with the Model 4P, Tandy's transportable version of the Model 4, as soon as I turned on the machine. The 9-inch display is sharp and the first prompt, "Close the floppy drive door and try again," appears in three languages: English, German, and French. I can only read one of the three, but it sure looks impressive.

This computer is also rugged. I've already knocked it over twice without damaging it or throwing the drives out of alignment.

And the Model 4P shows that Tandy does listen to their customers' demands. It's similar in operation to the standard Model 4, but with several important exceptions. I'll compare the two.

Their common points include 64K RAM, Z80A central processing unit (CPU), three special-function keys, a caps lock key, key click, TRSDOS 6.1, a parallel printer port, an RS-232 port, an 80-column by 24-line screen for CP/M and TRSDOS 6.1, a 64-column by 16-line screen in the Model III mode, reverse video, sound, MEMDISK (also called RAMdisk), and Microsoft Basic.

The Outside

The most obvious difference between the Model 4 and the 4P is size. With the case closed, the 4P measures 16½ inches wide at the front, tapering to 15 inches at the back. It starts 9



Photo. Tandy's portable Model 4.

inches high at the front and tapers to 8½ inches at the back. It measures 13½ inches deep.

Releasing the two latches at either side of the computer opens the case to reveal the display and two disk drives. The keyboard is a separate unit that slides out of a compartment under the machine.

A small plastic pocket inside the cover is wide enough for two sets of disks to sit side by side, with a maximum stack of about five disks each. One side of the pocket is for carrying the 4P's Portable Reference Guide, and the other is for carrying disks.

The pocket is poorly placed; you have to bend the disks slightly to get them to fit past the sides of the case. This isn't enough to harm the disks, but it makes me uncomfortable to bend disks.

The screen measures only 9 inches diagonally while the Model 4 has a 12-inch screen. This keeps the size and

weight of the 4P within reasonable limits. The smaller screen size is not a problem; in fact, the display on the Model 4P is cleaner than that on the Model 4, with none of the character fuzziness you see on the desktop version.

The brightness and contrast controls are on the left front of the unit, above the power switch/light and the reset switch, so you can easily make adjustments when you set up in a new location.

On the right side of the unit, mounted vertically, are the Model 4P disk drives, which are half as wide as standard drives.

They are the standard single-sided, double-density, 40-track drives that are on the desktop model. You insert disks with the label facing you, instead of facing away like the old Models I and II disk drive units.

The keyboard is a standard full-size layout, connected to the main unit by a 14-inch cable. The keyboard unit is barely 1 inch thick, and only 1½ inches shorter than the Model 4P itself.

As a convenience to typists, the keyboard has two fold-out plastic legs that lift the back ¼ inches, giving it the same tilt as the Model 4 keyboard. Tandy designed the keys with this slope in mind, and gently sculptured them to match it. Typing with the keyboard flat on the table is a little strange at first, but you quickly adjust to it. I prefer the keyboard tilted. The keys have a nice feel and are quite comfortable.

The keyboard also has a separate numeric pad with three function keys

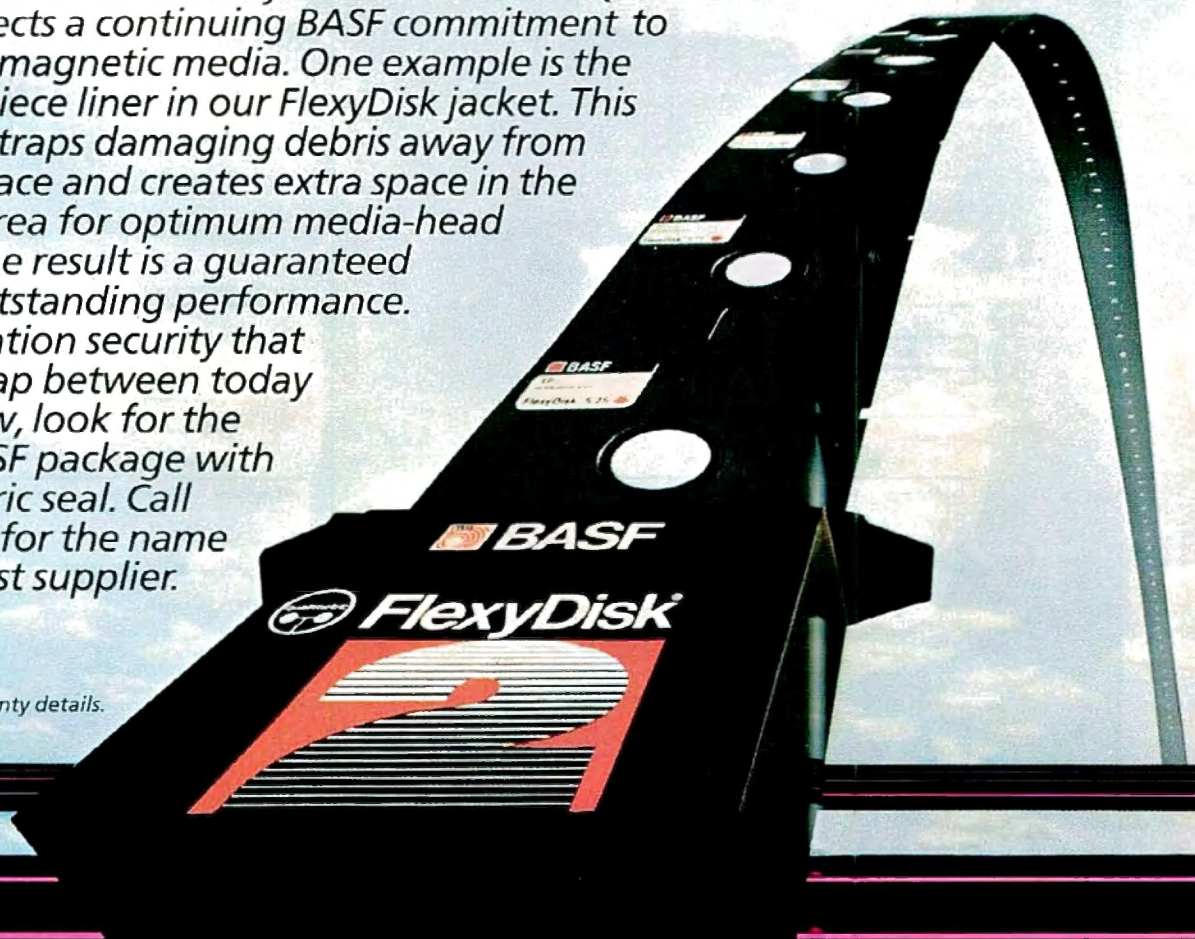
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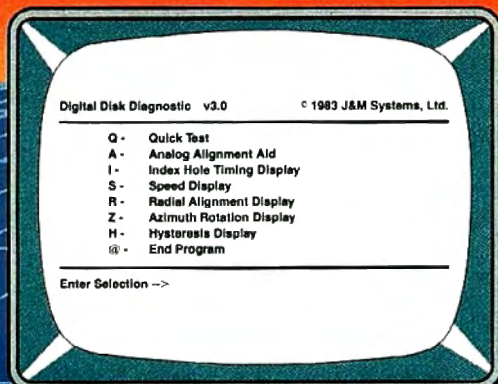
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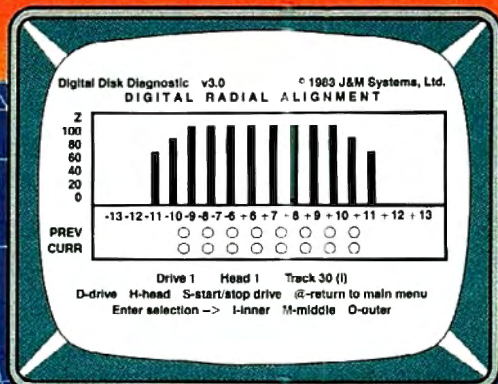
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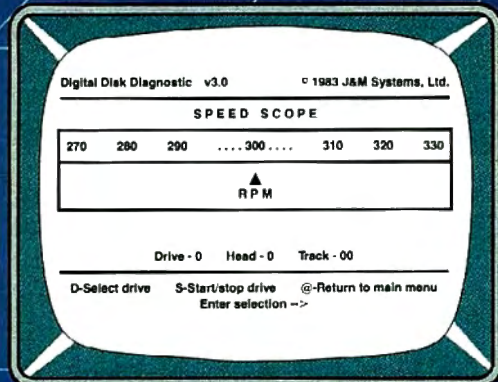
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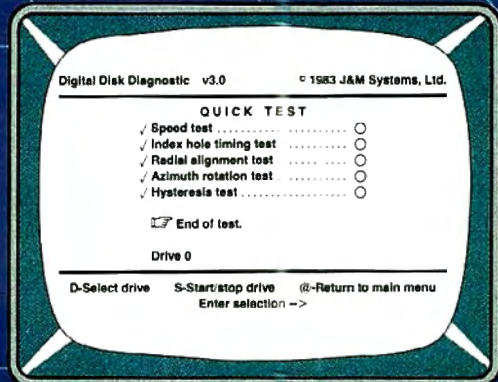
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and a control key. As a system option you can make the computer click every time you press a key.

The keyboard cable lets you type with the keyboard in your lap, but its short length forces you to sit close to the table. Within limits, the cable makes it easy to adjust your distance from the display to accommodate any personal preference, or to put papers between the display and the keyboard.

On the back of the Model 4P are the interface connections, hidden by a panel that uses press-tabs to lock closed. Opening the panel reveals the parallel printer, RS-232, input/output (I/O) bus, and power connectors. You can unplug the power supply cable from the computer and carry it in the cover. The rear compartment has plenty of room to just wrap the power cord and leave it in place while transporting the computer.

Close examination of the rear compartment reveals that it has no connector for external floppy drives. If you want to use more than two floppy drives, you have to make your own cable that connects to the I/O bus port and converts the pin count to match your disk drives.

The 4P doesn't have a cassette port either, so any type of cassette transfer is impossible. If you have a Model I, III, or 4 cassette system and want to upgrade to the 4P, you have to trash all your cassette programs and convert the tape data to disk.

Above the RS-232 and I/O ports is a removable metal cover that contains the connectors for the optional modem card should you buy it. Speaking of options, the I/O bus supports the Radio Shack hard disk, and you can get the high-resolution graphics board installed in the 4P. Another option you have is adding 64K for a total of 128K of RAM. The 4P treats the extra memory as a RAMdisk for rapid data storage and manipulation.

The Inside

Unlike Tandy's previous computers, the Model 4P wears a metal jacket underneath the plastic case. This complies with the Federal Communications Commission (FCC) regulations regarding radio frequency interference (RFI) pollution.

Also unlike previous computers, the 4P features a hefty power supply. The screen doesn't shrink noticeably every

time the disk drives come on.

Like the desktop version, the 4P comes with TRSDOS 6.01, LDOS custom designed for the Model 4. Unlike the desktop model, the portable doesn't have Model III ROMs. It uses a disk-stored ROM image that loads into memory when you want to use Model III mode.

This approach has many advantages over the dedicated ROM used in the standard Model 4. Having the Model III ROM as an image in RAM means you can customize the ROM

TRS-80 Model 4P

★ ★ ★ ★ ★

Tandy/Radio Shack
One Tandy Center
Fort Worth, TX 76102
\$1,799

<i>Easy to use?</i>	★★★★★
<i>Good docs?</i>	★★★★☆
<i>Well-made?</i>	★★★★★
<i>Does the job?</i>	★★★★★

for special purposes and use the modified ROM in place of the standard ROM image. Tandy designed the 4P so you can elect to load either the standard ROM image or a modified ROM image into memory.

If you want to, you can use your program to modify the ROM, then reboot and use the system without reloading the ROM image over your modifications. The function keys and other selected keys control loading the ROM image and the operating system, either from floppy disk or hard disk.

As soon as I had the computer set up, I tried to use my Model III games disk. Following the instructions, I booted the MODEL A/III disk (which contains all 19 games of the ROM image program) and loaded my games disk.

It worked perfectly and I discovered that a speaker in the 4P responds to the sound-generating routines of Big Five games, which use the cassette port to send sound to an audio ampli-

fier. Tandy seems to have thought of everything!

Since it is a chore to use two disks every time you want to use the Model III mode with an applications program, you can transfer the MODEL A/III program from the supplied disk to your applications disk. Then put your disk in drive zero and press the reset button. The Model 4P detects that you're using a Model III disk, looks for the MODEL A/III program, loads it, then loads TRSDOS 1.3 from your applications disk. All this is done quickly and neatly.

The Model 4 mode is almost exactly the same as the desktop model's, except that you don't have the cassette-manipulation utilities.

The only problem I've had with the 4P concerns software. Many of the programs sold by independent vendors have a non-Tandy DOS, most frequently TDOS (a stripped-down version of DOSPLUS) or MULTIDOS. The problem is that Model III TRSDOS 1.3 won't read these non-Tandy DOSes, so you'll have trouble getting these applications programs from their distribution disks to the Model 4.

You can read these disks with TRSDOS 6.1 if you use the Repair command. TRSDOS 6.1 goes to the foreign disk and converts it so that you can read it and transfer files. Unfortunately, TRSDOS 6.1 is as incompatible with TRSDOS 1.3 as the original distribution disk, and since these Model III applications programs won't work in the TRSDOS 6.1 environment, that's no help at all.

While TRSDOS 6.1 is the only safe bet in Model 4P software, you can use Model III DOSes other than TRSDOS 1.3. With a TRSDOS 6.1 system disk (containing the MODEL A/III file) in drive zero, and your III system disk in drive 1, press the reset button, the F3 key, and a lowercase "p" in rapid sequence.

The 4P will load the Model III ROM image from the 6.1 disk, then prompt you to put the III disk in drive zero and press the enter key. This three-key trick (hidden in an appendix to the 4P's *Introduction to Your Disk System* manual) loaded most of 80 Micro's DOSPLUS and NEWDOS/80 disks, though it struck out with some self-booting games.

Documentation

The manuals for the 4P are all the same as those for the desktop version, except for the *Introduction Manual* and the *Portable Reference Guide Manual*, which are tailored to the specific abilities of the 4P. The reference guide is a 50-page booklet the size of a disk that fits in the plastic pocket in the case cover.

The other booklet, the introduction, isn't supposed to fit in the case, but I found enough room in the keyboard compartment for both the keyboard and the manual. The manual provides a little extra cushion.

Tandy did leave out one important resource, the technical manual. The main manual supplied is strictly for software, with only the technical information needed for the software. It doesn't even list the weight of the computer (26 pounds) or its dimensions. You can order the 4P technical manual separately, but Tandy should include it with the computer.

Summary

I find the Model 4P to be an excellent transportable computer. It has good hardware and software features and it's competitively priced with other transportables.

While it doesn't include bundled software, the 4P does provide access to the entire Tandy Models I, III, and 4 software market. With the expected availability of CP/M, this computer will definitely have an advantage in offering access to the extensive CP/M software base while maintaining compatibility with the previous Tandy computers.

If you need a portable computer, access to the Tandy market, and access to CP/M, this computer is the one for you. I've already decided to buy one (the editors at *80 Micro* have threatened violence if I don't return theirs). ■

Smart Communication With Intellitem

by Mel Patrick

Intellitem is one of the finest smart terminal programs available. Some of its main features include split screen for viewing, adjustable RS-232 parameters, direct file transfer, upload-

ing/downloading, and optional control by another remote Intellitem system.

The Intellitem program disk also includes a simple Bulletin Board system (BBS). When you use this option with an auto-answer modem, any terminal can access your system for information. Another Intellitem user has the advantage of the program's additional features.

See Table 1 for a list of Intellitem commands. You invoke a command by pressing the @ key and the indicated letter.

Features

Intellitem works best with another Intellitem system. A good example is direct file transfer of machine-language files. Usually a file of this type is expanded to normal ASCII codes. The program would transmit 0D hexadecimal (hex) as an ASCII zero and an ASCII D. Thus, any given file expands to twice its normal size. Also, most smart terminals require that you load the file into a buffer, so buffer size restricts you.

Intellitem reads files directly from the disk and sends them to the remote system, which writes them directly to

the disk byte by byte. The program performs a checksum after sending each sector, and, if an error occurs, automatically sends that sector again.

Another plus for Intellitem is its user-definable translation tables to convert incoming and outgoing data. The package includes a Basic program so you can create these tables at any time.

You also have an option to edit a previously defined table. While in this mode, you enter all characters in the usual hex format. The nine program-mable keys are not the standard macro type, but retain only one character.

Intellitem's major feature requires two systems with the same program. You can put Intellitem into a Slave or Controller mode so one terminal runs both systems. The down-arrow key on the controller system acts as a control key for the Slave. The Slave executes all commands that the Controller issues.

Intellitem includes three Basic programs for system file creation or selection. Table/BAS lets you create or edit translation file tables, and LOGIN/BAS allows creation of an auto-dial, auto log-in text file. Menu/BAS is

Command	Function
A	Opens buffer and appends incoming file.
B	Closes main input buffer.
C	Toggles the display on/off for high baud rates.
D	Displays directory.
E	Toggles between half and full duplex.
F	Returns to TRSDOS Ready for TRSDOS command.
G	Invokes split screen option.
H	Displays Help list.
I	Changes RS-232, line feed, echo, and printer parameters.
J	Echoes half-duplex remote systems characters back.
K	Toggles line feeds after carriage returns on or off.
L	Loads ASCII file to the main buffer.
M	Selects communication mode (Slave/Controller).
N	Loads translation table.
O	Opens the buffer and removes information there.
P	Toggles printer on or off.
Q	Quits Intellitem.
R	Receives file.
S	Rcsets RS-232 parameters to defaults.
T	With R transfers files with another Intellitem system.
U	Displays RS-232 settings.
V	Transmits buffer.
W	Writes buffer to disk.
X	Displays extended Help list.
Y	Loads auto-dial and log-in buffer.
Z	Zeros system clock.

Table 1. Intellitem commands.

simply a main menu where you can choose an option to run.

CBBS Option

The optional CBBS program and supporting utilities help you create your own bulletin board system. Although Intellitem modem support is clearly for the Hayes Smartmodem (5923 Peachtree Industrial Blvd., Norcross, GA 30092), the CBBS portion works in conjunction with any auto-answer modem.

The CBBS program is bare-bones software that provides you with the necessary framework to build it up to the more common BBS systems.

As it stands now, the BBS is more like a simple host with the ability to recycle should the remote cause an error or drop the carrier. However, it does have the option to transfer control directly to Intellitem. If the remote is running the same program, the terminals can control the complete system and recycle automatically.

The package includes two utility programs for use with the CBBS option. Pass/BAS creates a password file that the caller must use to gain access to the system. NEWAUTO/BAS sets up the system to run the CBBS program should you reboot the disk system or drop a carrier.

Drawbacks

Intellitem falls short in only two areas. First, if you perform direct file transfer (using the R and T options) with a file that isn't machine language, TRSDOS 1.3 incorrectly writes the

end of file and makes the transfer useless.

This seems to be a bug in TRSDOS 1.3 rather than an Intellitem defect. The people at Microcorp advise that you pad files of this type or use the LDOS version (available from Microcorp). If you use the buffers instead, this isn't a problem.

Also, Intellitem doesn't support XON and XOFF. A remote system (like a BBS) can't open and close your buffer for downloading a file, so you must do this manually.

Summary

The 123-page Intellitem manual clearly explains every command and includes a primary introduction to working with telecommunications. A five-page subsection contains BBS numbers for most states and a brief description of their themes. The manual also has an "In Case of Difficulty" section to help ease anyone into communications.

Despite a couple of drawbacks, Intellitem is a very good communications package. If you're in the market for a smart terminal program, seriously consider this one. ■

Transfer for Profile III Plus

by Wynne Keller

Transfer is a utility program for owners of Profile Plus (Model II) or Profile III Plus (Model III). It lets you transfer Profile data files between two computers via a serial cable or two modems.

You can move data between two Model IIIs, two Model IIs, or a Model II and a Model III. In the latter case, you need the more expensive version of the program, which includes both an 8- and a 5¼-inch disk.

You can search and select records you want transferred. This is convenient for many purposes. If you're moving data from a Model II to a Model III, selection can be crucial for a successful transfer. The Model III has smaller disk capacity and all the records from a Model II might not fit on one disk.

At the receiving computer, you can append the data to an existing file, replace the existing file, or go to a new

Transfer

★ ★ ★ ★ ★

The Small Computer Company
230 W. 41st St., Suite 1200
New York, NY 10036
Models II and III
\$150 and \$200

Easy to use? ★★★★★

Good docs? ★★★★★☆

Bug free? ★★★★★

Does the job? ★★★★★

file with a different name.

Because the Model II and III versions of Profile aren't identical, a few complications might crop up. Model II Profile limits the key file length (which includes all fields you want searched or sorted) to 85 characters. Model III Profile Plus allows 255 characters.

Thus, you might not be able to transfer a data file developed on a Model III to a Model II if the key file is over 85 characters. In such a case, you would have to restructure the data file with the help of a programmer or the Propack utility program (reviewed in July 1983, p. 64).

A different problem occurs when transferring from the Model II to the Model III. Model II Profile lets each record use 256 characters; Profile III Plus allows 255.

If the Model II records are full to capacity, the last character of the last field in each record is lost in the transfer. In addition, if the last field is a one-character field, the transfer cannot occur at all.

Using the program is quite simple. First, connect the two computers with a cable between the serial ports, or with two modems and two telephones.

From TRSDOS Ready, type the program name and new data file name, if any, plus the baud rate for the data transfer. You must do this on both computers. After the program loads, simply select whether the computer receives or transmits data, and let the program do the rest.

If the transfer fails to occur, the manual gives troubleshooting advice

Intellitem

★ ★ ★

Microcorp
913 Walnut St.
Philadelphia, PA 19107
Models I and III
\$150

Easy to use? ★★★★★☆

Good docs? ★★★★★☆

Bug free? ★★★★★☆

Does the job? ★★★★★☆

concerning the connection between the computers, baud rates, and so on. The documentation assumes some knowledge of communications.

Advanced readers might wonder what real purpose Transfer serves. If you have two modems and terminal programs, it is not very difficult to transmit the data file without using Transfer at all.

I believe Transfer, like Propack, was written to give less experienced computer users the power that advanced users already have as a result of their greater knowledge. In addition, the selection capability of Transfer is not available if you use a regular terminal program.

Transfer has a limited market, a fact that's reflected in the steep price tag. However, if moving Profile data between computers is one of your problems, you will welcome this efficient solution. ■

Mathematics In Modules

by Thomas L. Quindry

Math-Analyzer-Paks is a specialized, expandable software tool for scientists, engineers, and mathematicians that lets you create, execute, and save mathematical formulas for future use. Unfortunately, this package is plagued by bugs and inaccuracies.

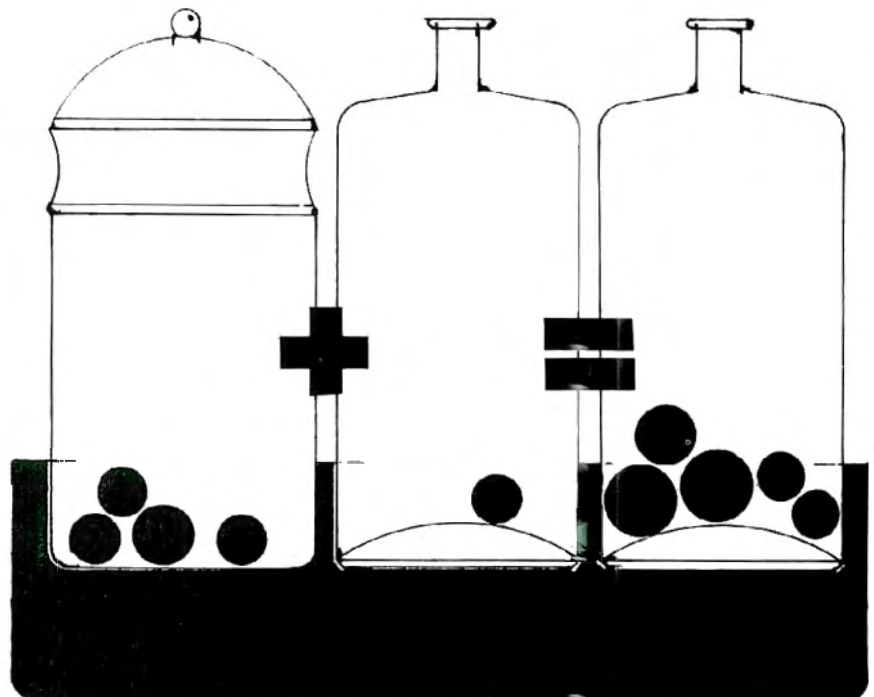
For the Model I, Math-Analyzer-Paks comes with seven single-density data disks in TRSDOS format. The Model III's double-density format requires slightly fewer disks.

Program Operation

The data disk (labeled zero) contains the control system. You should transfer the control system to a disk with your DOS on it. Although I recommend two disk drives, you can get by with one except during transfer of the programs from data disks to system disks.

To use one drive, you must include the control system module ACCRT/CMD on the system disk containing each file. One program, SMA/CMD, also requires the control system module ACCEL/CMD.

The control system disk for Math-Analyzer-Paks is a Basic program



compiled by ACCEL3 from Southern Software (Eastleigh, Hants, England) to run faster. The compiled program isn't easy to edit. It's a hybrid program with both Basic and machine code, and it needs the ACCEL/CMD module to run. In spite of the increased programming speed, you will encounter waiting periods because of the many disk accesses.

In the normal method of operation, you boot up the system disk containing the control system or runtime module, put a disk with program files for formulas that interest you in one of the drives, and call it from the runtime module.

You can call a specific formula number or query a file that lets you scroll forward and backward to get a description of all formulas in that file. When you find the formula you want, you specify its number to load it into the runtime program in memory.

You can manually input values for each variable when prompted. Also, in the case of physical constants and other known conversion values, you can call a table, select a constant, and specify which variable you want to use. Once a variable has a value, you can easily recall it.

X1 is the only variable that changes when the program processes a formula. You can then use the results in a subsequent equation.

You can call auxiliary functions to

set the angular mode in degrees, radians, or grads; turn printing on or off; set the number of decimal places; select repetitive calculations of a formula using delta or sigma increments; call the calculation/statistics program; edit the current formula; or call the disk directory on the Model III version.

Special function keys store or recall formulas in temporary storage registers—useful for dividing complex formulas into simple parts and using results from one part in another. They also shift variables, and get or save formulas, tables, or programs.

You can create and save your own formulas and tables to new or existing files. You can develop complex formulas using math functions that include powers, roots, exponents, logs, absolute values, and factorials. Trigonometric functions include inverse or hyperbolic functions.

You can also have conditional statements to some degree. A special version of the main program even allows the combination of real and imaginary numbers.

Files supplied are as simple as conversion formulas and tables for fields such as physics, electronics, and chemistry. Information is available on derivatives, integrals, heat constants, dielectric constants, planets, the solar

Continued on p. 232

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TRS-NUKE

You've just sent out for coffee (black, one sugar) after checking the status indicators in the nuclear power plant control room where you work. All systems read normal.

Suddenly, a red warning light flashes. No cause for alarm—could be a malfunction. Then an indicator gauge goes into the red. A buzzer sounds, a bell rings, a whistle blows.

The full-alert alarm goes off. You find that the core of the nuclear reactor is overheating. Your back-up systems refuse to kick in. You feel the heat build in the plant...the floor begins to shake...the walls collapse...the plant falls apart...you've just entered... THE CHINA SYNDROME. And you suddenly realize you're not going to get that cup of coffee.

Not a pretty situation in which to find yourself. Fortunately, you wouldn't panic if you were a properly trained control room operator. Nuclear plant operators learn how to handle accidents like that described above on power plant simulators. Having worked on this type of simulator, I decided to try to build and program a nuclear power plant simulator that would work on my Model I. Here are the results of my efforts.

The Real Thing

A full-scale nuclear power plant simulator consists of a complete model of the control room and a fleet of computers that imitate the plant's operation. The computers create problem situations or events that give inexperienced operators the opportunity to deal with unexpected crises.

While this simulator follows the basic

operation of a nuclear plant, it doesn't begin to take into account the infinite safety and automatic systems inherent in a real nuclear power plant.

The Pressurized Water Reactor

My model simulates a pressurized water reactor type of power plant. In a pressurized water reactor, high-pressure water circulates through the reactor core to remove the heat generated by the nuclear chain reaction (see Fig. 1).

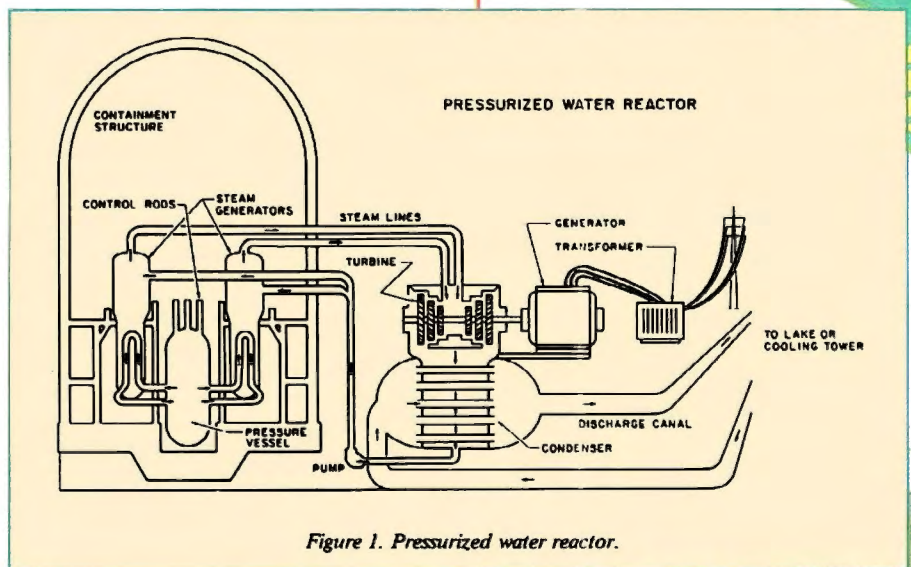


Figure 1. Pressurized water reactor.

The heated water exits from the reactor vessel and passes into the steam generators via the coolant loop piping. Here the water gives up its heat to the feed water that, in turn, generates steam for the turbine generator. Steam exiting from the turbine condenses back into water that's piped back into the reactor vessel and into the steam generators.

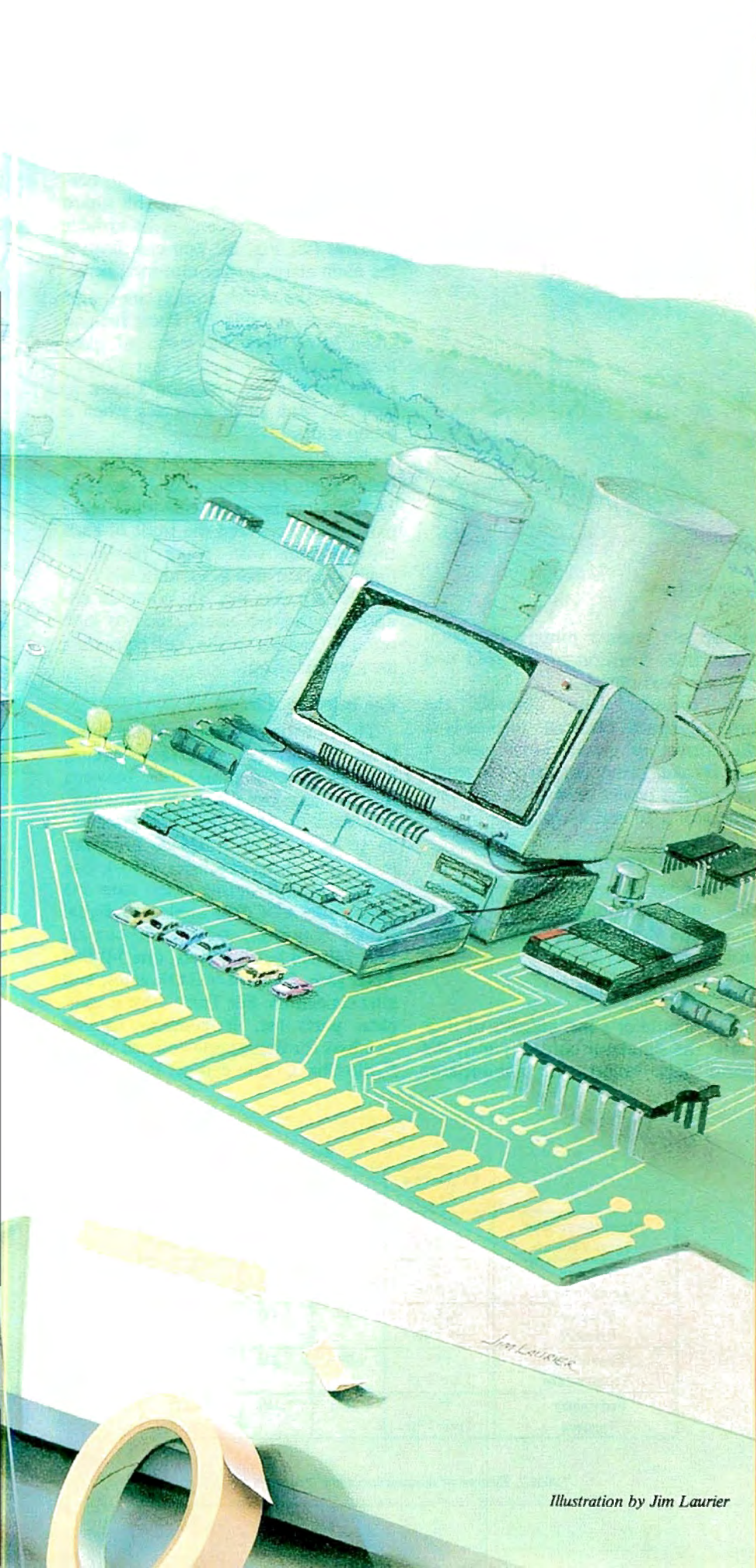


Illustration by Jim Laurier

Turn your Model I into a nuclear power plant simulator, complete with lights, bells, and whistles.

by W. Mark Wright

The plant I simulated consists of three primary loops. Each loop has its own reactor coolant pump (RCP) and steam generator (S/G). (See Table 1 for a complete list of acronyms and their definitions.) Raising or lowering the control rods determines the amount of steam the reactor generates.

In case of a leak in these loops, safety injection protects the plant. Safety injection forces water into the primary loop to compensate for the leak. If the pressure in the primary loops gets too high, a power operated relief valve (PORV) vents the excess pressure.

Overview of the Simulator

While this simulator is a scaled-down model of a real plant, I haven't included certain parts of the plant. For example, the pressurizer, which maintains the primary loop pressure within defined limits, isn't included.

Since operation of the pressurizer is automatic for the most part, its exclusion from the model does not impair the simulator's realism. The model compensates for the lack of a pressurizer by allowing a wider range of pressures and temperatures (see Table 2).

Two feed pumps (FP) and two auxiliary feed pumps (AFP) supply the steam generators with water. Its respective feed valve controls the rate of

The Key Box

10049 46

Model I
16K RAM Cassette Basic
without comments
32K RAM Disk Basic
Hardware Project

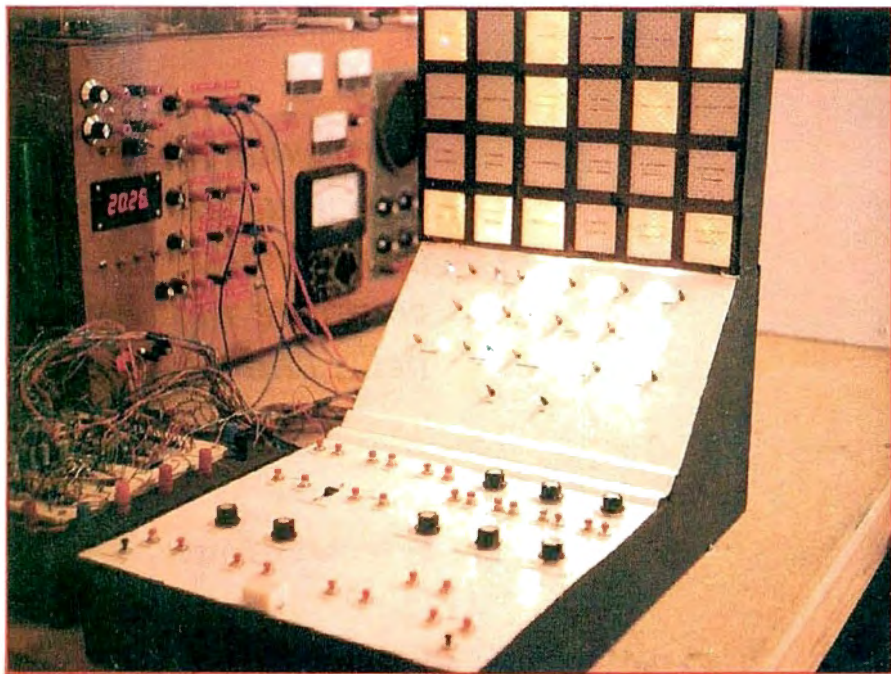


Photo 1. Simulator control board.

flow to each steam generator. Steam from the steam generators flows to the turbine connected to the generator.

In the event that you lose or trip the turbine, a steam dump valve dumps the steam directly to the condenser. A secondary PORV (SEC-PORV) rapidly lowers the pressure in the secondary loop.

I've omitted the condensate and

condensate booster pumps and combined their function in the feed and auxiliary feed pumps.

A throttle valve controls the turbine's speed. Once the turbine is at the correct or synchronous speed, a grid breaker switch connects the generator to the power lines. You can vary generator load and its voltage.

Simulator Components

My power plant simulator comprises three main components: the simulator panel, the video display, and the controlling software.

The Simulator Panel

The simulator panel consists of four parts: the simulator control panel, the status light board, the annunciator

board, and the interface circuit. I followed no formal plan in building the simulator panel, preferring instead to construct a purely functional board from plywood, nails, and a lot of glue.

The simulator control board (see Photo 1) contains all the controls necessary for plant operation. This board provides 31 switches and eight variable controls (see Fig. 2). You can also see the main alarm buzzer mounted here.

Above the switch section are the 30 status lights (see Fig. 3). These red and green lights show the status of plant equipment: Red indicates that a pump is not running (a condition known as tripped), and green indicates when a pump starts.

The annunciator board is above the status lights (see Photo 2). It contains 24 lights mounted in individual compartments. I covered the front of each compartment with white plexiglass. Each location has a warning label attached to it (see Fig. 4). When an abnormal condition exists, such as high primary pressure, the corresponding location lights up.

The Interface Circuit

The fourth component of the simulator panel, the interface circuit, handles all communications between the simulator panel and the computer. It is made up of 53 2N2222 transistors, 86 resistors, four M8255A programmable peripheral interfaces (PPIs), one SCS11C3 SCR optocoupler, one 555 timer, one ADC0808 analog to digital (A/D) converter, one piezo buzzer, four 74LS04 hex inverters, one 74LS08 AND gate, four 74LS32 OR gates, and nine capacitors. See Table 3 for a complete parts list. It contains catalog numbers for those parts you can buy at Radio Shack. You can get the remain-

AFP	Auxiliary feed pump
CBP	Condensate booster pump
CP	Condensate pump
C/R	Control rods
FP	Feed pump
FV	Feed valve
GEN	Generator
MVA	Megavoltamperes
MVAR	Megavars
MW	Megawatts
PORV	Power operated relief valve
PRZR	Pressurizer
PWR	Pressurized water reactor
RCP	Reactor coolant pump
RIL	Rod-in-light
ROL	Rod-out-light
RV	Reactor vessel
Rx	Nuclear reactor
SCR	Silicon controlled rectifier
SD	Steam dump
S/G	Steam generator
SI	Safety injection
SUR	Start-up rate
SYNC	Synchronous
TUR	Turbine
TV	Throttle valve

Table 1. List of acronyms and their definitions.

	Ranges			
	Rx/Turbine Trip	Lo Alarm	Hi Alarm	Rx/Turbine Trip
Steam Generator Level Percent	Rx Trip		70	80 Turb Trip
Primary Temperature	475 Rx Trip	500	600	625 Rx Trip
Primary Pressure	1,900 Rx Trip	2,000	2,300	2,350 Rx Trip
Secondary Temperature	950 Turb Trip	1,000	1,200	1,250 Rx Trip
Secondary Pressure	950 Turb Trip	1,000	1,150	1,175 Rx Trip

Table 2. Ranges of temperatures and pressures.

ing parts from Jameco Electronics (1355 Shoreway Road, Belmont, CA 94002).

I built the interface circuit on a breadboard, since my experience is that new circuit designs always fail if you solder them. I used solid telephone wire to connect the simulator panel to the interface circuit.

A 3-foot, 40-pin ribbon cable connects the interface circuit to the Model I. Neither length nor placement of parts on the breadboard is critical. See Fig. 5 for pin-outs of the chips I used in the project.

The integrated circuits receive power from a 7805 voltage regulator. Power for the lights is an unregulated 7 volts. See Fig. 6 for power supply specifics.

The interface circuit consists of six parts. Part one is the PPI selection circuit (see Fig. 7), which enables the computer to address 16 ports (zero through 15) and generate the four chip-select lines for the PPIs. The In and Out lines are combined in one-fourth of the 74LS08. Since these lines go low when active, the output from the 74LS08 is high until you select either of these lines. This output is ORed with address lines A7, A6, A5, and A4.

Address lines A3 and A4 are connected to NOT gates and ORed to give four discrete lines. I ORed these lines with the output from the A7-A4/In-Out combination. This gives the four chip-select lines required by the PPIs. The In and Out lines, along with address lines A1 and A0, connect directly to the PPIs.

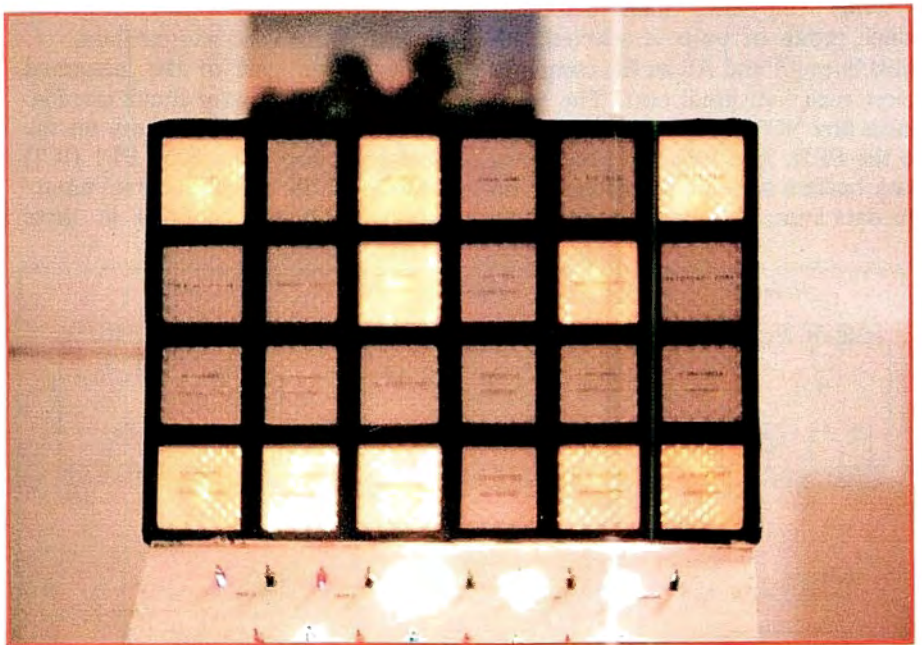


Photo 2. Annunciator board.

Rx TRIP	SI	RCP TRIP	STEAM DUMP	HI S/G LEVEL	LO S/G LEVEL
HI START UP RATE	PRI-PORV	LO PRIMARY FLOW RATE	AUX FEED PUMP START	FEED PUMP TRIP	SECONDARY PORV
HI PRIMARY TEMPERATURE	HI PRIMARY PRESSURE	REACTOR OVERPOWER	GENERATOR OVERPOWER	HI SECONDARY TEMPERATURE	HI SECONDARY PRESSURE
LO PRIMARY TEMPERATURE	LO PRIMARY PRESSURE	TURBINE TRIP	STEAM/FEED MIS-MATCH	LO SECONDARY TEMPERATURE	LO SECONDARY PRESSURE

Figure 4. Annunciator panel.

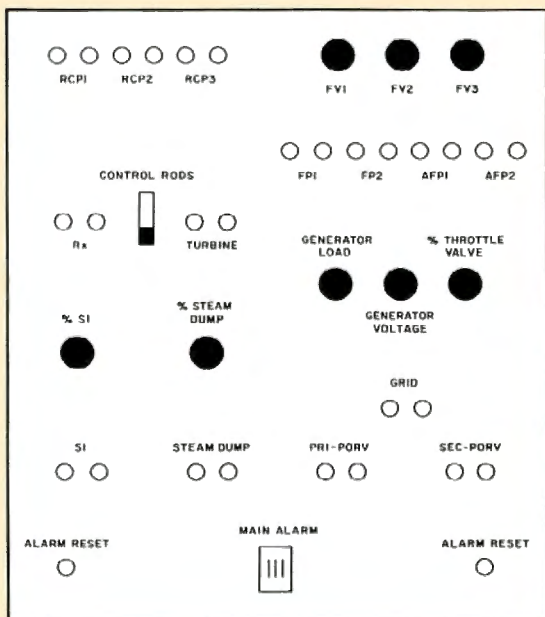


Figure 2. Switches and variable controls layout.

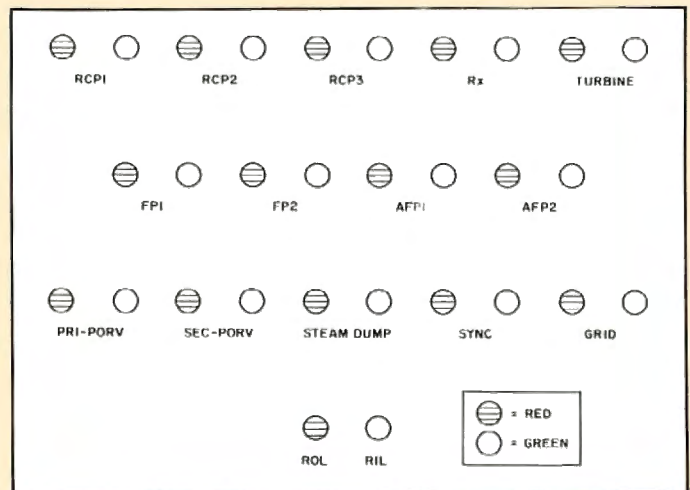


Figure 3. Status lights layout.

While chip-select lines determine which group of ports is selected, address lines A1 and A0 let the computer select each individual port. The Reset line is first NOTted and then connected to the PPIs. The PPIs have their own data buffers so none are necessary on the data lines. They connect directly to

the PPIs. See Table 4 for corresponding outputs for valid address lines.

The second part of the integrated circuit, the annunciator circuit (see Fig. 8), lights up the annunciators on the simulator panel. The 8255 PPI (IC1) consists of 24 programmable input/output (I/O) pins defined in three

groups of eight (PA0-PA7, PB0-PB7, PC0-PC7) corresponding to ports zero, 1, and 2, respectively. When you write a value of 128 to the control register (port 3), all the ports become outputs. The command Out 0,1 makes PA0 go high.

All 24 pins connect to a 2N2222 transistor via a 100-ohm resistor. One side of the lights connects to +7 volts. The other side connects to the transistor's collector. The transistor's emitter connects to ground. When any of the 24 output pins goes high, the transistor switches on to provide a path through which the current flows.

The status circuit (see Fig. 9), which controls the status lights on the simulator panel, is the third part of the interface circuit. You access it through ports 4 and 5. When you write a value of 128 to the control register (port 7), all IC2's I/O pins become outputs.

Only lines A0-A7 and B0-B5 control the status circuit. Each line connects to the transistors that control the green lights in the same way as they do the annunciator circuit. Since the status of each piece of equipment is either red or green, the pins also connect to hex inverters.

The output from the inverters then connects to the transistors that control the red lights. If pin A0 is high, the transistor controlling the green light switches on. The inverted A0 is low, so the red light stays off.

The fourth part of the interface, the switch circuit (see Fig. 10), determines which momentary single-pole, single-throw (SPST) switch on the simulator panel you have pressed. You access the PPI on ports 8, 9, and 10. When you write a value of 155 to the control register (port 11), all 24 IC3 I/O pins become inputs.

Each side of the push-button switches connects to +5 volts. The other side connects directly to the PPI input pins (A1-A7, B0-B7, C0-C7).

Pin A0 connects to a double-pole, double-throw (DPDT) slide switch (SW1) that performs two functions. First, it shows the direction in which the control rods are moving. Second, it lights up the rod in light (RIL) or the rod out light (ROL).

IC3 ties terminal 1 to PA0. Terminal 2 connects to +5 volts. IC4 ties terminal 3 to PA5, and terminal 4 is tied to one side of the red ROL. Terminal 5 connects to +7 volts, and terminal 6 is tied to one side of the green RIL.

This slide switch also appears in the switch/alarm circuit (see Fig. 11). Using a slide switch frees the operator to

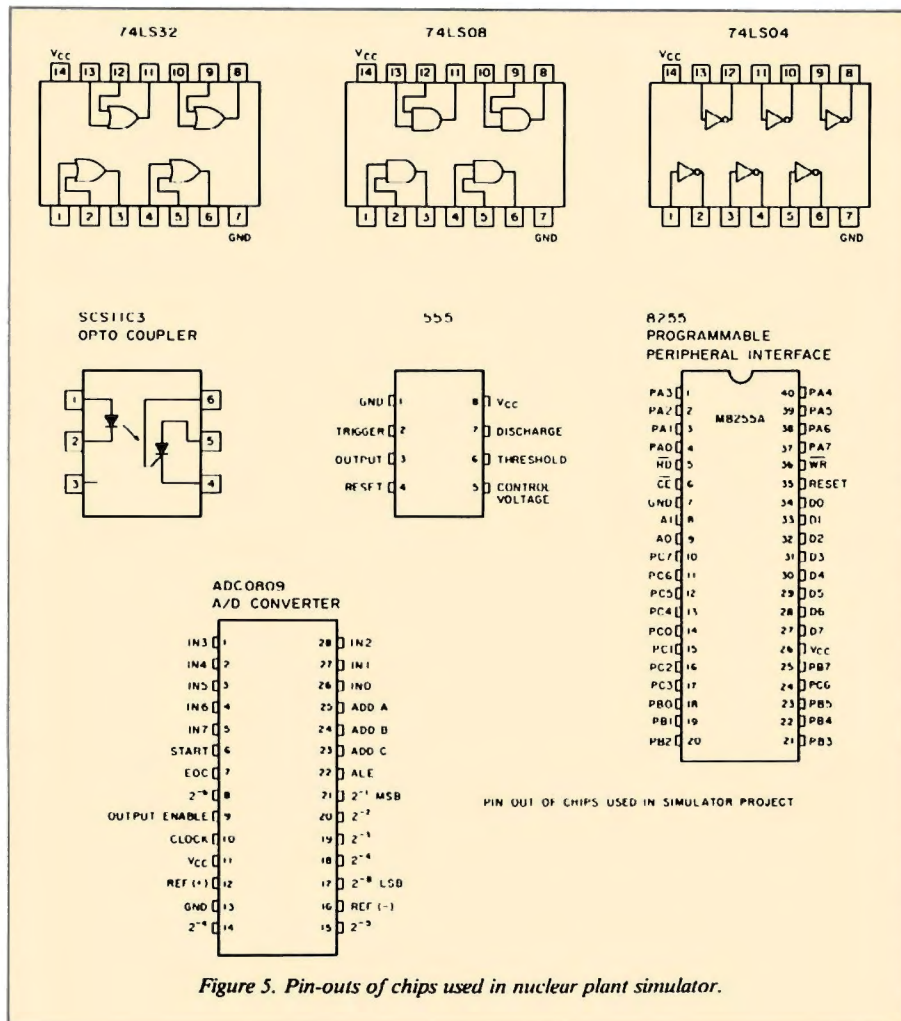


Figure 5. Pin-outs of chips used in nuclear plant simulator.

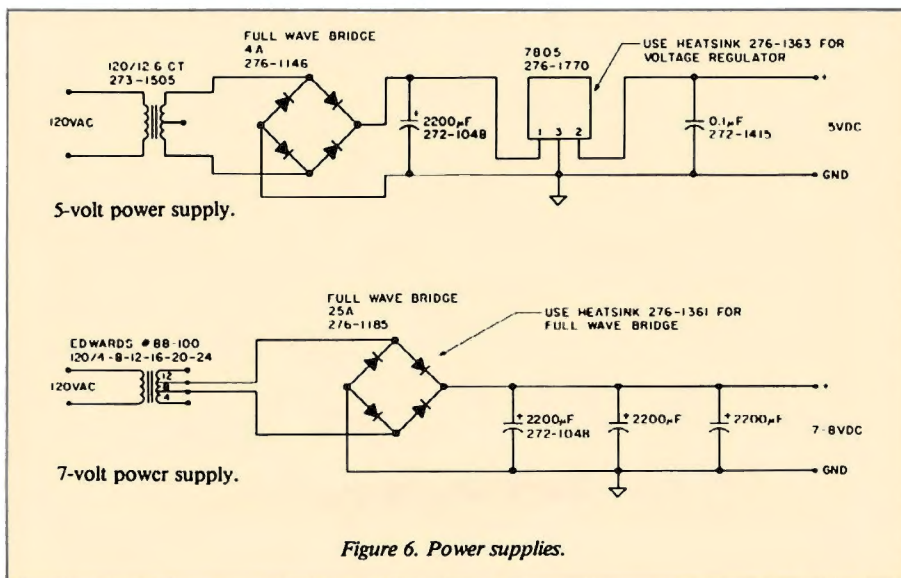


Figure 6. Power supplies.



Photo 3. The nuclear plant simulator components.

- 1 ADC0809 8-bit A/D converter, eight channel
- 4 8255 programmable peripheral I/O (PPI)
- 1 555 timer
- 1 SCS11C3 SCR output optocoupler Radio Shack #276-136
- 1 74LS08 quadruple two-input positive AND gate
- 4 74LS04 hex inverters
- 4 74LS32 quadruple two-input positive OR gate
- 1 piezo buzzer Radio Shack #273-060
- 1 6V dc buzzer Radio Shack #273-054
- 53 2N2222 NPN transistors Radio Shack #276-1617
- 54 7-8 volt light bulbs/miniture Christmas tree lights
 - 24 yellow
 - 15 red
 - 15 green
- 8 potentiometers 1M ohm Radio Shack #271-211
- 28 mini SPST momentary contact switch normally open (N.O.) Radio Shack #275-1547
- 2 mini SPST momentary contact switch N.C. Radio Shack #275-1548
- 8 knobs Radio Shack #274-415
- 54 resistors 100-ohm 1/4 watt Radio Shack #271-1311
- 31 resistors 10,000-ohm 1/4 watt Radio Shack #271-1335
- 1 resistor 1,000-ohm 1/4 watt Radio Shack #171-1321
- 1 slide switch DPDT Radio Shack #275-403
- 1 capacitor 0.01 μ F ceramic Radio Shack #272-131
- 8 capacitors 22 μ F 33V Radio Shack #272-1014
- 1 40-conductor, 3-foot ribbon cable with card edge and 40-DIP socket

5-volt power supply

- 1 transformer 12.6 CT Radio Shack #273-1505
- 1 full-wave bridge rectifier 4-amp Radio Shack #276-1146
- 1 capacitor 2,200 μ F 50V Radio Shack #272-1048
- 1 fixed 5V voltage regulator 7805 Radio Shack #276-1770
- 1 TO-220 heat sink Radio Shack #276-1363
- 1 capacitor aluminum electrolytic 0.1 μ F 16V Radio Shack #272-1415

7-volt power supply

- 1 transformer Edwards Signal #88-100
- 1 heat sink universal Radio Shack #276-1361
- 1 full-wave bridge rectifier 25 A Radio Shack #276-1185
- 3 capacitors 2,200 μ F 50V Radio Shack #272-1048

Table 3. Parts list.

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2000	713.2	7.8	98.9

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perform other duties while changing the power level in the reactor. All 24 lines connect to ground through a 10,000-ohm resistor. These resistors pull the pins low when no switch is activated.

The switch/alarm circuit is the fifth part of the interface. The PPI (IC4) in this circuit is configured so that lines A0-A7 and C0-C7 are inputs and B0-B7 are outputs. You do this by writing the value 153 to the control register (port 15). Accessing ports 12, 13, and 14 selects A0-A7, B0-B7, and C0-C7, respectively.

You use lines A0-A4 for the remaining push-button switches. Line A5 is for the other half of the slide switch (SW1). These push-button switches are set up as for the switch circuit. You do

not use lines A6 and A7.

Lines B0-B3 connect to the A/D circuit. B0-B2 let the A/D converter select one of eight inputs from the variable controls (potentiometers). B3 starts the conversion process on the A/D converter.

B4 triggers the main annunciator alarm, which sounds whenever a new annunciator lights up. B4 connects to the optocoupler SCR via a 100-ohm resistor. When a pulse travels out B4, the SCR conducts current that causes the main annunciator alarm buzzer to sound. The SCR remains on until you press one of the two alarm reset switches located on the simulator panel. These switches are momentary normally closed (N.C.) SPST.

B5 controls the alarm clear piezo buzzer. Whenever an annunciator light goes off or clears, a pulse travels out line B5. This pulse drives the base of a 2N2222 transistor through a 100-ohm resistor. The transistor switches on with a short beep that lets the operator know an annunciator has cleared. You do not use B6 and B7. Lines C0-C7 are used for input from the A/D converter.

The A/D converter circuit (see Fig. 12) completes the interface; it changes voltages from the eight potentiometers to a digital number. The potentiometers' resistance is 1 megaohm. Pin 1 goes to +5 volts and pin 3 goes to ground. Pin 2 connects to the A/D converter. These pins also connect to ground through a 22-μF capacitor that delays the changing voltages.

The A/D converter is referenced high at +5 volts and referenced low at ground. This gives the computer a value of 255 for a voltage of 5 volts and zero for zero volts. The switch/alarm PPI ties ALE and Start on the converter to B3.

B0-B2 access the eight variable controls. Clock pulses come from a 555 timer set-up to act as a pulse generator. Since the control program is written in Basic, sufficient time passes from when the program pulses the A/D to when it reads the data from port 14.

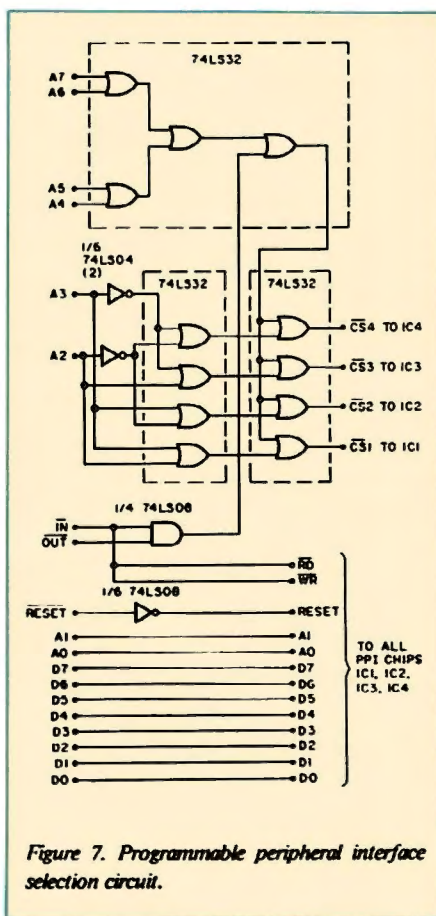


Figure 7. Programmable peripheral interface selection circuit.

A7	A6	A5	A4	A3	A2	IN	OUT	RD	WR	CS1	CS2	CS3	CS4	PORTS	PPI
L	L	L	L	L	L	L	H	L	H	L	H	H	H	0-3	IC1
L	L	L	L	L	L	H	L	H	L	L	H	H	H	0-3	IC1
L	L	L	L	L	H	L	H	L	H	H	L	H	H	4-7	IC2
L	L	L	L	L	H	H	L	H	L	H	L	H	H	4-7	IC2
L	L	L	L	H	L	L	H	L	H	H	H	L	H	8-11	IC3
L	L	L	L	H	L	H	L	H	L	H	H	L	H	8-11	IC3
L	L	L	L	H	H	L	H	L	H	H	H	L	L	12-15	IC4
L	L	L	L	H	H	H	L	H	L	H	H	H	L	12-15	IC4

Table 4. Corresponding outputs for valid address lines.

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The Video Display

The third part of the simulator is the TRS-80's video display (see Photo 4). The screen is divided into three sections: primary, secondary, and electrical.

The primary section shows the reac-

tor's power level in megawatts thermal (MWTH) and in percent power. It indicates the control rods' positions, as well as temperature and pressure in the primary loop.

Flow rate and mass appear as per-

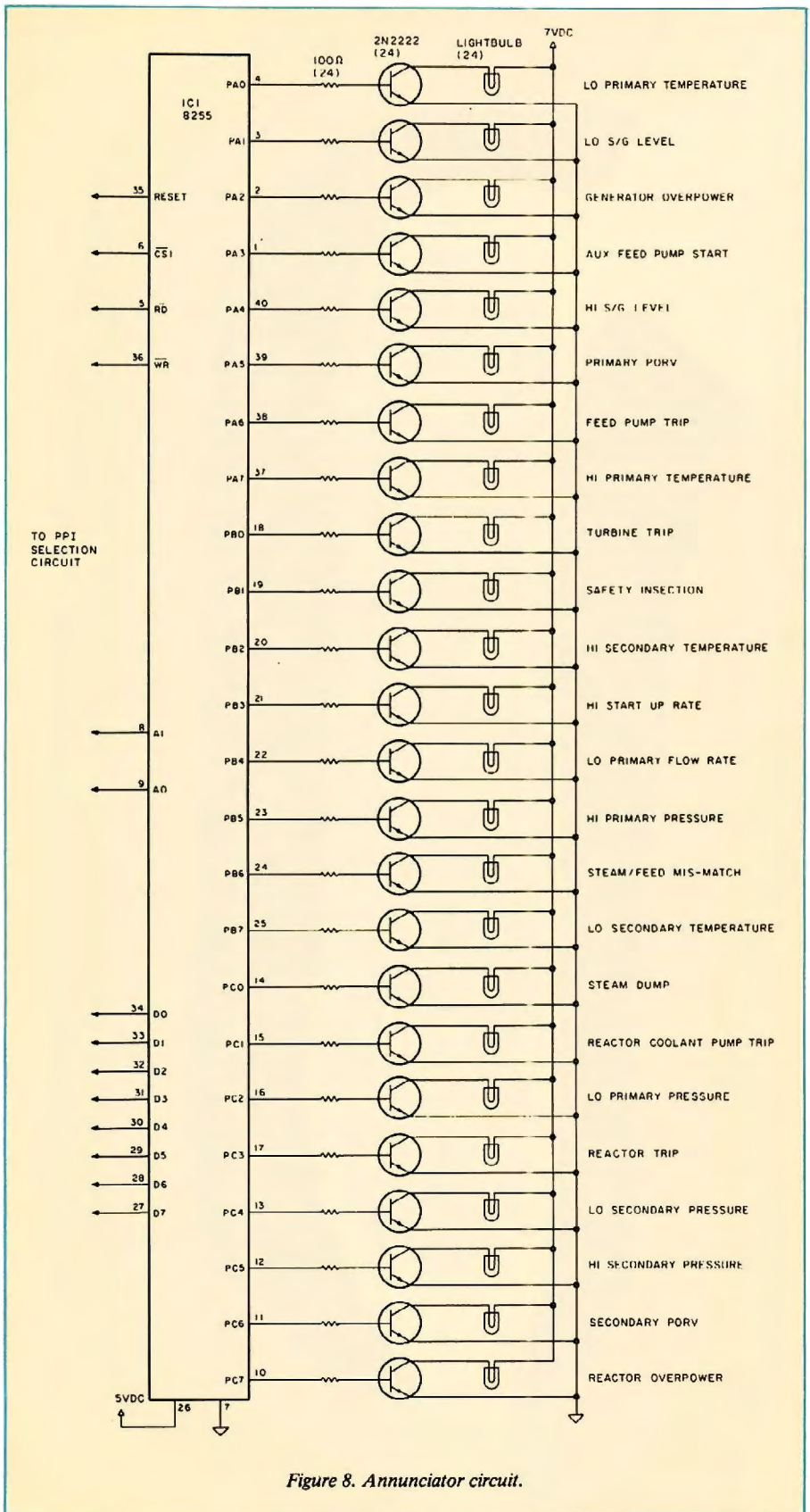


Figure 8. Annunciator circuit.

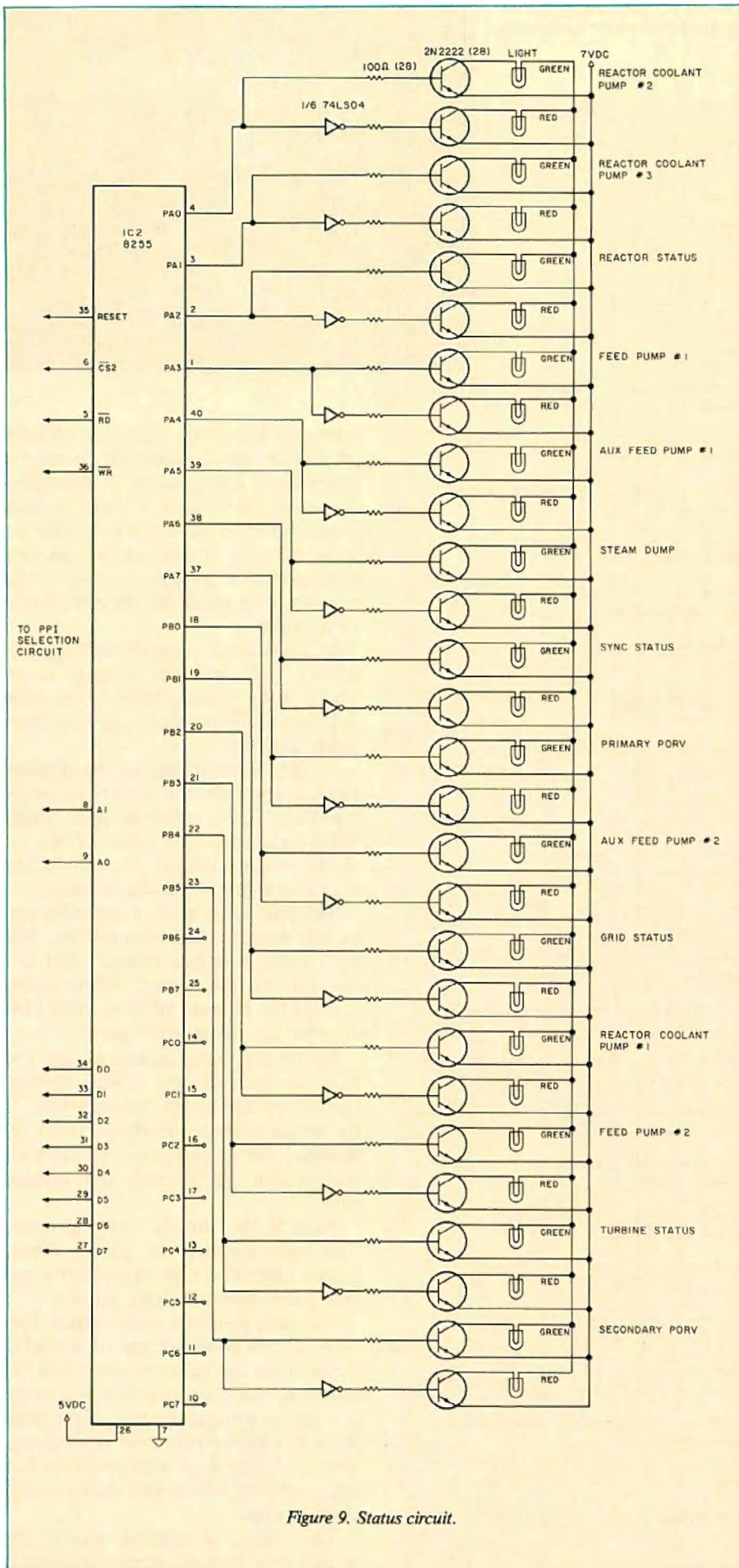


Figure 9. Status circuit.

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Photo 4. The Model I video display indicates the status of simulator components.

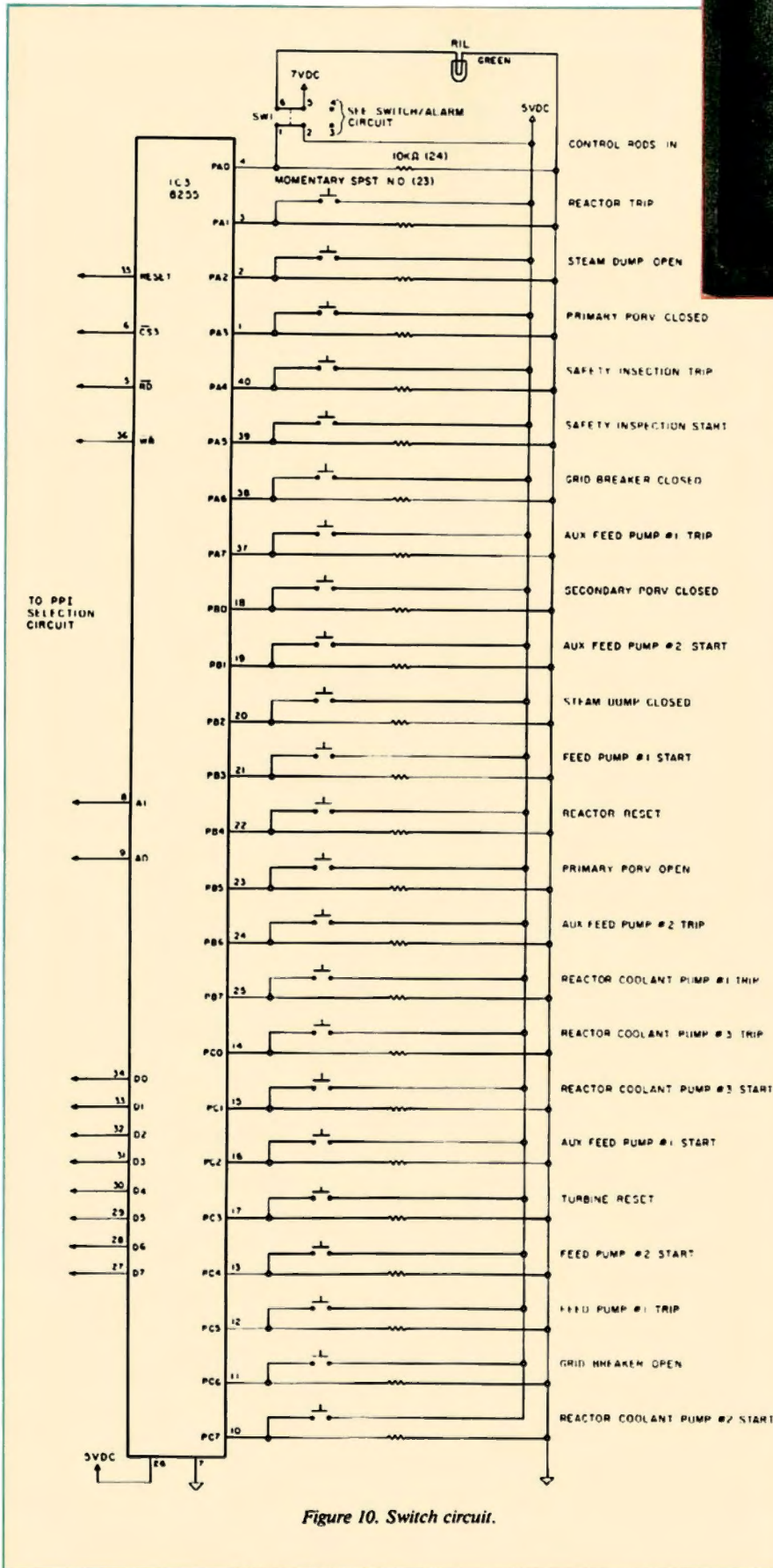
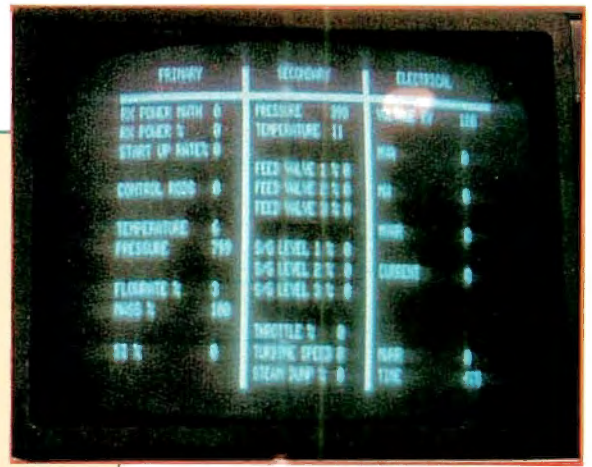


Figure 10. Switch circuit.

centages. Flow rate indicates whether or not a reactor coolant pump is operating at full capacity. A real nuclear power plant doesn't have a mass gauge; however, since the containment structure that houses all the primary components is airtight, a leak in the primary loop raises the pressure inside containment.

In a real plant, a rapidly falling pressurizer level indicates a leak somewhere in the primary loop. If the mass falls below 100 percent, you must start safety injection.

In fact, the last part of the primary section represents the percent of safety injection. This indicates how much water (in percent) the system injects into the primary loop if you start safety injection from the simulator panel.

The secondary section indicates secondary pressure and temperature. The feed valve positions appear right below this on the screen. These valves control the amount of feed water that flows to the steam generators.

Below the valve positions are the level in each of the steam generators—very important information. If the steam generator level falls below 30 percent, the reactor trips. If the level rises above 80 percent, the turbine trips.

Next is the throttle valve percent. This valve controls the turbine speed, shown next. Too high or too low a turbine speed opens the grid breaker.

The next number, steam dump percent, shows what percent of available steam from the steam generators is bypassed to the condenser if you activate it from the simulator panel. If the reactor is at a high power level and the turbine trips, you'll get high pressures and temperatures unless you activate this steam dump.

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Next the computer checks all the switches by using the Input command (INP) on ports 8, 9, 10, and 12. To check for individual switches, the program ANDs the value obtained in the INP command with one, two, four, eight, and so on. Then it adjusts the status lights for any new conditions; i.e., if feed pump one is starting, PB3 on IC3 is high. A high on IC2's PA3 lights the green status light for feed pump one.

Next, the program checks the eight potentiometers by outputting values zero to seven to the A/D converter on port 13's lines B0-B2. A pulse on line B3 starts the conversion process. The program reads the corresponding potentiometer's value from port 14.

The control program's next task is determining plant conditions. Calculated values have a delay factor that adds to their realism. For example, if you start one pump, the flow rate increases slowly instead of instantaneously.

The program updates the video display along with the annunciator lights. To check for new or clear annunciator

lights, the control program checks the present value output to ports zero, 1, and 2 with the value previously output. If the number is greater, new annunciator lights have come on. A lower number indicates that annunciator lights have cleared.

For instance, if the Hi Primary Pressure and Hi Secondary Temperature annunciators are lighted, IC1's lines PB2 and PB5 are high. A value of 36 output to port 1 causes this. If the primary pressure decreases below 2300, the value output to port 1 is only 32. By comparing this new value of 32 with the previous value of 36, you know that an annunciator has cleared.

The computer then sends a value of 32 out port 13 of IC4 to send the alarm cleared piezo buzzer. A value of zero output to port 13 in line 340 shuts off the buzzer.

If the reverse situation exists (a new value of 36 to compare with a previous value of 32), the computer sends a value of 16 out port 13 to IC4. This sounds the main annunciator buzzer. Since a silicon controlled rectifier (SCR) activates the buzzer, the alarm con-

tinues until you press one of the two alarm clear push buttons located on the simulator panel. The program then decrements the time remaining on the simulator and jumps to line 340 again.

Since I use variables throughout the program, almost every line has comments. These comments occur on odd lines (not multiples of 10), so you can enter the program using AUTO 10.

The following two procedures demonstrate start-up and operation of the plant. Use the first procedure when the plant is at cold shutdown, and the second when the plant is at hot standby.

Start-Up from Cold Shutdown

You need to pay close attention to Figs. 13 and 14. Figure 13 is the primary pressure to temperature curve, which shows the correct pressure for a given temperature in the primary loop. Deviations from this curve indicate that something is wrong with the plant; in other words, the events section has created some problems. When the plant produces electric power, operation in the shaded area of this chart results in a reactor and/or turbine trip.

You consult reactor power versus MVA (Fig. 14) when you have the generator producing power. This chart shows electrical output from the gener-

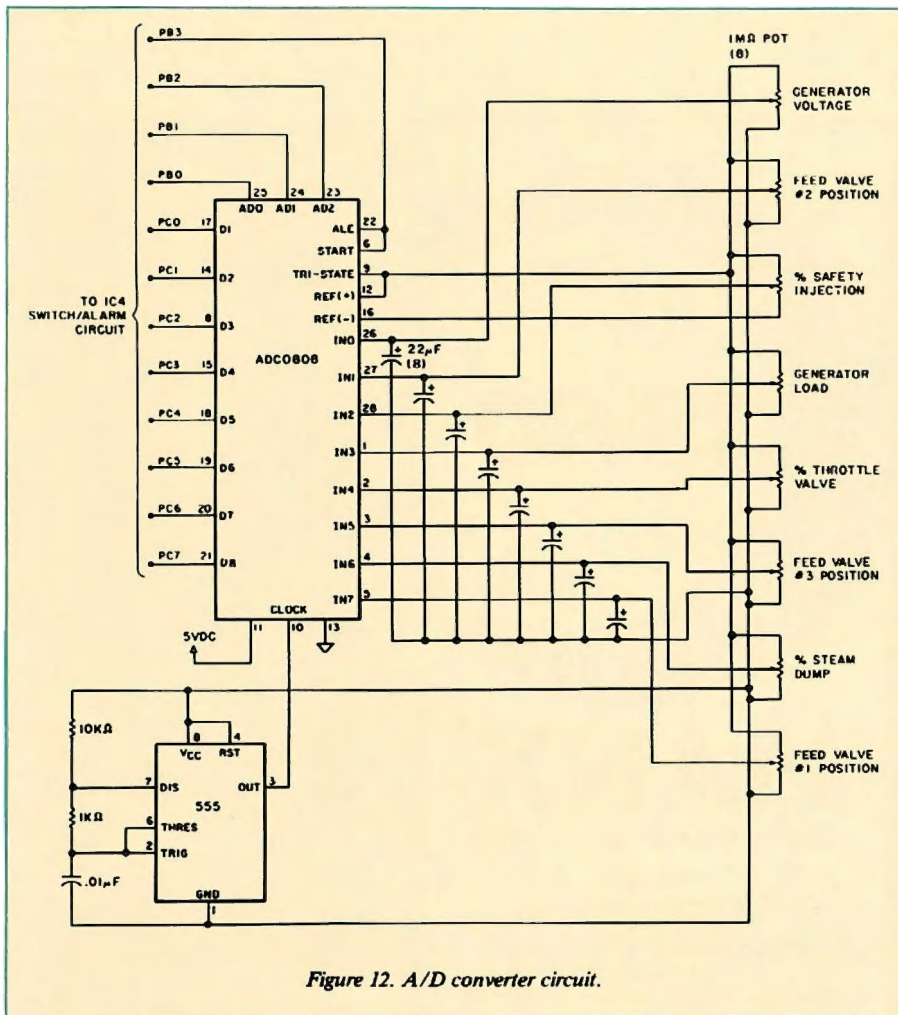


Figure 12. A/D converter circuit.

Status Lights

- RCP 1 Red
- RCP 2 Red
- RCP 3 Red
- RX Red
- Turbine Red
- FP 1 Green
- FP 2 Green
- AFP 1 Green
- AFP 2 Green
- PRI-PORV Green
- SEC-PORV Green
- Steam Dump Green
- Sync Red
- Grid Red
- ROL Not lit
- RIL Not lit

Annunciator Lights On

- RX trip
- RCP trip
- Low S/G level
- Low primary flow rate
- Aux feed pump start
- Low primary temperature
- Low primary pressure
- Turbine trip
- Low secondary temperature
- Low secondary pressure

Table 5. Conditions for start-up.

ator in MVAs to the power output from the reactor in percents. Again, deviations from this curve indicate that the events section has interfered.

To start from cold shutdown, you must verify several conditions on the video display. The reactor's power (labeled Rx power), start-up rate, and control rod position should all equal zero. The mass percent should equal 100. See Table 5 for the correct status light and annunciator light conditions.

Now, review the ranges for desired operating conditions (Table 2). Start reactor coolant pumps RCP 1, RCP 2, and RCP 3, and verify that the RCP trip annunciator clears after the final pump starts. The low primary flow rate annunciator clears after the primary flow rate is greater than 98 percent.

Next, you must open FV 1, FV 2, and FV 3 to 20 percent. Close the feed valves when the steam generator levels are greater than 50 percent. The low steam generator level annunciator clears when all levels exceed 39 percent.

Trip the auxiliary feed pumps. You won't need these pumps unless the main feed pumps become inoperable. Verify that the annunciator for the auxiliary feed pump clears. Now reset the reactor. The reactor trip annunciator clears.

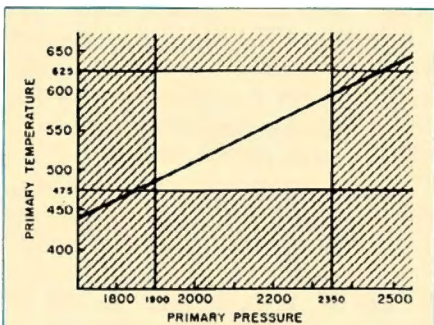


Figure 13. Primary pressure to temperature curve.

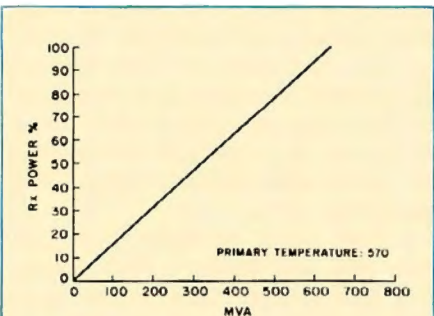


Figure 14. Reactor power to megavoltamperes curve.

Pull the control rods to position 1. If you advance the control rods past position 1, a high start-up rate occurs. This means that the reactor is powering up too quickly. The excessive start-up rate triggers the Hi Start-Up Rate annunciator and trips the reactor.

After the start-up rate percent drops below 50, you slowly pull the control rods to position 25. Watch the start-up rate percent on the video display. If this rate gets higher than 95 percent, the reactor trips.

Lo Primary Temperature, Lo Primary Pressure, Lo Secondary Temperature, and Lo Secondary Pressure annunciators clear as the reactor power

level increases. Check the primary pressure-to-temperature curve for any deviations in pressure or temperature.

On the video display, verify that the Rx power is greater than 360 but below 370. Make sure that the control rods' positions are at 25. Also verify the following conditions: that primary temperature is greater than 560 but under 570, that primary pressure is greater than 2,200 but below 2,250, that secondary pressure is greater than 1,100 but under 1,150, and that secondary temperature is greater than 1,100 but below 1,150.

Open the safety injection potentiometer to 5 percent and the potentiom-

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Program Listing. Control program for the nuclear plant simulator.

```

10 CLEAR
20 DEFINTD,W,P,A,Y,L,Z,B,C,S,T,F,I,H,J
30 DIMD(43)
40 RANDOM
50 HG=6:HR=30:HU=40:HV=60:HX=70:HY=80:JA=100:JB=105:JH=400:JI=47
5:JJ=500:JK=600:JL=625:JN=700:JO=950:JP=1000:JQ=1150:JR=1200:JS=
1900:JT=2000:JU=2300:JV=2350:JW=3500:JX=3595:JY=3605:JZ=RND(10):
KA=500:GM=1.25:GN=0.75:GO=5/100:GP=30/255
60 GO=100/255:GR=1000/255:GS=25/100:JF=200:JM=700:HB=1:JC=120:JG
=300:HC=2:JE=135:HZ=99:KB=300:KC=200
64 REM
65 REM          SET UP THE 8255s
66 REM
70 OUT3,128:OUT7,128:OUT11,155:OUT15,153
80 CLS
84 REM
85 REM          CHECK TO SEE IF THE CONTROLS ARE RESET
86 REM
90 OUT13,0:OUT13,8:OUT13,0:WA=INP(14):OUT13,1:OUT13,9:OUT13,1:WB
=INP(14):OUT13,2:OUT13,10:OUT13,10:OUT13,2:WC=INP(14):OUT13,3:OUT13,11:OU
T13,3:WD=INP(14):OUT13,4:OUT13,12:OUT13,4:WE=INP(14):OUT13,5:OUT
13,13:OUT13,5:WF=INP(14):OUT13,6:OUT13,14:OUT13,6
100 WG=INP(14):OUT13,7:OUT13,15:OUT13,7:WH=INP(14):A=INP(8):B=IN
P(12):IFWA>0ORWB>0ORWC>0ORWD>0ORWE>0ORWF>0ORWG>0ORWH>0ORA>0ORB>O
THEN10 ELSE120
110 PRINT@472,"RESET ALL CONTROLS":GOTO90
114 REM
115 REM          CYCLE LIGHTS AND ALARMS
116 REM
120 CLS:PRINT@467,"** LIGHT TEST MODE **":PRINT@650,"HIT ANY KEY
TO CONTINUE":OUT0,255:OUT1,255:OUT2,255:OUT13,16
130 OUT13,32:OUT4,255:OUT5,255:FORI=1TO600:NEXT:OUT13,0:OUT4,0:O
UT5,0:FORI=1TO600:NEXT:AS=INKEY$:IFAS=""THEN130
134 REM
135 REM          SET INITIAL CONDITIONS FOR COLD SHUTDOWN
136 REM
140 CLS:AH$="T":AI$="T":AJ$="T":AL$="O":AN$="C":GG=5/10:GI=31/10
0:GH=35/100:GJ=34/100:MP=101:GL=.75
144 REM
145 REM          SET TIME LIMIT FOR REACTOR OPERATION
146 REM
150 CLS:PRINT@340,"TIME LIMIT IS ";KA:PRINT@529,"CHANGE TIME LIM
IT? <Y/N>"
160 AS=INKEY$:IFAS=""THEN160
170 IF AS="N"THEN210
180 IFAS="Y"THEN200
190 GOTO160
200 CLS:PRINT@465,"INPUT NEW TIME LIMIT":INPUTKA
204 REM
205 REM          SELECT PLANT STATUS
206 REM
210 CLS:PRINT@148,"** PLANT STATUS **":PRINT@404,"<1> COLD SHU
TDOWN":PRINT@532,"<2> HOT STANDBY";
220 AS=INKEY$:IFAS=""THEN220
230 IF AS="1"THEN270
240 IF AS="2"THEN260
250 GOTO220
260 GOSUB 1990
264 REM
265 REM          ENABLE/DISABLE EVENTS SECTION
266 REM
270 CLS:PRINT@462,"EVENTS          <Y> YES          <N> NO"
280 AS=INKEY$:IFAS=""THEN280
290 IFAS="N"THEN320
300 IFAS="Y"THEN330
310 GOTO280
320 KC=0:GO=0
324 REM
325 REM          DRAW SCREEN FORMAT
326 REM
330 GOSUB1570
334 REM
335 REM ***** MAIN PROGRAM *****
336 REM
337 REM
338 REM          SUBTRACT SCORE FOR LIT ANNUNCIATORS
339 REM
340 OUT13,0:FORI=0TO7:A=I(2:IFLAANDATHENPZ=PZ-1
350 IFLBANDATHENPZ=PZ-1
360 IFLCANDATHENPZ=PZ-1
370 NEXTI
374 REM
375 REM          IF EVENTS SECTION IS ENABLED THEN BRANCH
376 REM
380 IFRND(KB)=KCTHENGOSUB1630
384 REM

```

Listing continued

eter steam dump to 10 percent. Last, open the potentiometer throttle valve to 50 percent. The plant is now at hot standby.

Start-Up from Hot Standby

To begin start-up procedures when the plant status is hot standby, reset the turbine. When turbine speed is greater than 3,595 and below 3,605, the red synchronous (SYNC) status light goes off and the green light goes on.

Close the grid breaker. The green grid breaker status light comes on. Increase the generator load very slowly.

Now, pull the control rods out to maintain reactor temperature at greater than 500 but less than 600. Open the feed valves to keep the steam generator levels greater than 40 percent but less than 70 percent.

Adjust the generator voltage to minimize MVARS. Check the Rx power versus MVA curve (Fig. 14) for deviations in reactor power versus generator output.

Abnormal Conditions

The purpose of the control program's events section is to create plant problems. Here are some suggestions to help you handle crisis situations.

If the primary flow rate is low, the computer has slowed down between one and three of the reactor coolant pumps. Start all the pumps again.

A leaking PRI-PORV or a primary line break causes mass percent to fall below 98. For the PORV, press the PRI-PORV close button and start SI to bring the mass percent back to 100.

The line break is a trickier situation. Start SI, then adjust the potentiometer SI percent until mass percent increases slowly. When mass percent is around 96, trip SI. It takes time for the SI pumps to stop. If mass percent goes above 100, open PRI-PORV to vent the excess mass.

When the steam generator level falls below 40 percent, the auxiliary feed pumps start. This causes faster changes in the steam generator levels, so don't open the feed valves too wide. Remember to trip the auxiliary feed pumps after the steam generator level is above 40 percent, since you lose points when the annunciator light, auxiliary feed pump start, is on.

A high steam generator level trips both feed and auxiliary feed pumps. You cannot start these pumps again until all levels in the steam generators fall below 70 percent. The situation is bad if one S/G is at 75 percent and another is at 35 percent. The idea is to

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keep the levels in all S/Gs approximately the same.

You can salvage a loss of generator and/or turbine if you act quickly. First, open the steam dump. Start inserting the control rods, then adjust the steam dump percent control to keep the pressure and temperatures in the correct ranges. If the reactor power level is at 75 percent or higher, also open SEC-PORV. Close the PORV when you can control pressure and

temperatures with the steam dump.

The events section can slow down a pump or cause a PORV to leak, conditions that will not affect the annunciator lights. Only a tripped pump or open PORV shows up on the annunciator panel.

If you select the events section at the beginning of the program, it can interfere at any time from plant start-up to full power operation. Lines 1635-1977 of the control program describe the

events that might occur.

My simulator has been up and running for several months with no problems (except the ones that the events section creates for me!). After some practice with yours, you'll competently handle crisis situations in your nuclear plant control room. ■

Contact W. Mark Wright c/o Shearon Harris Nuclear Power Plant, P.O. Box 165, New Hill, NC 27562.

Glossary

Auxiliary feed pumps: Supply feed (water) to the steam generators when normal feed pumps are not available. Also used to fill the steam generators.

Clear (an alarm): When a condition that caused an alarm no longer exists, the alarm clears or cuts off.

Cold shutdown: A nuclear plant condition when the reactor is shut down. All the control rods are inserted into the core. The plant produces no electrical power.

Condensate booster pumps: Boost the pressure of the water coming out of the feed water heaters. Operation of these pumps combines in the feed/aux feed pump systems.

Condensate pumps: Draw condensate (water) from the condenser. Output from these pumps goes to several feed water heaters. Operation of these pumps combines in the feed/aux feed pump systems.

Condenser: Changes steam exhausted from the turbine into water. Water from a cooling tower or lake circulates through the condenser to condense the steam into water.

Control program: A computer program written in Level II Basic. Gathers data from the simulator panel, makes calculations, and displays the calculated values and alarms on the simulator panel.

Control rods: Inserted into the reactor core to control the nuclear reaction by absorbing excess neutrons created by nuclear fission. Limiting the number of neutrons holds the

power level of the reactor to a constant value.

Core: Located within the reactor vessel. Consists of Zircaloy-clad slightly enriched uranium dioxide fuel arranged in canless assemblies, various internal structures, and monitoring instrumentation.

Event: Anything that deviates from normal operation.

Feed valve: Controls the amount of feed (water) admitted into a steam generator.

Feed water heaters: Raise the temperature of the condensate to increase plant efficiency. In this simulator, they are combined in the feed/aux feed pump systems.

Feed water pumps: Under normal conditions, these pumps supply feed (water) to the steam generators.

Generator: Converts the turbine's mechanical energy into electrical energy. The generator in this simulator is rated at 900 MW @ 3,600 RPM.

Grid: An interconnected system in which high-voltage, high-capacity backbone lines overlay and connect with networks of lower voltages. Energy from the generator is fed into the grid.

Grid breaker: Connects the generator to the grid. In the event of an overload, the grid breaker opens to protect the generator from damage.

Hot standby: A nuclear plant condition when the reactor is at 1-5 percent power. The turbine is ready to

accelerate to synchronous speed. All pumps needed for full power operation are running.

Megavars: A unit of reactive power in power plant generation. One megavar equals one million vars.

Megavoltamperes: A unit of apparent power in power plant generation containing reactance. One megavoltampere equals one million voltamperes.

Megawatts: A unit of real power in power plant generation. One megawatt equals one million watts.

Nuclear chain reaction: Reaction accompanied by a tremendous release of energy when the nucleus of an atom is split into smaller pieces (fission).

Nuclear power plant: An electric power plant whose heat source is supplied by a nuclear chain reaction.

Overload: Load greater than that which a whole grid is designed to carry.

Power operated relief valve: Used to vent excess pressure. Its operation can be automatic or manual. Different from a safety valve because it needs an electrical signal to operate. The safety valve can operate when no electrical power is available.

Pressurizer: Maintains the reactor coolant system pressure during steady-state operation and limits pressure changes during transients.

Glossary continued

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Glossary continued

Pressurized water reactor: Nuclear power plant type in which high pressure water circulates through the reactor core to remove the heat generated by the nuclear chain reaction. The heated water exits from the reactor vessel and passes via the coolant loop piping to the steam generators. Here it gives up its heat to the feed water to generate steam for the turbine generator. The cycle is complete when the water pumps back to the reactor vessel.

Primary loop: Contains water under high pressure. The water pumps through the reactor vessel to remove heat from the core, then flows into the steam generators, giving up heat to the feed water. The water exits the steam generators and returns to the reactor coolant pumps to start the process again.

Reactor coolant pump: Circulates water in the primary loop.

Reactor core: See Core.

Reactor vessel: Cylindrical vessel with a hemispherical bottom head, and a flanged and gasketed upper head. Contains the core and control rods.

Reset: To return a piece of equipment to normal operation. For example, when a pump has tripped (stopped), resetting the pump causes it to start again.

Rod-in-light: A green light on the control board that comes on as the control rods are inserted into the core.

Rod-out-light: A red light on the control board that comes on as the control rods pull out of the core.

Safety injection: A set of pumps used to replace water leaking out of the primary loop. When you determine that the plant is losing water, starting these pumps forces water back into the primary loop.

Glossary continued

Listing continued

```

385 REM      CHECK FOR REMAINING TIME FOR REACTOR OPERATION
386 REM
390 IFKA=0THENGOSUB1610 ELSEKA=KA-1
394 REM
395 REM      CONTROL RODS IN
396 REM
400 A=INP(8):IFAAND1THENAO=AO-1
410 IFA0<0THENAO=0
414 REM
415 REM      BOTTOM CONTROL RODS IF THE REACTOR IS TRIPPED
416 REM
420 IFAH$="T"THENAO=0
424 REM
425 REM      TRIP REACTOR
426 REM
430 IFAAND2THENGOSUB1600
434 REM
435 REM      STEAM DUMP OPEN
436 REM
440 IFAAND4THENAN$="O"
444 REM
445 REM      PRIMARY PORV CLOSED
446 REM
450 IFAAND8THENAK=0
454 REM
455 REM      SAFETY INJECTION TRIP
456 REM
460 IFAAND16THENAJ$="T"
464 REM
465 REM      SAFETY INJECTION START
466 REM
470 IFAAND32THENAJ$="S"
474 REM
475 REM      GRID BREAKER CLOSED
476 REM
480 IFAAND64THENAL$="C"
484 REM
485 REM      AUX FEED PUMP #1 TRIP
486 REM
490 IFAAND128THENAF=0
494 REM
495 REM      SECONDARY PORV CLOSED
496 REM
    
```

Listing continued

Listing continued

```

500 A=INP(9):IFAAND1THENAM=0
504 REM
505 REM          AUX FEED PUMP #2 START
506 REM
510 IFAAND2THENAG=200
514 REM
515 REM          STEAM DUMP CLOSED
516 REM
520 IFAAND4THENAN$="C"
524 REM
525 REM          FEED PUMP #1 START
526 REM
530 IFAAND8THENAD=375
534 REM
535 REM          RESET REACTOR
536 REM
540 IFAAND16THENAH$="R"
544 REM
545 REM          PRIMARY PORV OPEN
546 REM
550 IFAAND32THENAK=5
554 REM
555 REM          AUX FEED PUMP #2 TRIP
556 REM
560 IFAAND64THENAG=0
564 REM
565 REM          REACTOR COOLANT PUMP #1 TRIP
566 REM
570 IFAAND128THENAA=0
574 REM
575 REM          REACTOR COOLANT PUMP #3 TRIP
576 REM
580 A=INP(10):IFAAND1THENAC=0
584 REM
585 REM          REACTOR COOLANT PUMP #3 START
586 REM
590 IFAAND2THENAC=34
594 REM
595 REM          AUX FEED PUMP #1 START
596 REM
600 IFAAND4THENAF=200
604 REM
605 REM          TURBINE RESET
606 REM
610 IFAAND8THENAI$="R"
614 REM
615 REM          FEED PUMP #2 START
616 REM
620 IFAAND16THENAE=375
624 REM
625 REM          FEED PUMP #1 TRIP
626 REM
630 IFAAND32THENAD=0
634 REM
635 REM          GRID BREAKER OPEN
636 REM
640 IFAAND64THENAL$="O"
644 REM
645 REM          REACTOR COOLANT PUMP #2 START
646 REM
650 IFAAND128THENAB=34
654 REM
655 REM          REACTOR COOLANT PUMP #1 START
656 REM
660 A=INP(12):IFAAND1THENAA=34
664 REM
665 REM          SECONDARY PORV OPEN
666 REM
670 IFAAND2THENAM=100
674 REM
675 REM          FEED PUMP #2 TRIP
676 REM
680 IFAAND4THENAE=0
684 REM
685 REM          REACTOR COOLANT PUMP #2 TRIP
686 REM
690 IFAAND8THENAB=0
694 REM
695 REM          TURBINE TRIP
696 REM
700 IFAAND16THENAI$="T"
704 REM
705 REM          CONTROL RODS OUT
706 REM
710 IFAAND32THENAO=AO+1
720 IFAO>500THENAO=500
724 REM

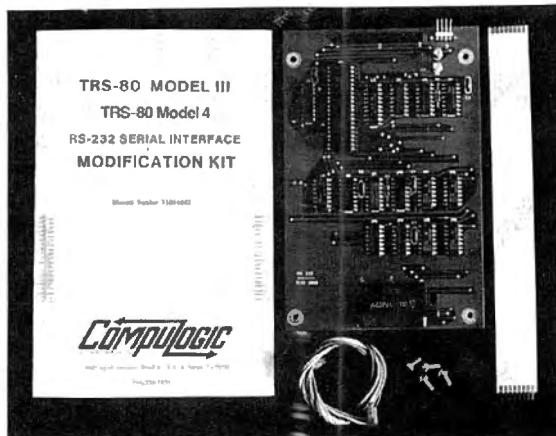
```

Listing continued

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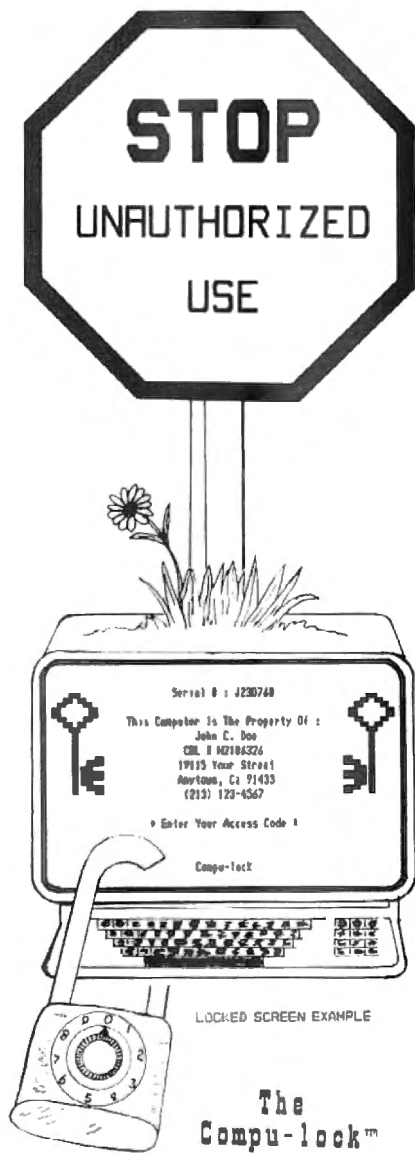
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→323

Glossary continued

Scram: Same as tripping the reactor. To shut down a nuclear reactor quickly by fully inserting the control rods.

Secondary loop: Begins in the upper half of the steam generators. Converts feed water into steam. Steam from the three steam generators flows into a common header. From this header, it flows to the turbine. Steam exiting from the turbine is condensed back into water in the condenser. Water from the condenser then pumps back into the steam generators to begin the process again.

Simulator: A device that represents a system or phenomenon and reflects the effects of changes in the original so that it can be studied, analyzed, and understood from the behavior of that device.

Simulator panel: Mimics the control room of a nuclear power plant. Contains all major controls and status lights as well as annunciator lights that warn of abnormal conditions.

Start-up rate: Rate at which the reactor is changing power levels. A positive rate indicates an increase in power; a negative number indicates a decrease in power.

Steady-state operation: Condition in which plant values remain essentially constant. Occurs after all initial transients or fluctuating conditions have settled down.

Steam dump: Bypasses the steam that normally goes to the turbine and dumps it directly into the condenser. When the turbine trips at a high reactor power level, the steam previously going to the turbine must be condensed or high secondary and primary temperatures and pressures occur. The steam dump gives the reactor a way to remove its energy while safely shutting down.

Steam generator: Generates steam to turn a turbine. High pressure water in the primary loop flows into the steam generator via bundles of tubes where heat from the reactor is transferred through the tube walls to convert pure secondary side feed water into steam. Steam generators provide isolation between the primary and secondary loops.

Synchronized: When the frequency of the generator is equal to the frequency of the grid. The frequency of the generator is directly proportional to its speed. At 3,600 RPM, the frequency of the generator is 60 hertz.

Throttle valve: Controls the speed of the turbine. Adjusting this valve brings the turbine up to synchronous speed.

Transient: A phenomenon in a system caused by a sudden change in conditions, and which persists for a relatively short time after the change.

Turbine: Converts steam into mechanical energy. The turbine is connected to the generator. ■

Listing continued

```

725 REM      BOTTOM CONTROL RODS IF REACTOR IS TRIPPED
726 REM
730 IFAH$="T"THENAO=0
734 REM
735 REM      IF REACTOR IS TRIPPED THEN TRIP THE TURBINE
736 REM
740 IFAH$="T"THENAI$="T"
744 REM
745 REM      IF THE TURBINE IS TRIPPED THEN OPEN THE GRID BREAKER
746 REM
750 IFAI$="T"THENAL$="O"
754 REM
755 REM      REACTOR COOLANT PUMP #2 STATUS
756 REM
760 IFAB>0THENYA=1ELSEYA=0
764 REM
765 REM      REACTOR COOLANT PUMP #3 STATUS
766 REM
770 IFAC>0THENYB=2ELSEYB=0
774 REM
775 REM      REACTOR STATUS
776 REM

```

Listing continued on p. 174

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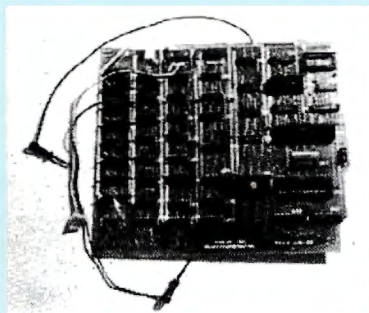
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MMS

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The Model 2000 is Tandy's response to PC fever. And a powerful response it is: 720K disk drives, 640- by 400-pixel graphics resolution, an Intel 80186 microprocessor running at 8 MHz, and MS-DOS 2.0 controlling it all.

80 Micro gave you an overview of MS-DOS (January 1984, p. 84). Now I want to take a closer look at the 2000's MS-DOS 2.0.

MS-DOS performs all the usual functions of a disk operating system—managing programs in memory, controlling disk read and write operations, monitoring and controlling peripherals, and providing a link between you and the hardware.

MS-DOS 2.0 doesn't stop there, though. It includes some features not yet available on many other microcomputers. Among them are a special directory structure, command piping, filters, data redirection, and a batch-file process.

MS-DOS also includes a line-oriented editor, a debugger, and a linking loader.

The Directory Structure

MS-DOS 2.0's directory structure lets you group related files into their own directories. You could, for example, put all your word processing files into one directory, all your accounting files into

another, and all your spreadsheet files into a third.

This makes file management a lot easier. With two disk drives, the Model 2000 can store 1.4 megabytes of information. If your average file size is 10K, you could have 140 files on-line at once. With a 10-megabyte hard disk, you can have over 1,000 files on-line. Now call up a directory and try finding that business letter you wrote last Tuesday, the one whose file name you've forgotten.

With MS-DOS 2.0, you'd have no problem. First, you'd set up a directory for all your word processing files. Next, you'd set up a subdirectory for all your business letters. Finally, you could set up subdirectories for each day of the week.

You can then get a directory of all the business letters you wrote last Tuesday by telling MS-DOS to follow a path through each directory until it gets to the one with the file in which you're interested.

A directory diagram is shown in Fig. 1. The directory on the top is the root directory. This is the first directory level on a disk and MS-DOS creates it automatically when you format a disk. You can, in fact, forget about MS-DOS's special directory features and work only with the root directory.

Think of the root directory as a file

cabinet. Each drawer in the cabinet represents a subdirectory. Each subdirectory contains its own folders, or files.

From the MS-DOS command prompt, you can create a new directory by simply typing MKDIR \name, where name is the name of the subdirectory you want to create. The MKDIR command doesn't actually create a new physical directory on the disk; it creates a file that contains a list of the files you assign to it.

Just as you can create new directories, you can delete existing ones. However, if you want to save any files in the directory, you have to put them somewhere else before you delete the directory.

Use the file-cabinet analogy. If you throw away a drawer (a directory), you also throw away the files in it unless you put them somewhere else first.

In MS-DOS, you move from one directory to another using the CHDIR (change directory) command. To continue with the example above, suppose it's Wednesday, you've just turned on your Model 2000, and you need to work with your business letter directory.

Typing CHDIR \WORDPRO\BUSLET\WED from the MS-DOS command prompt makes WED the current directory. The backslashes (\) in the command separate each directory

DOS

Operating System

name. The directory names separated by backslashes make up MS-DOS's path name. A path name shows MS-DOS what path to follow to reach the directory you want to use.

When you change directories using the CHDIR command, the directory to which you change is now the current directory. You can access any file in that directory without typing in the full path name. If you need to use a file in a different directory, however, you have to specify a path name that tells MS-DOS how to find the other directory.

Piping Hot

Most DOSes assume that your commands will come from the keyboard, and that the system's response will go to the screen. MS-DOS lets you redirect input and output. The command `DIR > FILELIST`, for example, sends the directory listing (which would normally go to the screen) to a file called FILELIST.

MS-DOS comes with a sorting program called Sort. Need to see an alphabetically sorted list of files? The command `DIR | SORT` lets you. Want to save that sorted list? Type `DIR | SORT > SORTDIR`.

The vertical bar (|) is called the pipe separator. Any output created by the command to the left of the bar becomes

input for the command to the right. The greater-than sign (>) redirects the sort program's output (which normally goes to the screen) to a file called SORTDIR.

Filters

The sorting program is one of three filters that comes with MS-DOS. A filter is a command that takes data coming in and transforms it in some way before sending it on its way.

The Sort filter can also sort in reverse order (from Z to A instead of from A to Z), and you can tell it by which column to sort. If you have a file called Names that looks like Fig. 2, typing in `SORT +9 < NAMES` sorts the file by column 9 (in this case, the last name) and displays the sorted data on the screen.

Similarly, the command `SORT +52 < NAMES` sorts the file by state. The less-than sign (<) tells MS-DOS to use the contents of the Names file as input to the Sort filter. If you omit the sign and the file name, MS-DOS expects the input to come from the keyboard.

As a reminder of how you can redirect input and output, the command `SORT +9 < NAMES > SORTNAME` sorts the file by last name (column 9) and outputs the sorted data to a file called SORTNAME instead of to the screen.

A filter called More simply takes

standard screen output and displays it one screen at a time. For example, assume you want to read a long file called Letter. The command `TYPE LETTER | MORE` displays the file one screen at a time, with the message -MORE- appearing at the bottom of each screen. Pressing the enter key advances you to the next screen.

The Find filter does just that—searches for a string or a constant in a file. Suppose you're working with that file called Letter and you need to find the string "I hope to see you there." Use the command `FIND "I hope to see you there" LETTER`.

The Find filter also has options that let you display all the lines that don't contain the string, display only the number of lines in the file that contain the string, and display a relative line number before each line.

Each MS-DOS filter is valuable by itself. Used together and with piping and input/output redirection, they are powerful utilities that you can use to master powerful hardware.

Batch Files

MS-DOS also has a powerful batch-processing feature. With batch processing, you're able to store a batch of commands in a file and execute them by typing in the file's name instead of typing

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in each command.

MS-DOS takes batch processing one step further. Your batch files can contain dummy parameters that you replace with real parameters when you use the batch file.

Suppose you have a batch file called FILECOPY.BAT that contains the following:

```
TYPE %1
COPY %1 %2
DEL %1
DIR | SORT
```

Type FILECOPY NEWPAGE.TXT B:OLDPAGE.TXT, and MS-DOS displays the contents of the file called NEWPAGE.TXT, copies the file to the disk in drive B, and calls the new copy OLDPAGE.TXT. It then deletes NEWPAGE.TXT from the disk in the current drive and displays a sorted directory listing of the current disk.

The result is the same as if you typed in:

```
TYPE NEWPAGE.TXT
COPY NEWPAGE.TXT B:OLDPAGE.TXT
DEL NEWPAGE.TXT
DIR | SORT
```

MS-DOS has batch-processing commands that let you write batch files approaching the power of complete programs. The For command lets you execute a command more than once, giving the command new parameters with each execution.

The If command lets you execute a command based on the existence of a specified file, or based on the receipt of an error code from an MS-DOS program. The Goto command alters the execution flow of a batch file based on the result of an If test.

You can also use MS-DOS's filtering and piping features in batch files and as dummy parameters. This gives you some incredibly powerful and versatile batch files.

The biggest limitation of MS-DOS's batch-processing capabilities is that the

Humble Beginnings

Once upon a time back in the late 1970s, a company called Seattle Computer developed an S100-based microcomputer that used a new 16-bit chip—the Intel 8086. The one thing missing was a disk operating system for the machine.

Tim Paterson, one of the firm's programmers, whipped out a quick-and-dirty operating system for the new machine. He called it, for lack of a better name, QDOS. Seattle Computer soon renamed the fledgling DOS 86-DOS, probably because their marketing people were tired of explaining the acronym.

A couple of years later, Microsoft licensed 86-DOS from Seattle Computer to develop some 16-bit software. Soon after that, they bought the rights to the system and changed its name again, this time to MS-DOS.

Eventually, a computer company called IBM went looking for a disk operating system for a new microcomputer they were developing. They contacted Digital Research and Microsoft to see what each had to offer.

Digital Research pushed CP/M; Microsoft pushed MS-DOS. For a variety of reasons, some technical, some economic, IBM chose to go

with Microsoft. They licensed MS-DOS and—you guessed it—renamed it PC-DOS.

As it happened, IBM's Personal Computer (PC) took the industry by storm. Seeing IBM enter the market finally convinced the skeptics who still thought microcomputers were the hula hoops of the 80s.

In 1982, IBM sold 200,000 PCs. Last year, they sold about a half-million. New companies formed, sometimes overnight, to manufacture PC clones—machines that performed almost exactly like the PC and that ran the same software.

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When IBM introduced the PC/XT, a personal computer with a built-in hard disk, Microsoft introduced MS-DOS 2.0, a new, more powerful version. What began as QDOS has become the king of the 16-bit operating system mountain. ■

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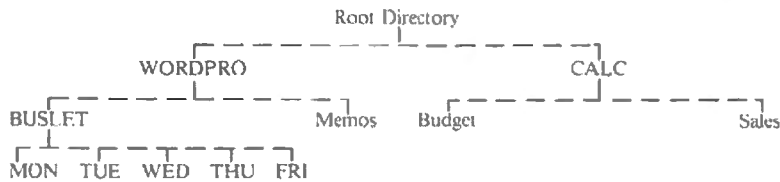


Figure 1. A typical MS-DOS directory tree, containing a root directory and subdirectories.

Joe	Smith	53 Lookout St.	Peterborough	NH	03458
Mary	Jones	120 Grove Ave.	Sometown	PA	40345
Fred	Bates	5323 Ferndale	Detroit	MI	34233
Kelly	Bugsy	10 Strand Way	Skokie	IL	60077

Figure 2. The Names file.

Function	Key(s)	Description	Level II Basic
Copy char	F1 or →	Copies one character from the template to the command line	spacebar
Delete char	Delete	Deletes a character from the template	D
Copy to char	F2 char	Copies all characters up to the specified character	S char
Copy all	F3	Copies all remaining characters	X
Insert	Insert	Lets you insert characters (pressing F3 exits insert mode)	I
Replace template		Makes the new line the new template, but does not send it to the command processor	none
Void line		voids the current input, leaving the template unchanged	Q

Table 1. The MS-DOS editing template commands and Level II Basic equivalents.

Table 2. The MS-DOS commands. The letter in parentheses after each command indicates whether the command is internal or external.

Command	Function
Backup (E)	Copies files from hard disk to floppy disks
Break (I)	Disables or activates the MS-DOS break key (control/C)
Chdir (I)	Changes the current directory and displays it
Chkdsk (E)	Reads and checks a directory for errors, and also repairs some errors
CLS (I)	Clears the screen and returns the cursor to upper left
Compdupe (E)	Copies disk in drive A to disk in drive B, then compares the two
Copy (I)	Copies the specified file or files
Ctty (I)	Changes the input/output device
Date (I)	Displays and sets the date
Del (I)	Deletes the specified file or files
Dir (I)	Displays the contents of the directory
Diskcopy (E)	Copies a disk
Echo (I)	Turns the batch file echo feature on or off
Erase (I)	Deletes the specified file or files (same as Del)
Exe2bin (E)	Converts executable files to binary (command) format
Exit (I)	Exits a command and returns to the lower level
FC (E)	Compares two files
Find (E)	Searches for a string or value
For (I)	Executes a command for each item in a set (batch processing)
Format (E)	Initializes a floppy disk to receive files
Goto (I)	Transfers control to a specified line in a batch file
If (I)	Allows conditional execution of commands in a batch file
Hformat (E)	Formats a hard disk drive

Table 2 continued

system cannot ask questions and execute commands based on your response.

The Editing Template

Tandy's command-editing template is a unique feature that might not excite you much at first. However, once you master MS-DOS and start typing long, complex command lines, you might wonder how you got along without the template.

When you press the enter key after typing a command, MS-DOS sends the command to the command processor and also stores what you typed into the template. Using the Model 2000's function keys, you can then repeat the

*You'll appreciate
the template
when you start using
commands containing
long path names.*

command instantly, edit the command without retyping all of it, or edit the command into a similar command to save keystrokes.

The template isn't that valuable to you if most of your commands are simple and short, such as copying within the current directory and displaying the current directory. You'll appreciate the template when you start using commands containing long path names and using filters and piping.

Table 1 contains a list of the template editing commands, and compares the commands to a familiar and similar editor, the Level II Basic line editor.

MS-DOS Commands

Table 2 describes each MS-DOS command. I'll explain the most interesting ones below.

MS-DOS has two types of commands: internal and external. The code that executes internal commands is always in memory, while external commands are utility programs that load into memory when you type their names. Typical internal commands are Copy, Dir (the directory command), and the commands that create and change directories.

Among the more interesting external commands is Chkdsk, which checks a disk's directory for errors. Chkdsk automatically repairs several types of directory errors and displays a free

Table 2 continued

Mkdir (I)	Makes a directory
More (E)	Displays output one screen at a time
Path (I)	Sets a command-search path
Pause (I)	Suspends execution of a batch file
Print (E)	Lets you print while processing (spooler)
Prompt (I)	Lets you define a new system prompt
Recover (E)	Recovers a bad disk or file
REM (I)	Displays a remark in a batch file
Rename (I)	Changes the name of a file
Restore (E)	Copies backed-up files from floppy disk to hard disk
Rmdir (I)	Removes a directory
Set (I)	Sets one string value to another
Shift (I)	Increases the number of replaceable parameters in a batch process
Sort (E)	Sorts data alphabetically, forward or backward
Sys (E)	Transfers MS-DOS system files to the specified drive
Time (I)	Displays and sets the time
Type (I)	Displays the contents of the specified file
Ver (I)	Displays the MS-DOS version number
Verify (I)	Verifies all disk writes
Vol (I)	Displays the volume-identification number

space report, shown in Fig. 3.

Compdupe makes a mirror-image copy of a disk, then compares the two for discrepancies. FC (file comparison) compares two files, either line by line or byte by byte as you specify, and displays or prints the differences.

Exit lets you exit an application program, execute commands, and return to the program. Recover recovers either a file that contains bad sectors, or all files on a disk that contains bad sectors in its directory.

Other Utilities

Three larger utility programs supplied with MS-DOS are a line editor (Edlin), a debugger (Debug), and a linking loader (Link).

Edlin is a text-editing program that creates batch files and Assembly-language source files. The program has search and replace capabilities, and it lets you insert new lines in the middle of a file and move blocks of lines to different positions.

Edlin also uses the editing template. When you're using Edlin, the template stores the last line you type. You can then use the Model 2000's function keys (see Table 1) to save keystrokes if your next line is similar.

Edlin works, but its line-oriented editing is a real limitation. If you write a lot of Assembly-language programs, you'll probably want to buy a good full-screen editor that lets you move the cursor around on the screen.

The Debug utility is for Assembly-language programmers. It lets you display and modify memory and register contents, and it lets you execute a machine-language program with up to 10 breakpoints.

When Debug encounters a breakpoint, it stops executing the program and displays the registers, flags, and the next instruction in the program. Unfortunately, Debug won't let you single-step your way through a program.

Debug also lets you edit a disk file, compare two memory blocks, fill a memory block with a value or set of values, search memory for a string or value, disassemble programs, perform hexadecimal arithmetic, and input or output a byte to or from a port.

Link is another program that will interest only Assembly-language programmers. When you write an Assembly-language program, you must run the assembled object code through the linking process to create a file that the Model 2000 can execute.

Link produces relocatable object modules and combines separately produced object code into a single command file. It also resolves external references—references in one module to symbols defined in a different module.

Software?

You might be tempted to think that, because the Model 2000 runs MS-DOS, all programs written for MS-DOS, specifically those for the IBM PC, will run on the Model 2000.

Alas, that's not the case. Programs written to use a specific piece of the PC's hardware do not run on the Model 2000. Programs that use only MS-DOS system calls generally will run on the Model 2000. See Table 3 for a list of both types of programs.

A programmer would bypass an MS-DOS routine and go directly to the hardware for one primary reason: speed. Many IBM PC programs that re-

737280	bytes total disk space
40960	bytes in 2 hidden files
512	bytes in 2 directories
34560	bytes in 8 user files
661248	bytes available on disk
131072	bytes total memory
105038	bytes free

Figure 3. A sample Chkdsk report on a disk that contains no errors.

ly on a lot of displays or graphics directly access the PC's video memory. This makes them faster, but it also ties them to the PC and to clones with identically configured video memory.

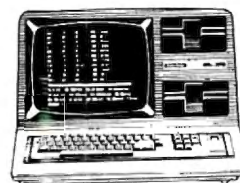
But the Model 2000 owner shouldn't worry. Many excellent programs are available for the 2000 now, and manufacturers will convert a lot of the incompatible programs.

Conclusion

Tandy's Model 2000 is a powerful computer that needs a powerful disk operating system to control it. MS-DOS 2.0 can handle the challenge.

Its tree-like directory structure lets

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you easily organize files on the Model 2000's high-capacity drives, its filtering and piping features add significant flexibility, and its powerful batch-processor lets you perform a multitude of commands and complex operations by typing in a few words.

Of course, power isn't everything. What makes a computer really valuable is the software available for it.

MS-DOS 2.0 comes out ahead here, too. The MS-DOS user can run some of the most powerful, yet easy to use, programs ever written for micros, and can

be sure that many more will be available in the future. ■

Jim Heid is a technical editor for Microcomputing magazine. Write to him c/o 80 Micro, 80 Pine St., Peterborough, NH 03458.

Packages that do run on the Model 2000, sometimes with modifications.

Software Package	Vendor Name	Software Package	Vendor Name
Bottom Line Strategist	Ashton-Tate	EasyFile	
Grammatik	Aspen/Wang	General Ledger	
Random House Dict/Proofreader		Inventory Control/Analysis	
PlanFin	Business Software	Order Entry	
ProFin		MasterSolver	MicroAp
Data Ace	Computer Software Design	Selector	
Application Library Vol. I	Target/Comshare	SuperSort	MicroPro
Financial Modeling		Punctuation/Style Checker	Oasis Systems
OmniBasc	Conceptual Software	The Word Plus	
CodeWriter	Dynatech	Accounts Payable	Open Systems
QuickCode	Fox and Geller	Accounts Receivable	
Real Estate Analyzer	HowardSoft (requires color monitor)	Basic Business Interpreter	
	(requires color monitor)	Front Runner Kit	
Tax Preparer	IBM	General Ledger	
Accounts Payable (Peachtree)		Inventory	
Accounts Receivable (Peachtree)		Job Cost	
General Ledger (Peachtree)		Payroll	
Payroll (Peachtree)		Sales Order Processing	
QuickPro+	ICR FutureSoft	Team Manager	
Accounts Payable	Info Unlimited Systems (IUS)	Letterform 1000	PBL Corporation
		PMCOBOL	Ryan McFarland
Accounts Receivable		Spellguard	Sorcim

Packages that do not run on the Model 2000.

Software Package	Vendor Name	Software Package	Vendor Name
Millionaire	Blue Chip Software	Transporter	
D.J. Market Analyzer	Dow Jones	Personal Investor	PBL
dGraph	Fox and Geller	Accounts Payable	Peachtree
dUtil		Accounts Receivable	(selfbound)
Smartcom	Hayes	General Ledger	
Mailing List	IBM	Graphics Language	
Payroll		Inventory Control	
Peachtext		Sales Invoicing	
Professional Editor		Smarterm PC	Persoft
Time Manager		Norton Utilities	Peter Norton
WordProff 1.0		WordPlus/The Boss	Professional Soft
The Instructor	Individual Software	Executive Secretary	SofSys
EasyMailer	Info Sys Unlimited	SuperCalc II	Sorcim
EasyPlanner		SuperWriter	
EasySpeller		Snooper Trooper	Spinnaker Software
EasyWriter		VisiCalc	VisiCorp
Volkswriter	Lifetree Software	VisiDex	
MasterType	Lightening Software	VisiFile	
DataFax	Link Systems	VisiSpell	
Lotus 1-2-3	Lotus	VisiTrend/Plot	
Lotus 1-2-3 Graph		VisiWord	
Async Communications	MicroPro		
CalcStar			
InfoStar Systems			
Starburst			
WordStar*			
Typing Tutor	Microsoft		
CrossTalk	MicroStuff		

**A version of WordStar does run on the Model 2000. MicroPro's plain MS-DOS version uses only MS-DOS system calls and is not modified to use any of the Model 2000's function and cursor-movement keys. MicroPro is working on a version especially for the Model 2000.*

Table 3. IBM Products.

CLONE I



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If you care about TIME, you need Clone. Why did you buy your computer? If you are like us, you need your computer to save you time. You follow proper programming procedures and backup everything twice. **THIS TAKES TIME!** If you use more than one disk operating system, **IT TAKES TIME.** At the end of our programming day we have at least 8 disks to backup twice. With the disk backup utilities that came with our disk operating systems, formatting and verifying that many disks could take 64 minutes, not to mention the amount of time that it took to initialize and answer the opening inquiries for the various disk operating systems we use. Now we use the Clone duplication system and the entire process takes less than 23 minutes. Clone is so reliable at verifying that we never worry about having a bad duplication. We are sure you know that a disk which has not been properly verified might cause problems you would not detect for months. Clone is so advanced that passwords, densities or different disk operating systems don't affect its efficient operation. Clone is so flexible that we are also able to duplicate Atari 400, Atari 800, TRS-80 Color Computer as well as TRS-80 Model I, III, or IV disks. Clone is so sophisticated that if it encounters a damaged disk and is unable to read it, you can ask it to keep trying, take it's best guess, or give up. Most backup utilities just give up. Clone's error messages will explain exactly what the trouble is. Finally, Clone IS FAST! It takes just 1 minute 25 seconds to format, duplicate, and verify a disk that used to take us 4 minutes to complete.

We are sure that everyone who owns a TRS-80 Model I, III, or IV would benefit from owning the Clone duplication system. Clone will become an indispensable part of your programming library. Unlike copying utilities, Clone will have a lasting usefulness which is not dependent on any other program's availability. That is why we at Gibberman Enterprises are proud to offer you Clone I for TRS-80 Model I or Clone III for TRS-80 Model III or IV.

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PRESS <CLEAR> TO PLAY

Month by month, this game will creep up on you.

Over the next six months, I'll show you how to write a program that's full of bugs. Hundreds of bugs. Star-shaped bugs that fly in deadly formation, flying saucer bugs that rain lethal bombs, killer spiders that swoop down at dizzying speed.

Bugs from Outer Space is a full-featured Model I/III machine-language arcade game. By the time you finish this series of articles, you'll not only be able to dodge bugs and bombs, fighting to reach immortality (or at least the permanent scoreboard), but you'll learn enough to write machine-language games of your own.

Programming Bugs

Bugs' source code consists of several parts (modules), linked together with equates. Therefore, resist the urge to modify the code as you enter it into the

editor/assembler—the addresses (second column) of the symbol tables must match those given in the article listings.

You won't have to wait six months for results; the modules are designed so you can execute the code each month and see the results of your efforts. This month, you'll write the title screen and compose a little Bugs music (the introductory sound).

Introducing the Bugs

Program Listing 1 is the first version of the main program, MAIN1/CMD. For the most part, the main program should call other routines in a loop, but Bugs contains additional code. Be sure to enter all lines, including those stored as comments (indicated by a semicolon); you'll use them, minus the semicolons, in later versions of the game.

MAIN1/CMD begins by calling the introduction subroutine, TEXT1/CMD (Program Listing 2). This routine first displays a screen, calls a subroutine twice to make a strange sound, then displays the title screen and produces the sound again.

The program stores the screen code using the space compression codes,

CO-FF hexadecimal (hex), which represent 0-3F hex (0-63) spaces. Note that it stores a zero in 4024 hex before the program calls the Display subroutine. This selects space compression rather than special characters on the Model III.

TEXT1/CMD then waits for you to press the clear key. A delay within the loop checks the key to prevent the TRS-80's high-frequency signals from causing false alarms.

When you press the clear key, TEXT1 executes a typical screen melt to erase the display, then returns control to the main program.

After you assemble both programs (don't forget the /CMD extension in the file name) and verify that the addresses in the symbol tables are correct, type LOAD TEXT1/CMD from the DOS Ready prompt. Then type MAIN1/CMD and press the enter key.

If you don't have a disk system, enter the source code into your tape-based editor/assembler, then save it. Load the source code and assemble the programs to tape with the names given above (without the /CMD extension).

Reset the computer and press the enter key at the Mem Size? prompt.

The Key Box

Models I and III
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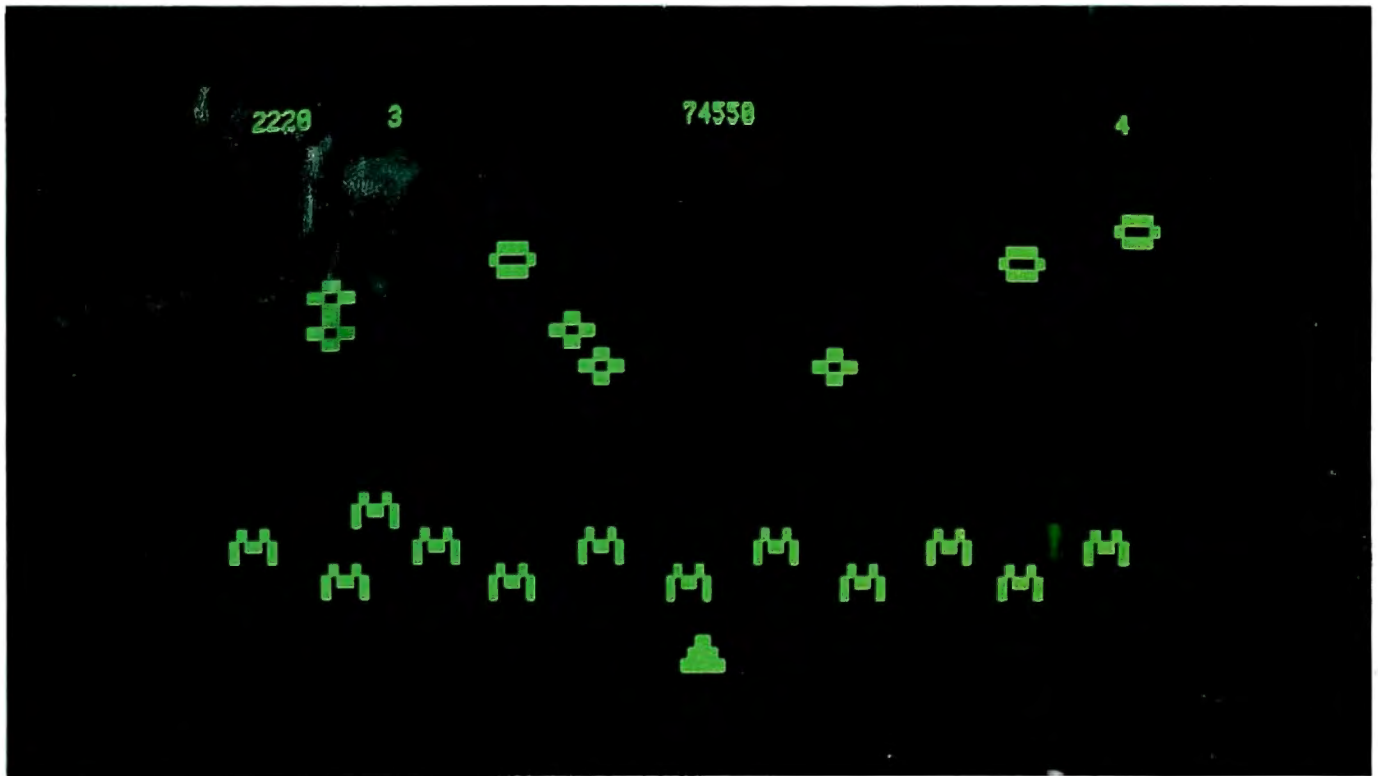


Photo 1 (left). Results of this month's Bugs program: the title screen. Photo 2 (above). Screen display of Bugs game in progress.

Use the SYSTEM command to load TEXT1's object code; when the * prompt reappears, load MAIN1's object code.

After MAIN1 loads and the asterisk appears again, type / and press the enter key.

You should see the first introductory screen and (if you have an amplifier connected to the cassette output) hear the accompanying sound. After a few seconds, the title screen appears and the sound continues for a short time.

If you then press the clear key, the screen melts and remains clear. That's all the program does until you add the other modules, except for what happens if you press P after the screen clears.

Next month, I'll describe how to display the score and build the game's command base. You'll need a month to practice moving and firing before you're ready to shoot down bugs. ■

Roger Smith is a software consultant and Beatles fan. He'll answer letters sent with stamped, self-addressed envelopes to 267 Seminole Tr., Crestview, FL 32536, but you'll have to wait for future articles to get the complete game.

Program Listing 1. Bugs from Outer Space main program, MAIN1/CMD.

```

00100 ;***** MAIN PROGRAM
00110 ;      VERSION 1
6DDD  00120      ORG      6DDDH
65C0  00130 ADD1      EQU      65C0H
663A  00140 ADD2      EQU      663AH
66B4  00150 ADD3      EQU      66B4H
6BFB  00160 ADDMB     EQU      6BFBH
6AB8  00170 ATTACK    EQU      6AB8H
6463  00180 BASEM     EQU      6463H
63EB  00190 BOMBS     EQU      63EBH
69E9  00200 BOOM      EQU      69E9H
6359  00210 RUG1      EQU      6359H
6389  00220 BUG2      EQU      6389H
63B9  00230 BUG3      EQU      63B9H
6203  00240 DISSCR    EQU      6203H
690D  00250 DRAW      EQU      690DH
6590  00260 EXPTAB    EQU      6590H
624F  00270 HIGH      EQU      624FH
6235  00280 INCSGR    EQU      6235H
62D9  00290 INIT      EQU      62D9H
61BC  00300 INTRO     EQU      61BCH
6A50  00310 LEVEL     EQU      6A50H
6AA4  00320 LEVTAB    EQU      6AA4H
640D  00330 MBASE     EQU      640DH
6C57  00340 MBOMB     EQU      6C57H
656C  00350 MINUS1    EQU      656CH
695D  00360 MOVEB1    EQU      695DH
6970  00370 MOVEB2    EQU      6970H
6983  00380 MOVEB3    EQU      6983H
6494  00390 MSHOT     EQU      6494H
6AB4  00400 ONE       EQU      6AB4H
6259  00410 PARAMS    EQU      6259H
6253  00420 SCORE     EQU      6253H
6568  00430 SHIPS     EQU      6568H
63E9  00440 SHOT      EQU      63E9H
6487  00450 SOUND1    EQU      6487H
6B56  00460 SOUND2    EQU      6B56H
6BE4  00470 SOUND3    EQU      6BE4H
6CAB  00480 SOUND4    EQU      6CABH
618A  00490 SOUNDX    EQU      618AH
640B  00500 TEMPW     EQU      640BH
6B20  00510 TEST      EQU      6B20H
6B74  00520 TEST2     EQU      6B74H
6B9B  00530 TEST3     EQU      6B9BH
6BC1  00540 TEST5     EQU      6BC1H
6CB6  00550 TEST6     EQU      6CB6H
64DF  00560 TEST7     EQU      64DFH
6CCD  00570 FLASH     EQU      6CCDH
6CF4  00580 SOUNDI    EQU      6CF4H
6D1B  00590 START     EQU      6D1BH
00600 ;***** ENTRY POINT
6DDD  CDBC61 00610 ENTRY  CALL  INTRO      ;INTRODUCTION
6DE0  21D962 00620 GAME   LD    HL,INIT    ;INITIALIZE PARAMETERS
6DE3  115962 00630        LD    DE,PARAMS
6DE6  017F00 00640        LD    BC,127
6DE9  EDB0   00650        LDIR

```

Listing 1 continued

- ADD
- CHANGE
- DELETE
- SORT
- SELECT
- SAVE
- PRINT
- COMPUTE
- REPORT
- MERGE



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SOFTRENDS

Listing 1 continued

```

6DEB 210000 00660 LD HL,0
6DEE 22506A 00670 LD (LEVEL),HL ;LEVEL = 0
6DF1 22526A 00680 LD (LEVEL+2),HL
6DF4 225362 00690 LD (SCORE),HL ;SCORE = 0
6DF7 225562 00700 LD (SCORE+2),HL
6DFA 226A65 00710 LD (SHIPS+2),HL
6DFD 210500 00720 LD HL,5
6E00 226065 00730 LD (SHIPS),HL ;BASES = 5
6E03 DD215962 00740 LD IX,PARAMS ;IX==>PARAMETER TABLE
6E07 110000 00750 LD DE,0
00760 ; CALL BASEM ;DISPLAY BASE
6E0A 11003C 00770 LD DE,3C00H
6E0D 215362 00780 LD HL,SCORE
00790 ; CALL DISSCR ;DISPLAY SCORE
6E10 11063C 00800 LD DE,3C06H
6E13 216065 00810 LD HL,SHIPS
00820 ; CALL DISSCR ;DISPLAY BASES LEFT
6E16 111E3C 00830 LD DE,3C1EH
6E19 214F62 00840 LD HL,HIGH
00850 ; CALL DISSCR ;DISPLAY HIGH SCORE
6E1C DD7E06 00860 LD A,(IX+6) ;STORE SPEEDS
6E1F DD7721 00870 LD (IX+33),A
6E22 DD7E08 00880 LD A,(IX+8)
6E25 DD7722 00890 LD (IX+34),A
6E28 DD363000 00900 LD (IX+48),0 ;NEW LEVEL FLAG
6E2C 215963 00910 NEXT LD HL,BUG1 ;CLEAR BUG TABLE
6E2F 115A63 00920 LD DE,BUG1+1
6E32 018F00 00930 LD BC,40+40+40-1
6E35 3600 00940 LD (HL),0
6E37 EDB0 00950 LDIR
6E39 219065 00960 LD HL,EXPTAB ;CLEAR EXPLOSION TABLE
6E3C 119165 00970 LD DE,EXPTAB+1
6E3F 012F00 00980 LD BC,47
6E42 3600 00990 LD (HL),0
6E44 EDB0 01000 LDIR
6E46 21EB63 01010 LD HL,BOMBS ;CLEAR BOMBS TABLE
6E49 11EC63 01020 LD DE,BOMBS+1
6E4C 011F00 01030 LD BC,31
6E4F 3600 01040 LD (HL),0
6E51 EDB0 01050 LDIR
6E53 210000 01060 LD HL,0
6E56 22E963 01070 LD (SHOT),HL ;CLEAR SHOT LOCATION
6E59 220B64 01080 LD (TEMPW),HL
6E5C DD362900 01090 LD (IX+41),0 ;RESET FLAGS
6E60 DD362A00 01100 LD (IX+42),0
01110 ; LD (IX+31),0
01120 ; LD (IX+32),0
6E64 DD362F00 01130 LD (IX+47),0
6E68 DD7E21 01140 LD A,(IX+33) ;RESTORE SPEEDS
6E6B DD7706 01150 LD (IX+6),A
6E6E DD7E22 01160 LD A,(IX+34)
6E71 DD7708 01170 LD (IX+8),A
01180 ; CALL FLASH ;FLASH AND CLS
01190 ; CALL SOUNDI ;SOUND AND INC LEVEL
01200 ; CALL START ;INITIALIZE
6E74 0604 01210 LOOPMN LD B,4
6E76 C5 01220 LOOPX0 BC
01230 ; CALL MOVEB1
01240 ; CALL MOVEB2
01250 ; CALL MOVEB3
01260 ; CALL DRAW
01270 ; CALL TEST8
01280 ; CALL MBOMB
01290 ; LD A,(IX+30) ;BASE HIT?
01300 ; OR A
01310 ; CALL Z,MBASE ;MOVE IT IF NOT
01320 ; CALL ADDBMB
01330 ; CALL SOUND4
01340 ; CALL MSHOT
01350 ; CALL SOUND1
01360 ; CALL TEST
01370 ; CALL SOUND2
01380 ; CALL BOOM
01390 ; CALL TEST2
01400 ; CALL TEST3
01410 ; CALL SOUND3
01420 ; CALL TEST5
01430 ; CALL TEST6
6E77 C1 01440 POP BC
6E78 DD7E2A 01450 LD A,(IX+42) ;NEXT LEVEL?
6E7B B7 01460 OR A
6E7C C22C6E 01470 JP NZ,NEXT
6E7F DD7E29 01480 LD A,(IX+41)
6E82 B7 01490 OR A
6E83 C2956E 01500 JP NZ,CONT ;JP IF BASE HIT
6E86 10EE 01510 DJNZ LOOPX0
6E88 DD342B 01520 CALL ATTACK
01530 INC (IX+43)
01540 ; CALL ADD1
01550 ; CALL ADD2
01560 ; CALL ADD3
6E8B 3A0438 01570 LD A,(3004H) ;CHECK FOR 'P'
6E8E E601 01580 AND 1
6E90 C4046F 01590 CALL NZ,PAUSE ;PAUSE IF SO
6E93 18DF 01600 JR LOOPMN ;LOOP
6E95 DD3523 01610 CONT DEC (IX+35) ;DECREMENT LEVEL
6E98 DD363001 01620 LD (IX+48),1 ;SET FLAG
6E9C 216065 01630 LD HL,SHIPS ;TEST IF 0 LEFT
6E9F 0603 01640 LD B,3
6EA1 AF 01650 XOR A
6EA2 B6 01660 CONT10 OR (HL) ;OR # SHIPS
6EA3 23 01670 INC HL
6EA4 10FC 01680 DJNZ CONT10 ;LOOP UNTIL B=0
6EA6 C22C6E 01690 JP NZ,NEXT ;JP IF NOT GAME OVER
6EA9 21DD6F 01700 LD HL,MESS10 ;DISPLAY MESSAGE

```

Listing 1 continued


```

6EAC 119B3C 01710 LD DE,3CA0H-5
6EAF 010B00 01720 LD BC,11
6EB2 EDB0 01730 LDIR
6EB4 21E6F 01740 LD HL,MESS20 ;DISPLAY SECOND LINE
6EB7 11D33C 01750 LD DE,3CE0H-13
6EBA 011D00 01760 LD BC,29
6EBD EDB0 01770 LDIR
6EBF 1E0A 01780 LD E,0AH ;SOUND
6EC1 0E10 01790 OVER05 LD C,10H
6EC3 0640 01800 OVER10 LD B,40H
6EC5 C5 01810 OVER20 PUSH BC
6EC6 10FE 01820 DJNZ $
6EC8 C1 01830 POP BC
6EC9 CD8A61 01840 CALL SOUNDX
6ECC 10F7 01850 DJNZ OVER20
6ECE 0D 01860 DEC C
6ECF 20F2 01870 JR NZ,OVER10
6ED1 010003 01880 LD BC,300H
6ED4 CD6000 01890 CALL 60H
6ED7 1D 01900 DEC E
6ED8 20E7 01910 JR NZ,OVER05
6EDA 3A4038 01920 OVER30 LD A,(3040H)
6EDD 10FE 01930 DJNZ $
6EDF E602 01940 AND 2
6EE1 28F7 01950 JR Z,OVER30 ;LOOP UNTIL <CLEAR>
6EE3 21003C 01960 LD HL,3C00H ;CLEAR SCREEN
6EE6 11013C 01970 LD DE,3C01H
6EE9 3680 01980 LD (HL),128
6EEB 01FF03 01990 LD BC,1023
6EEE EDB0 02000 LDIR
6EF0 C3E06D 02010 JP GAME ;DO IT
6EF3 DD7E2F 02020 TEST8 LD A,(IX+47) ;BUG HIT?
6EF6 B7 02030 OR A
6EF7 C8 02040 RET Z
6EF8 DD362F00 02050 LD (IX+47),0 ;RETURN IF NOT
6EFC 3A0C64 02060 LD A,(TEMPW+1) ;RESET FLAG
6EFF B7 02070 OR A ;SHOT FIRED?
6F00 C8 02080 RET Z ;RETURN IF NOT
6F01 C3DF64 02090 JP TEST7 ;BUG HIT SUB
6F04 1E20 02100 PAUSE LD E,20H
6F06 0E40 02110 PAUSEA LD C,40H
6F08 43 02120 PAUSEB LD B,E
6F09 CD8A61 02130 CALL SOUNDX
6F0C 10FE 02140 DJNZ $
6F0E 0D 02150 DEC C
6F0F 20F7 02160 JR NZ,PAUSEB
6F11 43 02170 LD B,E
6F12 10FE 02180 DJNZ $
6F14 1D 02190 DEC E
6F15 20EF 02200 JR NZ,PAUSEA
6F17 21003C 02210 LD HL,3C00H ;STORE LINE
6F1A 115E6F 02220 LD DE,BUFFER
6F1D 014000 02230 LD BC,64
6F20 EDB0 02240 LDIR
6F22 219E6F 02250 LD HL,MESS ;DISPLAY MESSAGE
6F25 11003C 02260 LD DE,3C00H
6F28 014000 02270 LD BC,64
6F2B EDB0 02280 LDIR
6F2D 3A4038 02290 PAUSE1 LD A,(3040H)
6F30 10FE 02300 DJNZ $
6F32 E602 02310 AND 2
6F34 28F7 02320 JR Z,PAUSE1 ;LOOP UNTIL <CLEAR>
6F36 215E6F 02330 LD HL,BUFFER ;RESTORE LINE
6F39 11003C 02340 LD DE,3C00H
6F3C 014000 02350 LD BC,64
6F3F EDB0 02360 LDIR
6F41 010020 02370 LD BC,2000H ;DELAY
6F44 CD6000 02380 CALL 60H
6F47 1E20 02390 LD E,20H ;MORE SOUND
6F49 0E20 02400 PAUSE2 LD C,20H
6F4B 7B 02410 PAUSE3 LD A,E
6F4C ED44 02420 NEG
6F4E 47 02430 LD B,A
6F4F CD8A61 02440 CALL SOUNDX
6F52 10FE 02450 DJNZ $
6F54 0D 02460 DEC C
6F55 20P4 02470 JR NZ,PAUSE3
6F57 43 02480 LD B,E
6F58 10FE 02490 DJNZ $
6F5A 1D 02500 DEC E
6F5B 20EC 02510 JR NZ,PAUSE2
6F5D C9 02520 RET
0040 02530 BUFFER DEFS 64
6F9E 2A 02540 MESS DEFM ' * * * * * PAUSE --- Press
<CLEAR> to play * * * * * '
6FDD 20 02550 MESS10 DEFM ' GAME OVER '
6FE8 20 02560 MESS20 DEFM ' Press <CLEAR> to play again '
0000 02570 END
00000 TOTAL ERRORS
28887 TEXT AREA BYTES LEFT
ADD1 65C0 00130
ADD2 663A 00140
ADD3 66B4 00150
ADDBMB 6BFB 00160
ATTACK 6AB0 00170
BASEM 6463 00180
BOMBS 63EB 00190 01010 01020
BOOM 69E9 00200
BUFFER 6F5E 02530 02220 02330
BUG1 6359 00210 00910 00920
BUG2 6389 00220
BUG3 63B9 00230
CONT 6E95 01610 01500
CONT10 6EA2 01660 01680

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SEE PAGE 11



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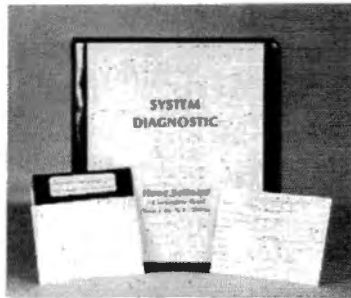
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Listing 2 continued

6052 97C1	00580	DEFW	0C197H
6054 8AB0	00590	DEFW	0B08AH
6056 85CF	00600	DEFW	0CF85H
6058 8PB0	00610	DEFW	0B0BFH
605A B5B2	00620	DEFW	0B2B5H
605C B3B3	00630	DEFW	0B3B3H
605E B3B3	00640	DEFW	0B3B3H
6060 B3B1	00650	DEFW	0B1B3H
6062 RA95	00660	DEFW	95BAH
6064 FFDE	00670	DEFW	0DEFFH
6066 3830	00680	DEFW	3838H
6068 C14D	00690	DEFW	4DC1H
606A 6963	00700	DEFW	6369H
606C 726F	00710	DEFW	6F72H
606E C161	00720	DEFW	61C1H
6070 6E64	00730	DEFW	646EH
6072 C152	00740	DEFW	52C1H
6074 6F67	00750	DEFW	676FH
6076 6572	00760	DEFW	7265H
6078 C153	00770	DEFW	53C1H
607A 6D69	00780	DEFW	696DH
607C 7468	00790	DEFW	6874H
607E F050	00800	DEFW	50F0H
6080 7265	00810	DEFW	6572H
6082 7365	00820	DEFW	6573H
6084 6E74	00830	DEFW	746EH
6086 00	00840	DEFB	0
6087 1C1F	00860	DEFW	1FLCH
6089 FFD1	00870	DEFW	0D1FFH
608B A090	00880	DEFW	90A0H
608D FDB8	00890	DEFW	0B8FDH
608F 87FC	00900	DEFW	0FC87H
6091 A09E	00910	DEFW	9EA0H
6093 8D8C	00920	DEFW	8C8DH
6095 8C8C	00930	DEFW	8C8CH
6097 AC90	00940	DEFW	90ACH
6099 C1A0	00950	DEFW	0A0C1H
609B 9CC3	00960	DEFW	0C39CH
609D B084	00970	DEFW	84B8H
609F C1B8	00980	DEFW	0B0C1H
60A1 8C8C	00990	DEFW	8C8CH
60A3 8C8C	01000	DEFW	8C8CH
60A5 BC84	01010	DEFW	84BCH
60A7 A09C	01020	DEFW	9CA0H
60A9 8C8C	01030	DEFW	8C8CH
60AB 8C8C	01040	DEFW	8C8CH
60AD E188	01050	DEFW	0B8E1H
60AF 87C4	01060	DEFW	0C487H
60B1 B087	01070	DEFW	87B0H
60B3 C1B8	01080	DEFW	0B8C1H
60B5 87C2	01090	DEFW	0C287H
60B7 A09E	01100	DEFW	9EA0H
60B9 81A0	01110	DEFW	0A081H
60BB 9E81	01120	DEFW	819EH
60BD C2A0	01130	DEFW	0A0C2H
60BF 9E81	01140	DEFW	819EH
60C1 C183	01150	DEFW	83C1H
60C3 8383	01160	DEFW	8383H
60C5 A39D	01170	DEFW	9DA3H
60C7 E1A2	01180	DEFW	0A2E1H
60C9 B3B3	01190	DEFW	0B3B3H
60CB 8383	01200	DEFW	8383H
60CD 8383	01210	DEFW	8383H
60CF 81C1	01220	DEFW	0C181H
60D1 8283	01230	DEFW	8382H
60D3 8383	01240	DEFW	8383H
60D5 8383	01250	DEFW	8383H
60D7 C283	01260	DEFW	83C2H
60D9 8383	01270	DEFW	8383H
60DB 83BD	01280	DEFW	0B83H
60DD 87C1	01290	DEFW	0C187H
60DF 8283	01300	DEFW	8382H
60E1 8383	01310	DEFW	8383H
60E3 8383	01320	DEFW	8383H
60E5 E2AA	01330	DEFW	0AAE2H
60E7 9D8A	01340	DEFW	849DH
60E9 B48C	01350	DEFW	8CB4H
60EB A88C	01360	DEFW	8CA0H
60ED 949C	01370	DEFW	9C94H
60EF 9894	01380	DEFW	9498H
60F1 C3A0	01390	DEFW	0A0C3H
60F3 B0B0	01400	DEFW	0B0B0H
60F5 B0B0	01410	DEFW	0B0B0H
60F7 B09E	01420	DEFW	9EB0H
60F9 81EA	01430	DEFW	0EA81H
60FB A2D1	01440	DEFW	0D1A2H
60FD B0B1	01450	DEFW	0B1B0H
60FF B082	01460	DEFW	82B0H
6101 8381	01470	DEFW	8183H
6103 01C1	01480	DEFW	0C101H
6105 81CE	01490	DEFW	0CE81H
6107 B0B0	01500	DEFW	0B0B0H
6109 B090	01510	DEFW	90B0H
610B E3AA	01520	DEFW	0AAE3H
610D 95C2	01530	DEFW	0C295H
610F AAC6	01540	DEFW	0C6AAH
6111 B0CD	01550	DEFW	0CD0B0H
6113 BFE6	01560	DEFW	0E6BFH
6115 AA95	01570	DEFW	95AAH
6117 C2AA	01580	DEFW	0AAC2H
6119 C1BF	01590	DEFW	0BFC1H
611B C1AA	01600	DEFW	0AAC1H
611D C183	01610	DEFW	83C1H
611F BF83	01620	DEFW	83BFH
6121 81AA	01630	DEFW	0AA81H
6123 B793	01640	DEFW	93B7H

Listing 2 continued on p. 92

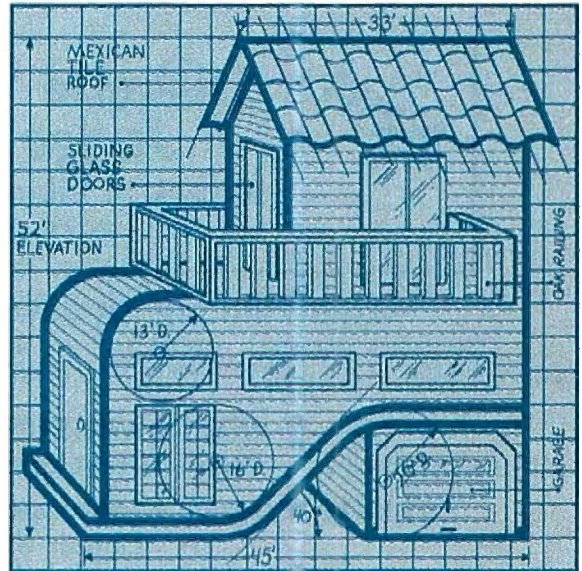
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Listing 2 continued from p. 88

6125	C1BF	01650	DEFW	0BFC1H
6127	8683	01660	DEFW	8386H
6129	81C3	01670	DEFW	0C381H
612B	8383	01680	DEFW	8383H
612D	8395	01690	DEFW	9583H
612F	AAB7	01700	DEFW	0B7AAH
6131	BBC1	01710	DEFW	0C1BBH
6133	BFB3	01720	DEFW	0B3BPH
6135	BBC1	01730	DEFW	0C1BBH
6137	BF83	01740	DEFW	83BPH
6139	81AA	01750	DEFW	0AA81H
613B	B793	01760	DEFW	93B7H
613D	D58A	01770	DEFW	8AD5H
613F	8D8C	01780	DEFW	8C8DH
6141	8C8E	01790	DEFW	8E8CH
6143	C18F	01800	DEFW	8FC1H
6145	8C8E	01810	DEFW	8E8CH
6147	C28F	01820	DEFW	8FC2H
6149	8C85	01830	DEFW	858CH
614B	8A8D	01840	DEFW	8D8AH
614D	8CC1	01850	DEFW	0C18CH
614F	8PC6	01860	DEFW	0C68PH
6151	8C8C	01870	DEFW	8C8CH
6153	8C85	01880	DEFW	858CH
6155	8A85	01890	DEFW	858AH
6157	C28F	01900	DEFW	8FC2H
6159	C18A	01910	DEFW	8AC1H
615B	C18F	01920	DEFW	8FC1H
615D	8C84	01930	DEFW	848CH
615F	8A8D	01940	DEFW	8D8AH
6161	8CD6	01950	DEFW	0D68CH
6163	4259	01960	DEFW	5942H
6165	C152	01970	DEFW	52C1H
6167	4F47	01980	DEFW	474FH
6169	4552	01990	DEFW	5245H
616B	C153	02000	DEFW	53C1H
616D	4D49	02010	DEFW	494DH
616F	5448	02020	DEFW	4854H
6171	FFFF	02030	DEFW	0FFFFH
6173	FP50	02040	DEFW	50FFH
6175	5245	02050	DEFW	4552H
6177	5353	02060	DEFW	5353H
6179	C13C	02070	DEFW	3CC1H
617B	434C	02080	DEFW	4C43H
617D	4541	02090	DEFW	4145H
617F	523E	02100	DEFW	3E52H
6181	C154	02110	DEFW	54C1H
6183	4FC1	02120	DEFW	0C14PH
6185	504C	02130	DEFW	4C50H
6187	4159	02140	DEFW	5941H
6189	00	02150	DEFB	0
618A	08	02200	SOUNDX	EX AF,AF'
618B	D3FF	02210	OUT	(255).A
618D	EE03	02220	XOR	3
618F	08	02230	EX	AF,AF'
6190	C9	02240	RET	
6191	21000H	02260	**** THE INTRO SOUND SUBROUTINE FOLLOWS	
6194	2B	02280	SOUND	LD HL,000H ;WEIRD SOUND
6195	E5	02290	LOOP10	DEC HL ;DECREMENT COUNT
6196	7D	02300		PUSH HL ;SAVE COUNT
6197	E60F	02310		LD A,L ;GET LSB
6199	07	02320	AND	0FH ;MASK LAST 4 BITS
619A	07	02330	RLCA	
619B	07	02340	RLCA	
619C	47	02350	LD	B,A ;A=A*B
619D	E5	02360	LD	B,A ;B=A
619E	C8A61	02370	LOOP20	PUSH HL ;STORE HL
61A1	2D	02380	CALL	SOUNDX ;SOUND OUT
61A2	20FD	02390	LOOP30	DEC I ;DELAY
61A4	E1	02400	JR	NZ,LOOP30
61A5	C5	02410	POP	HL ;RESTORE HL
61A6	10FE	02420	PUSH	BC ;SAVE BC
61A8	C1	02430	DJNZ	S ;DELAY
61A9	25	02440	POP	BC ;RESTORE BC
61AA	20F1	02450	DEC	H ;DECREMENT MSB
61AC	E1	02460	JR	NZ,LOOP20 ;AND LOOP UNTIL H=0
61AD	7C	02470	POP	HL ;RESTORE COUNT
61AE	FE06	02480	LD	A,H ;TEST IF MSB = 6
61B0	20E2	02490	CP	6
61B2	C9	02500	JR	NZ,LOOP10 ;LOOP IF NOT
		02510	RET	
61B3	7E	02530	**** THE FOLLOWING SUBROUTINE DISPLAYS A SCREEN	
61B4	B7	02550	SCREEN	LD A,(HL) ;GET CHARACTER
61B5	C8	02560	OR	A
61B6	CD3300	02570	RET	Z ;RETURN IF ZERO
61B9	23	02580	CALL	33H ;ELSE DISPLAY IT
61BA	18F7	02590	INC	HL ;BUHF POINTER
		02600	JR	SCREEN ;LOOP
61BC	3E01	02620	**** THE INTRODUCTION SUBROUTINE FOLLOWS	
61BE	08	02640	INTRO	LD A,1 ;INTRO SUB
61BF	AF	02650	EX	AF,AF' ;SET A' = 1
61C0	322440	02660	XOR	A ;SET SPACE COMPRESSION
61C3	210060	02670	LD	(4024H).A ; FLAG FOR MODEL III
61C6	CD361	02680	LD	HL,SCR1 ;DISPLAY SCREEN 1
61C9	CD9161	02690	CALL	SCREEN
61CC	CD9161	02700	CALL	SOUND ;MAKE SOUND
61CF	218760	02710	LD	HL,SCR2 ;DISPLAY SCREEN 2
61D2	CD361	02720	LD	HL,SCR2
61D5	CD9161	02730	CALL	SCREEN
61D8	F3	02740	CALL	SOUND ;SOUND
61D9	3A4038	02750	DI	A ;DISABLE INTERRUPTS
61DC	10FE	02760	INTRO2	LD A,(3840H) ;WAIT FOR <CLEAR>
			DJNZ	S ;DELAY TO PREVENT

Listing 2 continued


```

61DE E602 02780
61E0 28F7 02790 AND 2 ; FALSE SIGNALS
61E2 0640 02800 JR Z,INTRO2 ;MASK <CLEAR> KEY
61E4 21003C 02810 LD B,40H ;LOOP UNTIL <CLEAR>
61E7 7E 02820 INTRO3 LD HL,3C00H ;COUNT=64
61E8 FE00 02830 INTRO4 LD A,(HL) ;HL=>SCREEN
61EA 2809 02840 CP 80H ;GET CHARACTER
61EC FE21 02850 JR 2,INTRO5 ;IS IT = 128?
61EE 3005 02860 CP 21H ;SKIP IF SO
61F0 E603 02870 JR C,INTRO5 ;IS IT < 21H?
61F2 D3FF 02880 AND 3 ;MASK LAST 2 BITS
61F4 35 02890 OUT (255)-A ;AND SEND TO SOUND OUT
61F5 23 02900 DEC (HL) ;ELSE DEC CHARACTER
61F6 7C 02910 INTRO5 INC HL ;HL=HL+1
61F7 FE40 02920 LD A,H ;DONE?
61F9 20EC 02930 CP 40H ;LOOP IF NOT
61FB 0E00 02940 JR NZ,INTRO4 ;DELAY
61FD 0D 02950 LD C,00H
61FE 20FD 02960 INTRO6 DEC C
6200 10E2 02970 JR NZ,INTRO6
6202 C9 02980 DJNZ INTRO3 ;LOOP UNTIL B=0
6203 03010 NEXT1 EQU $ ;STARTING ADDRESS FOR
; NEXT ROUTINE
0000 03020
00000 TOTAL ERRORS
20943 TEXT AREA BYTES LEFT
    
```

```

INTRO 61BC 02640
INTRO2 61D9 02760 02800
INTRO3 61E4 02820 02900
INTRO4 61E7 02830 02940
INTRO5 61F5 02910 02850 02870
INTRO6 61FD 02960 02970
LOOP10 6194 02290 02500
LOOP20 619D 02370 02460
LOOP30 61A1 02390 02400
NEXT1 6203 03010
SCR1 6000 00170 02600
SCR2 6007 00860 02720
SCREEN 61B3 02550 02600 02690 02730
SOUND 6191 02280 02700 02710 02740
SOUNDX 618A 02200 02300
    
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Control Program for the Model 4

Montezuma Micro's CP/M 2.2 lets you read and write in virtually any CP/M format.

Model 4 owners can now move into the world of CP/M (control program for microcomputers) with this software package from Montezuma Micro. Montezuma's version of CP/M 2.2 includes many high performance utilities to let Model 4 owners access the wide variety of CP/M software available on 5¼- and 8-inch disks.

Montezuma CP/M not only lets you read these disks, but you can format and write CP/M disks as well. This is a significant advantage over other systems that permit only one-way file transfer. While it's not perfect, Montezuma CP/M ranks among the highest quality software I've used.

CP/M

CP/M performs functions very similar to TRSDOS 6.X, but each operating system's internal organization is different. CP/M uses high memory to store the resident nucleus of the operating system, generally referred to as the Basic input/output system (BIOS) and Basic disk operating system (BDOS). As in TRSDOS, CP/M uses a transient console command processor (CCP) to read the input from the terminal and interpret the DOS commands.

The remainder of the computer's memory is designated as the transient program area (TPA) and normally begins at 100 hexadecimal (hex). All user-written software and system transient commands, such as Status and Edit, use this area.

CP/M commands cover three broad categories: built-in commands, transient commands, and user-defined commands. This is much like the organization of commands under TRSDOS. This version implements all the standard CP/M 2.2 built-in commands and supplies most of the Digital Research

utility (transient command) programs.

The BIOS interfaces the CP/M operating system to the Model 4's physical resources—its peripherals. The BIOS contains all the drivers that interrogate the keyboard, send output to the video and printer, and communicate with the disk drives. Montezuma's BIOS treats the Model 4 display and keyboard as if it were a Lear Siegler ADM-3A terminal.

Montezuma's Enhancements

Montezuma Micro includes several utilities that enhance CP/M's operation on the Model 4. One main feature of these utilities is the overwhelming number of different disk drive types and formats they support. Table 1 lists the drive types supported and Table 2 lists the various CP/M disk formats supported.

The first thing you should do with CP/M 2.2 is format and back up the master disk. After you load the system, the opening message appears and the

system is up and running. I put a blank disk in drive B and typed FORMAT to let the system load the program while I found it in the documentation.

Before I found it, I noticed a menu displayed on the screen for formatting options listing the current CP/M disk parameters. Menu-driven operation for CP/M programs is so atypical that I decided to follow the menu prompts and use the documentation only when stumped.

Even without documentation, I was still using the system 90 minutes later, performing sophisticated file transfers between different density disks.

Format is a general format and back-up utility for CP/M. The opening display lists options for formatting disks, verifying disks, creating mirror-image back-up copies, and exiting to the DOS.

For each selection of source or destination disk, Format lists all the pertinent drive parameters and lets you enter your choice. Format then verifies that you have made the correct choice by re-displaying only the selected drive's parameters.

Format's back-up feature is a blessing. In most CP/M systems, you must format a disk and use the peripheral interchange program (PIP) to copy each file to the new disk. If you have used NEWDOS80's copy-by-file or LDOS's back-up-by-class options, you realize how much time you can save with another method.

However, mirror-image means just that—the disk drive parameters must match exactly or the back-up option will not proceed. In this case, you must use the PIP procedure described above.

Montezuma Micro has provided two utilities to allow use of the full range of formats in Table 2. These programs let you alter the configuration of the sys-

CP/M 2.2

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<i>Does the job?</i>	★★★★★

tem interfaces to the hardware and the disk drive parameter blocks.

CONFIG lets you alter the system interfaces to the disk drives and the RS-232 serial port, and saves the new configuration to the disk. For the disk drives, you can modify the density and number of bytes per sector, as well as the track count, number of sides, and track-to-track stepping rate. Once you make these selections, selecting the physical drive and the logical drive assignments completes the configuration for one drive.

The second part of CONFIG lets you establish default assignments of the protocol parameters used to initialize the RS-232 serial interface. You can individually set baud rate, parity, word length, and the number of stop bits.

The next option allows writing the newly configured system to the system disk in logical drive A. As part of this sequence, you have the option of specifying an Auto Execute command. This lets you configure the disk with a turn-key application and perform an auto-start without operator intervention. You can also suppress the CP/M sign-on message during boot-up.

The other utility for changing the disk parameters is INTERCHG. This program lets you overcome one of the most frustrating aspects of CP/M—the failure to adapt any one definite disk format for either the 5¼- or the 8-inch disks.

INTERCHG assigns the appropriate parameters to the disk parameter blocks in BIOS to let you read and write 22 popular CP/M format disks. You are no longer limited to CP/M software for only your type of disk format.

When you select the appropriate format from the menu, you can assign the physical drive number and the logical drive name to the parameters. For example, my system contains only two drives and I want to read my Model I Omikron Mapper CP/M format disks part of the time.

I use INTERCHG to establish drive C as physical drive I in the Omikron format. Drive B is untouched in the Model 4 CP/M format and is still assigned to drive 1. By changing the drive specification, I can now use drive 1 to read and write normal Model I or 4 disks.

CP/M 2.2 does not support memory in excess of 64K but you can use that extra 64K of RAM on your Model 4. TRSDOS 6.X thoughtfully provides MEMDISK to use this block as a 64K fast RAM disk; Montezuma Micro provides a similar option called MEMLINK.

Nothing provides for transferring information from TRSDOS to CP/M.

MEMLINK installs the alternate 64K bank of RAM as logical drive M. You have no alternatives, such as the bank selection options or drive options MEMDISK offers.

The MEMLINK documentation refers to two system features that you must consider. First, in a typical operation with CP/M, normal use of the reset key destroys all the links to drive M and all the information stored there.

Second, you must never use CONFIG to write a newly configured system to the disk with MEMLINK in operation. This alters the system jump vectors and the reconfigured system does not boot properly.

5¼-inch floppy drives
35-, 40-, 77-, and 80-track drives
Single- or double-sided drives
Single- or double-density drives

Table 1. Montezuma Micro's CP/M supports several types of disk drives.

Access Matrix
Cromemco Z-2 (double-density, single-sided)
Cromemco Z-2 (single-density, single-sided)
Eagle (80-track)
Holmes VID-80
Hurricane Compactor I and II
IBM PC CP/M-86
Kaypro 2
Lobo MAX-80
LNW-80
Memory Merchant Shuffleboard
Montezuma Micro
Morrow Micro Decisions
NEC PC-8001A
Omikron Mapper
Osborne-1
Osborne Executive
Radio Shack CP/M Plus
Xerox 820-1
Xerox 820-2
Zenith H89
Zenith Z100

Table 2. CP/M for the Model 4 supports disk formats for these systems.

Documentation

The documentation included with the CP/M 2.2 master disk is a 35-page booklet explaining CP/M's startup operations and the utilities Montezuma Micro provides. To document CP/M's functions, they include *Inside CP/M, A Guide for Users and Programmers* by David E. Cortesi (Holt, Rinehart, and Winston, 1982).

The Digital Research documentation is not contained in the package from Montezuma Micro, but the substitution of Cortesi's book is a good choice.

Conclusion

I was initially surprised at the price of this system, but comparison to the other CP/M systems makes this price consistent, especially considering the extremely valuable utilities. Just the ability to read, format, and write 22 other popular CP/M disk formats is almost worth the price.

The chosen system disk format is similar to the normal TRSDOS Model 4 format—256-byte sectors and 18 sectors per track for a 40-track disk. In fact, you can read a CP/M disk with TRSDOS 6.X under certain conditions.

The only difficulty is in the sector address numbering. TRSDOS 6.X numbers the 18 sectors from zero to 17 and CP/M numbers its sectors 1-18. Although the disk formats are similar, nothing provides for transferring information from TRSDOS to CP/M and vice versa. Given the other utilities provided, I do not see why Montezuma omitted this one—especially since the Basic interpreters for both systems are almost identical (TRSDOS Basic and Microsoft MBasic 5.2).

The BIOS keyboard driver uses the three function keys on the Model 4. The documentation presents a detailed and laborious procedure for changing these key assignments if you so desire. This procedure contains the only typographical error I noted in the manual—the sequence of Dynamic Debugging Tool (DDT) commands used does not work as it is printed due to omission of a blank in one of the Assembly codes.

I find it strange that Montezuma Micro provides the many detailed high-performance utilities included with this system only to leave the user to accomplish such a laborious task manually. In fact, only someone with a thorough knowledge of CP/M's internal structure should attempt to make such changes.

Another significant variation from standard Digital Research CP/M is that

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*I have never used
another CP/M system
for so long
without resorting
to the documentation.*

Montezuma's omits several files. The double-density disk has ample space for at least a partial set of the omitted files.

In particular, I'd like to have MOV-CPM, a dynamic relocation tool that provides a method of moving the operating system in memory. This is vital if you must make changes to the BIOS to allow installation of unique peripherals. At some point the BIOS will grow beyond the end of memory and you must relocate the CP/M BDOS and CCP.

Montezuma Micro also omits the BIOS and Boot Assembly-language source code. This prevents the ardent CP/M user from making alterations to his system configuration and is inconsistent with other CP/M applications.

On the plus side, this system is solid and stable. I have never used another CP/M system for so long without resorting to the documentation. I expected no problems with Montezuma's CP/M system and found none. The BIOS is an extremely powerful implementation and performs well. Also, I cannot say enough about the Montezuma utilities.

Montezuma states that all properly written CP/M software operates under this version. I attempted to use every CP/M program I have available and I haven't found any programs that don't work as they should. I did account for the expected differences: Model I CP/M treats the system display/keyboard differently from the Model 4, causing display control problems.

The programs in this package are of high quality. The lack of the original Digital Research documentation, the failure to include (or offer) the source code for the Boot and BIOS routines, and the missing relocation utility detract from this package's overall rating.

Despite these limitations, Model 4 CP/M is here and working. The ability to handle many different disk formats and access many different software bases makes this package worth its price. ■

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by Delmer D. Hinrichs

An old adage states that some things improve with age. Such is the case with this upgraded and revised version of my Basic word processor (*80 Microcomputing*, May 1980, p. 50). Since it first appeared, I received many letters suggesting various improvements, and in using the system I have thought of ways to update it.

This is a 48K Model I/III form-letter version that, with an Epson MX-80 and Graftrax-80, lets you include graphics in your text. It inserts addresses from a separate address file for multiple form letters, and inserts either the first or last names from the address into the body of the letter. It holds up to 176 lines of text and 176 address lines simultaneously. You can use multiple disk files to cover text files or address lists of any length.

The program has a built-in machine-language case reversal and a lowercase video driver for the Model I. If your

Model I doesn't have a lowercase modification, or if your Model I DOS or modification has its own case reversal and lowercase video driver, check line 9 of the program for instructions before running it.

Since I wrote the program in Basic with occasional remark statements, it's easy to modify. Table 1 lists all arrays and variables. If you alter the program, be sure to change the values of Clear and NL in line 20 to fit the new program size.

For the version presented here, reserve only one disk file when you load Basic. If you have different size Disk Basics, use the smallest so you don't run out of memory.

Using the Program

To use the program, load it and, if necessary, set the machine-language routine in lines zero through 9 for your system. Enter the Run command, which

POKEs this routine and deletes those lines. You can save a back-up copy only before you run the program. Running it a second time starts the program, displaying the title and command prompt. Here you press any one of the 21 single-letter commands listed in Table 2. Enter commands in lowercase.

Before you enter a text file, a, f, h, l, and x are the only reasonable commands. The others do nothing or give an entry-error message. When you leave any command the program returns to the prompt.

Except as noted, all references to pressing a keyboard letter imply a lowercase letter. The following paragraphs further explain the commands listed in Table 2.

Add Command

This command adds material to the end of a current text file or, if the file is

Table 1. Arrays and variables list.

Arrays	
AS(176)	Lines of text (Front array)
BS(176)	Lines of addresses (Back array)
S(32)	Position in text line to enter space for JUSTIFY
T(32)	Number of spaces to enter each place for JUSTIFY
Variables	
AS	Input entry character, one character from string
BS	Blank to end of video line (ASCII 30)
CS	Cursor graphics character, character from string
ES	Escape control code (ASCII 27)
FS	Format for line number ("### ")
F1\$	Temporary Filespec
F2\$	Temporary Filespec
FSS	Filespec for disk text or address file
HS	Heading for each printed page
LS	Left part of text string
MS	MX-80 graphics? ("y" or "n")
NS	Line numbers? ("y" or "n")
OS	Temporary text line
PS	Page stop? ("y" or "n")
P1\$	Print page number for page No. 1? ("y" or "n")
PN\$	Page numbers? ("y" or "n")
QS	Spaces, right character of string, number string
RS	Right part of text string
SS	One space character (ASCII 32)
TS	Title ("TEXT" or "ADDRESS")
T2\$	Temporary Title
US	Underline character (ASCII 95)
WS	Prompt segment
X\$	Text manipulation string
Y\$	Text manipulation string
Z\$	Text manipulation string
A	ASCII value of text character
AL	Address line number
B	Byte, beginning display line, control counter
C	Cursor position, ASCII value of left character
CL	Caps Lock flag (0 or 1)
D	Displacement of cursor for wrap-around lines, temporary cursor position, underline start position

F	First line for COMPILE, DELETE, MOVE; flag in EDIT for found character (0 or 1)
FL	First line to print
FP	First page number to list
FT	First text line to overprint with address
G	Get address flag (0 or 1)
H	Video print control flag (0 or 1)
I	Multi-use integer counter
IN	Insert line for MOVE
IT	Insert text flag (0 or 1)
J	Multi-use integer counter
K	Multi-use integer counter, L + 1
L	Line number of text being worked upon
L1	Temporary last line of text
L2	Last text line of Back text file
LA	Last text line of Front text file
LL	Line length in number of characters
LM	Left margin to start printing
LP	Last print line of text
M	Multi-use integer counter
N	Multi-use integer counter
NA	Number of address lines to print
NL	Number of lines of text maximum (176)
NP	No print flag for reverse scroll (0 or 1)
O	Length of O\$
P	Position in text line, line number in PRINT
PL	Page length in number of lines
PS	Page spacing in number of blank lines between pages
Q	Temporary position in text line, LA + 1
R	Right shift of heading for PRINT with line numbers, return or replace flag (0 or 1)
S	Spacing between text lines
T	Length of replacement string
U	Constant (32)
UN	Use last name flag (0 or 1)
V	Constant (64)
W	Write location for cursor position number (1003)
X	Multi-use integer variable
Y	Multi-use integer variable
Z	Multi-use integer variable
Z1	Z-1

empty, starts a new text file. It initially asks if you want to start a text or address file. A flashing cursor shows where you can add text. This command turns on the line number display option. You can type material continuously, without using the enter key.

It shows the cursor position as a number at the bottom of the screen, along with the text or address indicator; for address display it also shows the current line/address setting. When the file is full, the program gives a File Full message. To reserve a spacer line without text, add at least one space. This eliminates trailing spaces.

Add subcommands are listed in Table 3.

Blank Command

The Blank command eliminates all blank lines from the text file currently in the works and renumbers the lines. This command doesn't affect lines contain-

ing only a space. During operation, the program displays a Deleting Blank Lines message. When done, the Video command displays the text file.

Compile Command

The Compile command shifts words between the lines of a selected block of text to get the best possible fit.

To abort this operation and return to the command prompt, press the enter key. To Compile to the end of the text, enter a number as large as that of the last line of text.

This command works in four phases. First it spaces all words normally. It inserts three spaces after punctuation, two after a semicolon, and one space otherwise. This makes it possible to compile justified text.

Second, it checks for lines that are too long and pushes extra words onto the following line. Third, it determines whether a line can accept words from

the following line and pulls possible words onto this line.

Finally, it deletes blank lines. Compile can move words forward or backward any number of lines, and it automatically removes hyphens if it moves a broken word back together.

Use Compile one paragraph at a time, since it left-justifies all lines except the first within its range. It doesn't bury any end-of-page, hold-justify, e-underline, or line-feed markers within its range, but these markers inhibit movement of words between lines.

The Key Box

Models I and III
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During operation, the command displays the message "Compiling Line *n m*" where *n* and *m* are the first/second and third phase line numbers. When done, if the last line of the specified block is still too long, the program displays an appropriate message. To correct this, insert an empty line(s) before it, then compile only the blank line(s) and the line that's too long.

After completing the Compile operation, the Video command displays the file starting with the first compiled line.

Delete Command

This command eliminates a specific

block of lines. To eliminate one line, enter that line number as the first and last line number. To delete to the end of the text, enter a number as large as or larger than that of the last line of text.

During operation, the program displays deleting messages. Use Video to display the modified text starting at line zero. To abort the operation, press the enter key.

Edit Command

To edit a line, type in the line number and press the e key (which defaults to line zero). If you enter a nonexistent or empty line, the program displays an er-

ror message. The entire line is visible in Edit, even the character above the smaller Edit cursor. Edit turns on the line-number option and shows the cursor position as a number at the bottom of the screen.

To see text lines that contain nonprinting characters, such as those inserted by overstrike, font changes, or the underline mode, sweep the cursor over the line from right to left in the Edit mode. Nonprinting characters appear as fixed cursor blocks, except for ASCII 14, an underline character, and ASCII 27, the right arrow (or up-caret on the Model III).

If you enter nonprinting characters by mistake with Edit, remove them by using Delete or Again commands.

If the line is too long after exiting from Edit, the program gives the message "Line *n* has *x* Characters." If the line is equal to or shorter than the specified line length, the program displays text lines starting with the line just edited. Edit deletes extra trailing spaces.

Table 4 lists the subcommands in Edit.

Format Command

This command resets the 17 variables that control the display or printing text or addresses (see Table 5). Each variable has a default value, shown in parentheses; if you don't need to change the value, just press the enter key.

After going through these 17 Format variables, you return to the command prompt. If there is nothing in the file, it may skip some variables. Out-of-range entries have an "Entry must be --" message so you can try again.

Get Address

This command inserts addresses into the text, and finds either the first or last name and inserts it into the body of the text. You must include spacer lines in the text to allow room for insertion of the addresses, as addresses overwrite text lines. All addresses can automatically print a series of individualized letters, or you can examine each address and decide whether or not to use it.

The letter text must be in the Front array, and the addresses must be in the Back array before printing form letters with address insertion. See the New File command for instructions to get the files into the proper arrays.

Initially, you decide to use a first or last name to replace the up arrow. If the addresses are not ready, you return to Command mode. The program displays the current address number and ad-

a	Add	Add text to existing file, or start new file.
b	Blank	Remove blank text lines, and renumber lines.
c	Compile	Move words between lines to get the best fit.
d	Delete	Delete block of text lines, and renumber.
e	Edit	Edit text lines with Basic-like subcommands.
f	Format	Change formats for text display or printing.
g	Get Addr.	Insert addresses into text display for form letters.
h	Help	List all commands, and how to leave them.
i	Insert	Insert text line(s) into middle of text file.
j	Justify	Right-justify text lines by spacing words.
k	Kill	Remove all text, reset Format, and start anew.
l	Load	Load previously saved text file from disk.
m	Move	Move block of lines to new place in text file.
n	New File	Exchange Text and Address files in memory.
o	Overlay	Global search for or replace any word in text.
p	Print	Print text or address file on printer.
r	Replace	Replace one existing text line with another.
s	Save	Save text file onto disk.
v	Video	Display text file on video display unit.
x	Exit	Exit from program, reset string space, etc.
y	Your LtHd.	Print your letterhead, with graphics logo.

Table 2. Commands.

Space bar	Moves cursor one position to the right and adds one space.
Right arrow	Moves cursor continuously to the right (up to the line length), adding spaces to the end of the line.
Left arrow	Moves the cursor continuously to the left, erasing characters to the beginning of the line.
Shift/left-arrow	Erases the entire current line of text.
Less-than sign	Overstrike. Moves cursor one position to left over previously entered character, followed by a < symbol. Then key in overstrike character. (You need a backspacing printer to use overstrike.) Overstrike puts two invisible characters in line which can confuse erasing, Edit, and Justify commands.
@ key	Caps lock. Pressing the @ key alternately turns this function on or off. It affects only letters. A caps-lock message shows in the lower right of the screen.
Up arrow	Name-insertion marker for automatic first/last name insertion. See Get Address command.
Enter	Ends the current line and goes to the next line before the automatic end-of-line action.
Clear	Ends the line and holds it secure from the Justify command.
Shift/up-arrow	Ends the line, centers current line text and holds it secure from Justify. Leaves a ← mark.
Shift/right-arrow	Ends the line and moves the current line text to the extreme right.
Down arrow	Ends the line and inserts a blank line between lines of text, by adding line feed to line end.

Table 3. Add subcommands.

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Space Bar	Moves cursor one position to the right (no space).
Right arrow	Moves cursor continuously to right (no spaces added).
Left arrow	Moves cursor continuously to left (without deleting).
a	Again cancels previous edit and reenters Edit. List (l) makes all editing changes permanent.
n c	Changes next <i>n</i> characters to next <i>n</i> keyed characters then returns cursor to start (as "completed" signal). Note the @ and < keys, and control characters that you can't enter in Add, can be entered using Change.
n d	Deletes next <i>n</i> characters, and closes up the line.
e	Epson underlining, for Epson MX-80 printers. Puts cursor under first character you want to underline and press the e key for each character. Only one group per line can be underlined, not including double-width characters. After editing a line, use List before e underline, or the original unedited line is underlined. Later, an underline, two numbers, and a second underline show at the line end. The first number is the space before underline starts and the second is the number of characters you want to underline (used by Print command).
h	Hacks the rest of the line, and enters Insert mode.
i	Inserts characters into line at the current cursor position, and moves following characters to the right. While in the Insert mode, you can move the cursor left or right without changing the line by using the — or — keys as described above. You can insert the l key as a name marker. You can use the < key to insert overstrikes in Edit. See the Font Change section for printer font changes. See the TRS-80 Graphics Printing section for graphics.
n k c	Kill deletes all characters from the current cursor position to the <i>n</i> th time that character <i>c</i> occurs.
l	Lists the line and returns cursor to the start of the line. List makes editing changes immune to Again.
n s c	Searches for the <i>n</i> th occurrence of character <i>c</i> . Keeps upper- and lower-case separate (even with UC display).
u	Underlining for backspacing printers. Used like the e key above, except not restricted. Later, Video shows the underlines only, not the underlined characters.
x	Extends a line; enter the Insert mode at end of line.
Shift/@	Leaves the C, H, I, or X modes and returns to Edit. (Usually press shift/@ twice.)
Enter	Exits from the Edit command (including exit from the C, H, I, or X subcommands).

You cannot perform the following five subcommands if entered in the C, H, I, or X subcommands as they insert control characters into text.

Clear	Holds line secure from Justify (adds —).
Shift/up-arrow	Centers text line & holds it secure from Justify.
Shift/right-arrow	Moves the line's text to the extreme right of line.
Shift/down-arrow/Z	Adds End-of-Page marker (l) to end of text line.
Down arrow	Adds line feed (ASCII 10) to end of line, and exits from the Edit command.

Table 4. Edit subcommands (*n* always defaults to 1).

dress, and you have four options:

- To put only this address into the text, press the enter key. Video shows the results, and you can edit, justify, print, and so on, just like any other text. Note that the first or last name inserts only for the up-arrow symbol in the text. If you already changed the up arrow, you must reload the text file from the disk, or use Overlay to replace the old name with the new name.
- To print all texts with addresses, press a. It automatically cycles through all later addresses, printing a letter for each, inserting name for the up arrow in each letter.
- To get next address, press g. It gets the next address from the address list and returns to the four options. If there

are no more, it shows a no-more-addresses message.

- To quit and return to the Command mode, press q.

Note that the first/last name found in the address by this command ignores any leading/trailing titles if they end in a period or a capital letter.

Help Command

This command displays all legal commands and definitions, and indicates how to return to the Command mode.

Insert Command

This command inserts a line (or lines) of text into the middle of the current file, using the Add command. Key in the line number before which you want

to insert lines, and press the i key (defaults to line zero). It moves the following lines down and renumbers them.

A nonexistent line number causes an error message. To insert empty lines for Compile, press the enter key. At any time, to keep entered text and return to Command mode, press the shift/@ keys twice. If the text file becomes full, the program displays an appropriate message.

Justify Command

This command right-justifies all lines of the current file. Exceptions are lines with a Hold-Justify, End-of-Page, or a Line-Feed command, an e mode underline marker at the end, a line with no spaces between words, or a line already longer than the specified line length (as set in Format).

It inserts extra spaces between words, starting at a random position, but evenly distributed. It may insert spaces between adjacent words, or only every other word, depending on whether or not the line contains an odd or even number of words.

Justify text before underlining, changing fonts, or overstriking, as these operations insert nonprinting characters onto the text. When it is done, the Video command displays the text.

Kill Command

This command removes all text from both files, and resets Formats to their default values, leaving the program ready to start anew. This command asks again if you really want to kill text to avoid accidental loss of the files.

Load Command

This command loads a previously saved text or address file from disk. It shows the current filespec (or TEXT/BWP if you entered none) and asks if you want a different one. To abort this operation, press the shift/@ and enter keys.

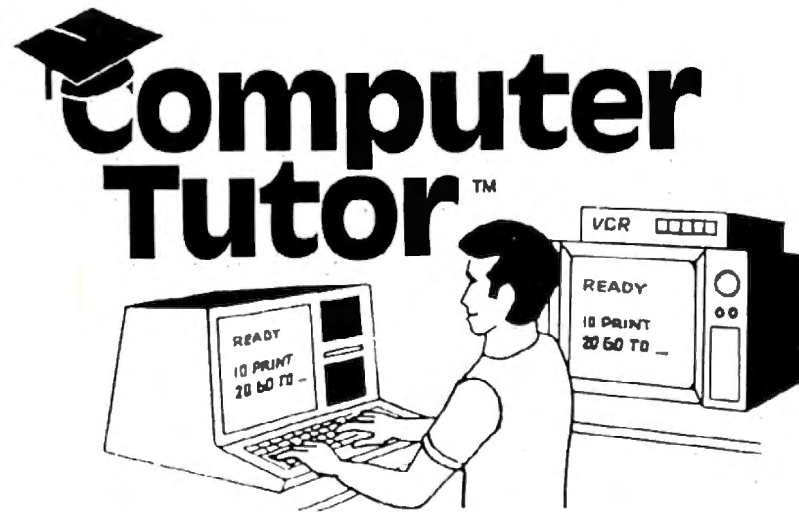
To leave the filespec unchanged, press the enter key. The program then loads the filespec specified while showing "Loading (filespec)".

If there is text in memory, Load appends new text onto old text. If there is no room for both, it shows a message and loads no text. In either case, the format variables become those of the new text.

Move Command

This command transfers a specified block of lines either forward or backward in the text or address files and renumbers lines. You can't use Move af-

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Variable	Description
Line length	(60 characters) Fits with the line number on one video display line. Limits are 20-122. Long lines may overwrite cursor position #.
Line spaces	(zero) No extra spaces between lines. Enter number of blank lines between text lines.
Line numbers	Y for yes; N for no.
First print line	(zero) To start printing from initial line of text. To start printing at a later line number, enter it. Limit—zero to last line in text or address file.
Last print line	Last line in file, to print to end of file. To end printing at an earlier line, enter it. Limit—first print line (set above) to last line in file.
Left margin	(10) To print the default 60-character line centered on an 80-character/line printer.
Page length	(15) To fill the video display. The number of lines per printed page is usually 56-58, so reset this to Print. Lines containing spaces are counted, but not line feeds (from item 2 above, or from the use of <code>l</code>).
Page spacing	(8) To use with Page length 58 for 66-line pages. If page numbers are printed, use 6 for Page spacing, or 56 for Page length.
Page numbers	(n) No page numbers. To show page numbers enter <i>y</i> . Note that you must show a page number to show page Heading (see Heading).
First page	(1) To start numbering pages at page 1. Enter a later initial page number if desired.
Page 1	(n) To not show a page number for page 1. To show page numbers. To show numbers enter <i>y</i> .
Page stop	(n) To not stop printing after each page. Enter <i>y</i> and you have time to insert a new page.
MX-80 graphics	(n) To not shift graphics characters sent to the printer up by 32 to match the MX-80 printer's graphics codes. Enter <i>y</i> to print block graphics on an MX-80 (but then <code>e</code> mode underlining and bit-mapped graphics can't be used).
First text line for address	(1) To insert address starting at text line 1, leaving line zero for date, etc. Limits, zero to 9.
Number of address lines	(3) For normal 3-line addresses. Limits, 3-5. All addresses must have the same number of lines, but spacer lines may be added.
Current address number	(1) The first address in the list. Enter a later number to skip earlier ones. Limits, 1 to last address number.
Heading	("") Null string—if you want to show a heading at the top left of each page, enter it. The heading shows only if the page numbers show.

Table 5. The 17 variables that control the display or appearance of text or addresses under the Format command. Default values appear in parentheses.

	Turn On	Turn Off
Emphasized	Shift-1-E	Shift-1-F
Double Strike	Shift-1-G	Shift-1-H
Compressed	Shift-1-O	Shift-1-R
Double Width	Shift-1-N	Shift-1-T

Table 6. Font changes.

ter a File Full message appears.

To abort the Move operation, just press the enter key in place of line numbers.

New File Command

This command exchanges the front and back files. Since you can use com-

mands (except Get Address) only on the front file, you must be able to exchange files, so you may load, save, modify, or print either the text or address file.

Overlay Command

This command provides a global search or replace function. It asks whether you want the Search or Replace mode.

Search looks throughout the text file for a specified word, and if it finds the word, enters the Edit mode. When you exit from Edit, you may continue the search from the current cursor position or return to the Command prompt. If the word isn't in the file, an appropriate message displays.

The Replace mode replaces any word in the file with a new word. This is useful for correcting a misspelling, changing a name, and so on. The new word can be longer or shorter than the old word, but Overlay maintains the same spacing of words.

Search and Replace modes may find a word that is part of a longer word. To avoid this, put a space before and/or after the word (which causes it to miss words at the start/end of line, etc.). It also misses capitalized words.

Print Command

This command prints the text or address file on the printer. Remember to

*The Replace mode
replaces any word
in the file
with a new word.
This is useful
for correcting misspellings
and changing names.
Overlay maintains
the same
spacing of words.*

reset the format variables first.

To avoid a possible function call error, it removes blank lines automatically before printing.

Replace Command

This command allows you to replace any specified line with a newly entered line. Key in the line number, then press the `r` key (defaults to line zero). Replace operates just like Add, except it applies only to one line. After a File Full message, you can't replace a line.

Save Command

This command records the front file, either text or address, on disk. It shows the current filespec and asks if you want to use a different one. To abort, just press the shift/@ and enter keys.

Use any legal filespec or, to leave the disk filespec unchanged, press the enter key. To save the file on a specified disk, end the filespec with `:d` (where *d* is the desired disk drive number). It deletes blank lines to avoid possible disk errors.

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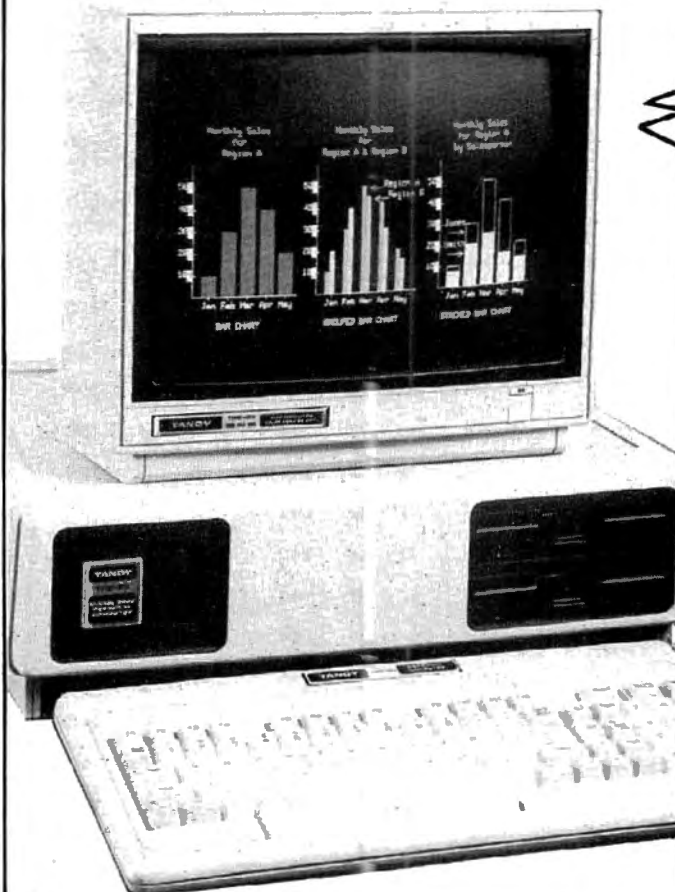
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MX-80 w/Grafrax-80

	Okidata	Turn On	Turn Off
Line Spacing 8 lines/in.	Shift-↑ 8	Shift-↑ 0	
Line Spacing 7/72 inch		Shift-↑ 1	
Line Spacing 6 lines/in.	Shift-↑ 6	Shift-↑ 2	
Italics		Shift-↑ 4	Shift-↑ 5
Compressed	Shift-↑ 3	Shift-↑ P	Shift-↑ Q
Normal Width	Shift-↑ 4		
Double Width	Shift-↑ 5		
TRS-80 Graphics		Shift-↑ S	Shift-↑ T
Reset to Cold Start		Shift-↑ :	Shift-↑ ;
		Shift-↑ @	

Note: Hyphen means hold down previous keys; no hyphen means release previous keys.

Table 7. Grafrax-80 font changes.

ASCII Code	Keyboard Entry
27	Shift ↑
76	L
14	Shift ↓ N
255	Shift ↓ Space
60	, (later Change to <)
66	B
66	B Shift ←
137	j Shift →
165	;
165	; Shift ←
133	f
133	f Shift →
165	;
165	; Shift ←
137	j Shift ←
66	B
66	B
60	, (later Change to <)

Table 9. Codes and keyboard entry for tiny happy face.

----- Low Graphics -----					----- High Graphics -----						
Key	Chr	ASCII	Key	Chr	ASCII	Key	Chr	ASCII	Key	Chr	ASCII
@	[	91	H	█	135	0	█	154	H	█	173
1	\	92	I	█	136	1	█	155	I	█	174
2	]	93	J	█	137	2	█	156	J	█	175
3	^	94	K	█	138	3	█	157	K	█	176
4	_	95	L	█	139	4	█	158	L	█	177
5	`	96	M	█	140	5	█	159	M	█	178
6	{	123	N	█	141	6	█	160	N	█	179
7	|	124	O	█	142	7	█	161	O	█	180
8	}	125	P	█	143	8	█	162	P	█	181
9	~	126	Q	█	144	9	█	163	Q	█	182
:	~	127	R	█	145	:	█	164	R	█	183
;	:	59	S	█	146	;	█	165	S	█	184
A	spc	128	T	█	147	A	█	166	T	█	185
B	█	129	U	█	148	B	█	167	U	█	186
C	█	130	V	█	149	C	█	168	V	█	187
D	█	131	W	█	150	D	█	169	W	█	188
E	█	132	X	█	151	E	█	170	X	█	189
F	█	133	Y	█	152	F	█	171	Y	█	190
G	█	134	Z	█	153	G	█	172	Z	█	191

TRS 80 graphics should be compressed for proper proportions:



Table 8. Block graphics and special characters.

Video Command

This command displays the front file on the video display. To start the display at any desired line, key in the line number before pressing the v key (defaults to line zero). If the line length is greater than 60 characters (64 if you set line numbers to n in Format), the lines

wrap around to the next display line.

After each displayed page, the program stops. To see the next page, press the enter key; use arrow keys to scroll. To enter a command, press the letter or the line number and letter. If you added any down-arrow (line feed) characters, or have wraparound lines, the top lines

of the page may scroll off the top of the screen. To avoid this, set the page length shorter in Format.

Video shows one of three nontext characters at the end of a line: a left arrow for Hold-Justify, a down arrow for end-of-page, or a single underline for a spacer line. In the middle of text, a right arrow replaces ASCII 27 (or a video reverse line feed), and an up arrow shows where you can insert the name from an address.

A line with e underlining ends with: “_ n, n_”. These markers allow you to keep better track of the text. In addition, a blank line (with no line number) follows any line that ends with a line feed marker. Blank lines follow all lines if you set line spaces to a value other than zero in Format.

Exit Command

This command allows for a graceful end to the program. More important, it clears the string space to its normal value, so that the next program run doesn't crash. It is easy to forget to CLEAR 50. Exit asks if you really want to exit the program to avoid possible accidental loss of both text and address files.

Your Letterhead Command

Use this command to print a letterhead containing a bit-mapped graphics logo. For plain text, or TRS-80 block graphics, it is just as easy to use a short text file that you save on disk and recall when it's needed. But you can't insert all ASCII characters needed for bit-mapped graphics into a text file. Specifically, you can't insert ASCII numbers zero, 13, and 224-254 into text with this

Line	ASCII	32,	32,	152,	134,	131,	131,	137,	164,	32,	32
1	Entry	Sp,	Sp,	Ly,	Lg,	Ld,	Ld,	Lj,	H.,	Sp,	Sp
2	ASCII	160,	134,	32,	94,	32,	32,	94,	32,	137,	144
	Entry	H6,	Lg,	Sp,	L3,	Sp,	Sp,	L3,	Sp,	Lj,	Lq
3	ASCII	150,	32,	32,	79,	32,	32,	79,	32,	32,	169
	Entry	Lw,	Sp,	Sp,	O,	Sp,	Sp,	O,	Sp,	Sp,	Hd
4	ASCII	149,	32,	32,	32,	47,	92,	32,	32,	32,	170
	Entry	Lv,	Sp,	Sp,	Sp,	/,	L1,	Sp,	Sp,	Sp,	He
5	ASCII	169,	32,	92,	95,	95,	95,	95,	47,	32,	150
	Entry	Hd,	Sp,	L1,	L4,	L4,	L4,	L4,	/,	Sp,	Lw
6	ASCII	32,	137,	144,	32,	32,	32,	32,	160,	134,	32
	Entry	Sp,	Lj,	Lq,	Sp,	Sp,	Sp,	Sp,	H6,	Lg,	Sp
7	ASCII	32,	32,	130,	137,	140,	140,	134,	129,	32,	32
	Entry	Sp,	Sp,	Lc,	Lj,	Lm,	Lm,	Lg,	Lb,	Sp,	Sp

Table 10. Codes and keyboard entry for large happy face.

word processor. You can insert numbers 192-224 only in the MX-80's graphics mode. This precludes the insertion of 255.

The routine, starting at line number 3600, prints a death's-head logo with a sample letterhead on an Epson MX-80 printer with Graftrax-80. You can easily change the text of the letterhead in line 3680 to whatever you want. You can also change the logo, but that requires quite a bit of calculation; even this small logo, as shown in Fig. 2, uses 468 bytes in the data statements—lines 3700-3770.

If you decide not to use this Letterhead command, you can remove it and gain 16 lines of text and address space. Do as follows:

```
Delete lines 3600-3770.
Change line 2190 to just: 2190 PRINT
Delete the ,3600 from the end of line 70.
Change line 20: CLEAR from 21520 to 23430
NL from 176 to 192
```

Font Changes

Some printers print different character fonts (different shapes and sizes). For printers that use imbedded control characters in the text, this program sets font changes in the middle of the text.

To do this, get in the Edit command, use the Insert subcommand, and press the shift/down-arrow/(x) keys. Letters B-Z (except M) insert ASCII codes 2-26. The numbers 1-5 (shifted) insert ASCII codes 27-31 and a space inserts code 255.

Insert the Escape code, ASCII 27, with the shift/up-arrow keys. Since inserting nonprint (invisible) characters confuses the display, be careful!

The Escape code is an upward line feed on the video display; to see the line normally, press the shift/@ keys twice.

As the Hack and Extend subcommands of Edit use the Insert subcommand, they can change fonts.

Some printers, such as the Centronics 737 (Radio Shack Line Printer IV), con-

*The graphics characters
appear normally
on the screen
but print wider
than displayed
unless you use
the compressed
print font.*

sider underlining as a font change. For these, insert the appropriate codes as if for a font change.

Note that for the shift/down-arrow/(letter), the shift/down-arrow acts as a control key, and must be held down while the (letter) is keyed in. Likewise for the shift/up-arrow/(letter) keys.

Thus, in these cases only, the letter you key in is an uppercase letter. Where the shift/up-arrow precedes a number or other nonletter character, release the shift/up-arrow keys before keying in the final character.

The codes to use for different font changes for the Epson MX-80 printer are given in Table 6. Except for double

width, all font changes for the MX-80 are for whole lines only. Thus you must put the turn-on and turn-off codes on different lines so they don't cancel each other out.

Added font change codes for the MX-80 with the addition of Graftrax-80, or for the Okidata printer, are in Table 7. With Graftrax-80, you can change fonts within a line, and line spacing within the text. It also allows use of italics.

With the Graftrax-80 addition to the MX-80, the e mode underlining doesn't work, but u underlining does. You can change the Print routine so the underlining works (but then it won't work on a normal MX-80).

To change to e mode underlining using Graftrax-80, in line 2950, starting with D=VAL(X\$), change the CHR\$(133) to CHR\$(5) and delete the final E\$;"2"; from the line. In line 2970, delete E\$;"A";CHR\$(140); from the line.

When using the Graftrax-80 addition to the MX-80, this change gives you the advantage of using both TRS-80 graphics and e mode underlining in the same text.

For any other printer, check the user's manual to find out what fonts it uses and which control codes it needs. This program should be able to insert the required codes.

TRS-80 Graphics Printing

This program allows direct keyboard entry of the 64 TRS-80 graphics characters, plus the [\] ^ _ ' { | } ~ special characters and bit-mapped graphics (see Table 8). The MX-80, among other printers, prints the graphics, while special characters are printable on most printers. See Fig. 1 for the characters this program prints.

The happy- and sad-face characters in Fig. 1 are bit-mapped graphics; 14 bytes define each face. It takes 4 bytes to set up bit-mapped graphics printing on the Epson MX-80 with Graftrax-80. See Table 9 for the happy-face codes and how to enter them from the keyboard.

You can print the large happy face in Fig. 3 on any printer that prints block graphics. Table 10 gives the codes to enter for each of the seven lines that make up this face.

The MX-80 requires that you shift the graphics characters up by 32 (ASCII 130 to ASCII 162). You can do this in the Format command, but this excludes e mode underlining. With the Graftrax-80 addition to the MX-80, there is

```

! " # $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ?
@ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _
` a b c d e f g h i j k l m n o p q r s t u v w x y z { | } ~
. : ; ' " & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ?
. : ; ' " & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ?

```

Each of these characters may be printed in 24 fonts: ☺
(except there are no italic graphics) ☻

1. Normal print, 80 characters per line.
2. Double width, 40 characters/line.
3. Compressed print, 132 characters per line.
4. Compressed double width print, 66 characters per line.
5. Emphasized normal print.
6. Double strike normal print.
7. Emphasized double strike normal print.
8. Emphasized double double width print.
9. Double strike double double width print.
10. Emphasized double strike double double width print.
11. Double strike compressed print.
12. Double strike compressed double width print.
13. Italic normal print, 80 characters per line.
14. Italic double width print, 40 characters/line.
15. Italic compressed print, 132 characters per line.
16. Italic compressed double width print, 66 characters/line.
17. Italic emphasized normal print.
18. Italic double strike normal print.
19. Italic emphasized double strike normal print.
20. Italic emphasized double double width.
21. Italic double strike double double width.
22. Italic emphasized double strike double double width print.
23. Italic double strike compressed print.
24. Italic double strike compressed double width print.

Figure 1. Epson MX-80 character set.



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Figure 2. Y command letterhead.



Sincerely,

Delmer D. Hinrichs
2116 S. E. 377th Ave.
Washougal, Wash. 98671
(206) 835-2983

Figure 3. Sample ending for letters.

an alternate font-change method to print TRS-80 graphics (see above). This font-change method mixes block and bit graphics.

To enter either special characters or graphics, use the Edit command. In the Hack, Insert, or Extend modes, press the shift/left-arrow keys for low-graphics entry, or shift/right-arrow keys for high-graphics entry.

The mode displays at the lower right of the video screen. Repeated pressing of either shift/left-arrow or shift/right-arrow toggles the graphics entry mode on and off. Then pressing the keys in Table 4 (unshifted) inserts the special

characters or graphics characters into the text.

The graphics characters appear normally on the screen, though they print much wider than displayed unless you use the compressed print font. In this graphics entry mode you can still overstrike with <.

Special characters may look different on the screen than when printed: On the Model I, [\] ^ are displayed as ↑ ↓ ← →.

Possible Problems

A program halt accompanied by a Basic error message or accidentally

touching the break key does not always lose your text and address files. In most cases, you can recover by keying in GOTO 60 and pressing the enter key. This returns you to the Command prompt.

Speed

This program is written in Basic, and therefore its handling of each entered character isn't fast enough to keep up with a good touch typist. A touch typist must key in text at a deliberate pace. This is especially true at the end of a line, where moving a too-long word to the beginning of the next line takes a little extra time.

The program occasionally pauses for a moment during operation. This is due to the way Basic handles strings. Each time you change a string (group of characters), Basic assigns it a new location in string space. As this quickly fills up all available string space, a garbage-collection routine in Basic clears out all the old, no-longer-needed versions of each string.

As the text file fills up, these pauses become longer and more frequent. The best solution to this problem is to save the text on disk as separate short files of 100 lines or so, rather than trying to fill the text file to its maximum capacity. Then combine the short text files for printing by using Load.

The Archbold clock control board that I use helps speed up the TRS-80's clock by 50 percent. The OUT254,1 statement in the program speeds up the clock, while the OUT254,0 statement slows it down again. If you do not have this board, these statements have no effect.

Algorithms for Compile, some Edit functions, and Justify are faster in disk and Level 3 versions.

For fast touch typists, compiled versions are the best solution, but are available for 48K Model I disk systems only.

Model III TRS-80s

The program automatically sets itself to allow for the lowercase display capability of the Model III, and allows for its slightly lower memory availability. The up, down, left, and right arrows for video display markers listed for the Model I show up as [\] ^ on the Model III, respectively.

Printer

The program routines for printing text work correctly on my Epson MX-80 printer, but may need changes for other printers. If the printer isn't ready, the program displays a "Printer

Not Ready" message. There is an underline routine for MX-80 e mode underlining that works even with the standard Radio Shack printer cable. Some printers may require LPRINT CHR\$(32) instead of LPRINT at the end of line 2860. There are many variations; the printer manual should tell you how to set the program to match its requirements.

Either TRS-80 graphics or e mode underlining print on the MX-80, but *not* both in the same text. The special characters, [\] ^ _ ' { | } ~ print either way. As mentioned above, with the Graftrax-80 font-change method of setting TRS-80 block graphics, you can mix e mode underlining and graphics in the same text.

Memory

This program uses essentially all of the TRS-80 memory. It POKEs the six machine-language routines into high memory, and lines zero through 9 delete themselves. If you use a machine-language printer driver, you have to relocate it and reduce the size of the program's text file to avoid getting an out-of-memory message. If you run it and see "Command?", immediately press

the break key, the PRINT MEM.

You should have at least 350 bytes of free memory left for work space. If not, you have to reduce the Clear (in line 20) and reduce the value of NL, where NL equals the number of lines. Set Clear to at least 300-400 bytes greater than the value of NL*LL*2, where LL equals the line length.

As shown in the Program Listing, the program requires 16,675 bytes of memory. After program lines zero through 9 automatically delete after use, the program needs 15,213 bytes. Deletion of the y command as described reduces the program to 13,303 bytes in its ready-to-use form.

Line Length

If you set the line length in Format equal to the maximum print line length of your printer, some printers insert blank lines between lines of text. The easiest way to avoid this is to set the line length shorter (i.e., 79 for an 80-character/line printer). Be sure to set the value of NL in line 20 smaller if you use line lengths greater than 60 characters; see the paragraph on Memory above for how to check for adequate memory. Set Left Margin in Format to zero also.

Lowercase Modifications

There are a number of different keyboard mods available for the Model I that allow you to display lowercase letters on the video. This program has a built-in lowercase driver. If you do *not* have a lowercase mod, delete the last two POKEs in line 5 of the program. If you use a lowercase mod or DOS that contains its own driver, delete all of line 5 following NEXT I. See line 9 of the program.

If you do *not* have a lowercase mod on your Model I TRS-80, these programs show both lower- and uppercase letters as uppercase on the video display. However, they print as lower- and uppercase letters, and you can check for case by using the Search (s) subcommand of Edit.

With a lowercase mod on a Model I, or with a Model III, the filespec in disk Load and Save displays as lowercase unless you shift the letters; this does no harm. The DOS interprets the filespecs as uppercase. ■

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Program Listing. Basic Word Processor.

```

0 ' << BASIC Word Processor, 48K Disk Form Letter Version >>
  by D.D.Hinrichs, 2116 S.E. 377th Ave., Washougal Wash. 98671
  Other tape and disk versions available from the author.
1 CLS :PRINT@ 320, CHR$(23); "Poke Scroll, LC Patch & Shift"
2 ' M/L Graphics Shift by Leo Christopherson, 80-US, Jan-F 1980
  M/L Scroll-Down by Bob Boothe, 80-Micro, April 1981, p. 116
3 ' M/L Video Patch by Tim Mann, TRS-80 Computing, V1, N2 (CIE)
  M/L Case Shift by Martin Hambel, 80-Micro, May 1981, p. 260
4 POKE 16561,149 :POKE 16562,255 :POKE 16409,0 :CLEAR 50
  :POKE 16553,255 :DEFUSR0=&HFFDC
5 RESTORE :FOR I=-106 TO -1 :READ B :POKE I,B :NEXT I
  :IF PEEK(84)=1 POKE -23,PEEK(16406) :POKE -22,PEEK(16407)
  :X=USR0(B)
  :POKE 16414,190 :POKE 16415,255
  ' POKE in six M/L routines,
  Divert to Keyboard Case Shift and Video Patch (if Model I).
6 POKE -95,PEEK(16422) :POKE -94,PEEK(16423)
  :DEFUSR0=&HFFA3
7 DATA 245,121,254,128,56,2,198,32,79,241,195,0,0, 217,17,255,
  63,33,191,63,1,192,3,237,184,33,0,60,17,1,60,1,63,0,54,32,
  237,176,217,201, 221,110,3,221,102,4,218,154,4,221,126,5,
  183,40,1,119,121,254,32,218,6,5,254,128,210,166,4,195,125,4
8 DATA 33,227,255,34,22,64,201, 225,33,235,255,229,195,0,0,
  254,65,56,14,254,123,48,10,254,91,56,4,254,97,56,2,238,32,
  195,221,3
9 CLS :PRINT@ 520, CHR$(23); "Key in: RUN <ENTER>"
  :DELETE 0-9
  ' For Model I TRS-80s without an LC keyboard mod, put a ' in
  line 5 after "X=USR0(B)". For Model I TRS-80s with an
  LC DOS, put a ' in line 5 after "NEXT I".
10 CLS :PRINT TAB(7) "BASIC Word Processor, 48K Disk Form Letter
  Version"
20 CLEAR21520:DEFINT A-Z:U=32:N1=176 ' (c) by D.D.Hinrichs 1983
30 DIM C,P,A$,A,A$(NL),B$(NL),S(U),T(U):V=64:W=1003:CMD"T"
40 B$=CHR$(30):E$=CHR$(27):F$="#":M$="n":N$="y":P$=M$:PN$=M$
  :PL$=M$:S$="":U$=CHR$(95)
50 FP=1:PT=1:LA=-1:LL=60:LM=10:NA=3:PL=15:PS=8
60 CLOSE:H=1:N=0:OUT254,1:PRINT:PRINT"Command? ";:GOSUB3510
70 PRINT:CL=0:G=0:H=1:I=LA:IT=0:R=0:IFA>96ONA-96GOTO90,610,650,
  960,1010,1560,1930,2170,2220,2260,2380,2400,2470,2540,2640,
  2800,80,3040,3070,80,80,3200,80,3580,3600
80 PRINT:PRINT"*** ENTRY ERROR ***":GOTO60
90 IFT$<"GOTO120 ' ADD
100 PRINT"Enter Text or Addresses (T/A)? ";:GOSUB3510
110 PRINT:IFA=97THENT$="ADDRESS"ELSEIFA=116THENT$="TEXT"ELSE80
120 CLS:D=0:P=1:N$="y":C$=CHR$(143):IFI<GOTO160
130 IFNL=LA+1THEN310ELSEIFI>13THENB=I-13ELSEB=0
140 FORL=BTOI:GOSUB3370:D=D+(Y+3)/V:IFA=10THEND=D+1
150 NEXTL
160 L=I+1:B=0:IFL+D>14THEND=14-L
170 IFP>61THEND=D+1ELSEIFP<60ORP<62ANDBTHEN180ELSEIFHGOTO190
180 PRINT
190 GOSUB550
200 PRINT@C,B$;:GOSUB3370:P=Y+1:C=C+P+3:K=L+1:H=1:GOSUB570
210 PRINT@W,P;
220 PRINT@C,C$;:A$=INKEY$:PRINT@C,S$;:IFA$=""GOTO220
230 B=0:A=ASC(A$):IFCLIFA>96THENA=A-U:A$=CHR$(A)
240 IFA>VTHEN290ELSEIFA>UGOTO280
250 A$=S$:IFA>7ONA-7GOTO420,460,490,80,80,310
260 IFA>23ONA-23GOTO440,480,400,410,80,80,80,500

```

```

270 GOTO80
280 IFA=60GOTO510ELSEIFA=VGOTO390
290 IFA=96THENLP=LA:IFLA<LTHENLA=L:LP=L:GOTO60ELSE60
300 PRINT@C,A$;:A$(L)=A$(L)+A$:IFP<=LTHENP=P+1:C=C+1:GOTO210
310 IFRGOTO60ELSEIFNL<KPRINT"FILE FULL":LA=NL-1:LP=LA:GOTO60
320 IFLEN(A$(K))THENL=K:GOSUB2230
330 IFK>LATHENLA=K
340 IFA$=S$GOTO380
350 FORM=LL+1TO2STEP-1:A$=MID$(A$(L),M,1):IFA$<S$NEXTM:GOTO380
360 A$(K)=RIGHT$(A$(L),LL-M+1):A$(L)=LEFT$(A$(L),M-1)
370 PRINT@C-LL+M-1,B$;:L=K:B=1:GOTO170
380 PRINTB$;:A$(L)=LEFT$(A$(L),LL):L=K:GOTO170
390 CL=1-CL:GOSUB570:GOTO210 ' C-L
400 IFP>LLGOTO310ELSEGOSUB1530:GOTO540 ' S-D
410 IFP>LLGOTO310ELSEGOSUB1510:GOTO540 ' S-U
420 IFP=1GOTO210ELSEC=C-1:P=P-1:A$(L)=LEFT$(A$(L),P-1) ' L
430 PRINT@C,C$;S$;:GOSUB530:IFPEEK(14400)=UTHEN420ELSE210
440 IFP=1GOTO210 ' S-L
450 A$(L)=""H=0:PRINT@960,B$;:GOTO190
460 IFP>LLGOTO210ELSEPRINT@C,S$;C$;:C=C+1:P=P+1 ' R
470 A$(L)=A$(L)+S$;GOSUB530:IFPEEK(14400)=VTHEN460ELSE210
480 IFP>LLGOTO310ELSEGOSUB1550:GOTO540 ' S-R
490 IFP>LLGOTO310ELSEGOSUB1540:D=D+1:R=0:PRINT:GOTO310 ' D-A
500 IFP>LLGOTO310ELSEGOSUB1520:GOTO540 ' CL
510 IFP=1GOTO210 ' <
520 PRINT@C,"<";:A$(L)=A$(L)+CHR$(8):C=C-1:P=P+1:GOTO210
530 PRINT@W,CHR$(15);P;:FORI=1TOI:NEXTI:RETURN
540 H=0:GOSUB550:PRINT@C,B$;:GOSUB3370:GOTO310
550 C=(L+D)*V:IFC>896THENC=896:IFHPRINT
560 RETURN
570 IFASC(T$)=65PRINT@960,"Use";NA;"lines/address";
580 PRINT@990,"<";T$;">";
590 PRINT@1014;,:IFCL=1PRINT"CAPS-LOCK";ELSEPRINTSTRING$(9,U);
600 RETURN
610 IFLA<0GOTO80 ' BLANK
620 CLS:PRINT"Deleting Blank Lines":FORJ=LATO0STEP-1
630 IFA$(J)=""FORI=JTOLA:A$(I)=A$(I+1):NEXTI:A$(LA)=""LA=LA-1
640 NEXTJ:IFRTHENRETURNELSE3200
650 F=0:INPUT"First Line to Compile";F:IFF<0THENF=0 ' COMPIL
660 Z=0:INPUT"Last Line to Compile";Z:IFZ>LATHENZ=LA
670 IFZ>ZTHEN80ELSECLS:PRINT"Compiling Line":J=1:Z1=Z-1
680 FORL=FTOZ:PRINT@15,L:GOSUB3440:IFY<2GOTO750
690 X$="";P=1:K=L+1
700 Q=INSTR(P,A$(L),S$):IFQ>PTHENJ=0ELSEIFQ=0THENQ=Y+1
710 IFJ=0IFP=QTHENP=Q+1:GOTO700
720 X$=X$+MID$(A$(L),P,Q-P+J):P=Q+1
730 IFQ<YGOSUB910:IFA=UGOTO700ELSEX$=X$+S$:GOTO700
740 A$(L)=X$
750 GOSUB3440:IFA=2ORA=3ORA=10ORA=95ORY<=LLORL=2GOTO810
760 X$="":FORI=YTO1STEP-1:A$=MID$(A$(L),I,1)
770 IFA$<S$THENX$=A$+X$:NEXTI:GOTO810
780 GOSUB910
790 A$(L)=LEFT$(A$(L),I-1):IFLEN(A$(K))=0THENA$(K)=X$:GOTO750
800 A$(K)=X$+Q$+A$(K):GOTO750
810 NEXTL:FORL=FTOZ1:K=L+1:X$=A$(L):PRINT@20,L:IFX$=S$THENX$=""
820 X=LEN(A$(K)):Y=LEN(X$):IFX=0THENK=K+1:IFK<=ZTHEN820ELSE900
830 GOSUB910:IFA=2ORA=3ORA=10ORA=95GOTO900
840 IFX>1IFASC(A$(K))=UTHENA$(K)=RIGHT$(A$(K),X-1):GOTO820
850 Y=Y+R:Q=INSTR(A$(K),S$):IFQ<=LORY=0THENQ$=""
860 IFQTHENY$=LEFT$(A$(K),Q-1)ELSEY$=A$(K):Q=X+1
870 IFLL-Y<QGOTO890ELSEX=X-Q:IFX<0THENX=0
880 X$=X$+Q$+Y$:A$(K)=RIGHT$(A$(K),X):GOTO820

```


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Listing continued

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890 IFR<0THENX$=X$+"-"  
900 A$(L)=X$:NEXTL:X=LEN(A$(Z)):N=F:R=1:GOSUB620:GOTO1150  
910 A=0:R=0:Q$=S$:IFY=0RETURN  
920 A=ASC(RIGHT$(X$,1)):IFA=59THENX$=X$+S$:R=1  
930 IFA=33ORA=46ORA=58ORA=63THENX$=X$+"":R=2  
940 IFA=45THENN=LEN(X$)-1:C$=MID$(X$,N,1)  
:IFC$<>S$ANDC$<>"-THENX$=LEFT$(X$,N):Q$="" :R=-2  
950 RETURN  
960 F=1:Z=0:INPUT"First Line to Delete";F:IFF<0THENF=0 ' DELETE  
970 INPUT"Last Line to Delete";Z:IFF>ZTHEN80ELSEIFZ>LATHENZ=LA  
980 CLS:PRINT"Deleting":J=Z  
990 FORI=FTOLA:J=J+1:IFJ>LATHENA$(I)=""ELSEA$(I)=A$(J)  
1000 NEXTI:LA=LA-Z+F-1:R=1:GOSUB610:GOTO3200  
1010 H=0:L=N:C$=CHR$(176):IFL<0ORL>LAORA$(L)=""GOTO80 ' EDIT  
1020 N$="y":IFITTHENP=Z-1:GOTO1040  
1030 P=1  
1040 C=P+3:O$=A$(L)  
1050 CLS:D=-1:R=0:GOSUB3370:GOSUB580  
1060 N=1:Q$=""  
1070 GOSUB1170:GOSUB3540:F=0:M=0:IFA=UTHEANA=9  
1080 IFA=8ORA=9GOSUB1200  
1090 IFA=97THENA$(L)=O$:GOTO1030 ' A  
1100 IFX=LLGOTO1120ELSEIFA=10GOSUB1540  
1110 IFA>24ONA-24GOSUB1550,1530,1510,560,560,560,1520  
1120 IFA>98ONA-98GOSUB1230,1260,1280,560,560,1300,1310,560,1440  
1130 IFA=115GOSUB1450ELSEIFA=117GOSUB1480ELSEIFA=120GOSUB1500  
1140 IFA=108GOTO1030ELSEL=L:IFMTHEN1060  
ELSEIFRPRINT0320,ELSE1050  
1150 IFLL<KPRINT"Line";L;"has";X;"Characters":IFIT=0GOTO60  
1160 IFITHENRETURNELSE3200  
1170 X$=MID$(A$(L),P,1):B=1:PRINT@W,P;  
1180 PRINT@C,C$;:A$=INKEY$:PRINT@C,X$;CHR$(15);:IFA$=""GOTO1180  
1190 A=ASC(A$):X=LEN(A$(L)):IFA=13THENR=1:RETURNELSERETURN  
1200 M=1:P=P+A*2-17:IFP<1THENP=1ELSEIFP>XTHENP=X ' MV  
1210 PRINT@C,X$;:C=P+3:X$=MID$(A$(L),P,1):PRINT@C,C$;:GOSUB530  
1220 K=PEEK(14400):IFK=UORK=VTHEN1200ELSERETURN  
1230 Q=P:D=C:FORI=1TON:GOSUB1170:IFA<UORA=96GOTO1250 ' C  
1240 PRINT@C,A$;:MID$(A$(L),P)=A$:P=P+1:C=C+1:IFP<XNEXTI  
1250 P=Q:C=D:A=U:RETURN  
1260 IFP+N-1>XTHENN=X-P+1 ' D  
1270 GOSUB1420:Q=P:P=P+N:GOSUB1430:A$(L)=L$+R$:P=Q:RETURN  
1280 PRINT@C+V,U$:C=C+1:P=P+1:M=1:IFD=-1THEND=P-2 ' E  
1290 A$(L)=O$+U$+STR$(D)+", "+STR$(P-D-1)+U$:RETURN  
1300 GOSUB1420:A$(L)=L$+S$:PRINT@C,B$ ' H  
1310 R=0:GOSUB1170:IFRORA=96GOSUB3440:X=Y:A=U:RETURN ' I  
1320 IFA=8ORA=9GOSUB1200:GOTO1310  
1330 IFA=26IFF=0THENF=1:GOTO1310  
1340 IFA=25IFF<>1PRINT@1010,,:IFF=2PRINTSTRING$(13,U);  
:F=0:GOTO1310ELSEPRINT"High Graphics";:F=2:GOTO1310  
1350 IFA=24IFF<>1PRINT@1010,,:IFF=3PRINTSTRING$(13,U);  
:F=0:GOTO1310ELSEPRINT"Low Graphics ";:F=3:GOTO1310  
1360 IFF=1THENF=0:IFA>UANDA<38THENA=A-6ELSEIFA=UTHEANA=255  
1370 IFF=2IFA>47ANDA<60THENA=A+106ELSEIFA>96THENA=A+69  
1380 IFF=3IFA>47ANDA<54THENA=A+43ELSEIFA>53ANDA<59THENA=A+69  
ELSEIFA>96THENA=A+31  
1390 A$=CHR$(A):IFP>XTHENX=P  
1400 GOSUB1420:GOSUB1430:IFA=60THENX$=CHR$(8):B=-1ELSEX$=A$ ' <  
1410 A$(L)=L$+X$+R$:PRINT@C,B$A$CHR$(15)R$:C=C+B:P=P+1:GOTO1310  
1420 L$="" :IFP<2RETURNELSEL$=LEFT$(A$(L),P-1):RETURN  
1430 R$="" :IFP>XRETURNELSER$=RIGHT$(A$(L),X-P+1):RETURN  
1440 D=P:GOSUB1450:N=P-D:P=D:C=P+3:GOTO1260 ' K
```

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1450 GOSUB1170:Q=P ' S  
1460 FORI=1TON:Q=INSTR(Q+1,A$(L),A$):IFQNEXTI:C=C+Q-P:P=Q  
1470 A=U:RETURN  
1480 P=P+1:GOSUB1420:GOSUB1430:A$(L)=L$+CHR$(8)+U$+R$ ' U  
1490 PRINT@C+V,U$:C=C+1:P=P+2:M=1:RETURN  
1500 A$(L)=A$(L)+S$:P=X+1:C=P+3:GOTO1310 ' X  
1510 A$(L)=STRING$(LL-LEN(A$(L)),2,U)+A$(L) ' S-U  
1520 A$(L)=A$(L)+CHR$(3):RETURN ' CL  
1530 A$(L)=A$(L)+CHR$(2):RETURN ' S-D  
1540 A$(L)=A$(L)+CHR$(10):R=1:RETURN ' D-A  
1550 A$(L)=STRING$(LL-LEN(A$(L)),U)+A$(L):RETURN ' S-R  
1560 CLS:PRINT"FORMAT:" ' FORMAT  
1570 PRINT"To leave Formats unchanged, press <ENTER>":PRINT  
1580 PRINT"Line Length =";LL;:X=LL:GOSUB1870:LL=X  
1590 IFLL<20ORLL>122GOSUB1920:PRINT"20 to 122":LL=60:GOTO1580  
1600 PRINT"Line Spaces =";S;:X=S:GOSUB1870:S=X  
1610 PRINT"Line Nos. = ";N$;" ";:X$=N$:GOSUB1890:N$=X$  
1620 IFLA<0GOTO1840ELSEIFLP>LATHENLP=LA  
1630 PRINT"First Print Line =";FL;:X=FL:GOSUB1870:FL=X  
1640 IFFL>LAGOSUB1920:PRINT"0 to";LA:FL=0:GOTO1630  
1650 PRINT"Last Print Line =";LP;:X=LP:GOSUB1870:LP=X  
1660 IFLP<FLORLP>LAGOSUB1920:PRINTFL,"to";LA:LP=LA:GOTO1650  
1670 PRINT"Left Margin =";LM;:X=LM:GOSUB1870:LM=X  
1680 PRINT"Page Length =";PL;:X=PL:GOSUB1870:PL=X  
1690 PRINT"Page Spacing =";PS;:X=PS:GOSUB1870:PS=X  
1700 PRINT"Page Nos. = ";PN$;" ";:X$=PN$:GOSUB1890:PN$=X$  
1710 PRINT"First Page = ";FP;:X=FP:GOSUB1870:FP=X  
1720 PRINT"Page 1 No. = ";P1$;" ";:X$=P1$:GOSUB1890:P1$=X$  
1730 PRINT"Page Stop = ";P$;" ";:X$=P$:GOSUB1890:P$=X$  
1740 PRINT"MX-80 Graphics = ";M$;" ";:X$=M$:GOSUB1890:M$=X$  
1750 IFASC(T$)=65ORL2<2GOTO1840  
1760 PRINT"1st Text Line for Address =";FT;:X=FT:GOSUB1870:FT=X  
1770 IFFT>9GOSUB1920:PRINT"0 to 9":FT=1:GOTO1760  
1780 PRINT"No. of Address Lines =";NA;:X=NA:GOSUB1870:NA=X  
1790 IFNA<3ORNA>5GOSUB1920:PRINT"3 to 5":NA=3:GOTO1780  
1800 A=AL/NA+1  
1810 PRINT"Current Address No. =";A;:X=A:GOSUB1870:A=X  
1820 AL=(A-1)*NA:A=L2/NA+1  
1830 IFAL<0ORAL>L2GOSUB1920:PRINT"1 to";A:AL=0:GOTO1800  
1840 PRINT"Heading = ";H$;" " "New =? ";:LINEINPUTX$  
1850 IFX$<>"THENH$=X$  
1860 GOTO60  
1870 PRINT"New =? ";:N=-1:GOSUB3510:IFA=13ANDN>-1THENX=N:RETURN  
1880 IFA=13RETURNELSEPRINT:GOSUB1920:PRINT"a number";:GOTO1870  
1890 PRINT"New (Y/N)? ";:N=-1:GOSUB3510:IFA=13ANDN=-1RETURN  
1900 IFA=121ORA=110PRINT:X$=A$:RETURNELSEIFA<>13PRINT  
1910 GOSUB1920:PRINT"Y/N (Unshifted)";:GOTO1890  
1920 PRINT"Entry must be ";:RETURN  
1930 CLS:PRINT"Get Addresses for Text:":PRINT ' GET ADDRESS  
1940 IFB$(AL)=""ORT$=""ORFT+NA>LAGOTO1960  
1950 IFASC(T$)=84GOTO1970  
1960 PRINT"Addresses not ready":GOTO60  
1970 PRINT"Replace '[' with First or Last name (F/L)? ";  
1980 GOSUB3510:PRINT:IFA=102THENUN=0ELSEIFA=108THENUN=1ELSE1970  
1990 CLS:PRINT"Current Address is No. ";AL/NA+1:PRINT  
2000 FORI=ALTOAL+NA-1:PRINTB$(I):NEXTI:PRINT  
2010 PRINT"To put it into the Text press <ENTER>"  
2020 PRINT"To print All texts with Addresses press 'A'"  
2030 PRINT"To Get the next Address press 'G'"  
2040 PRINT"To Quit press 'Q'":PRINT:H=0:GOSUB3510  
2050 IFA=113THEN60ELSEIFA=103ANDAL<L2THENAL=AL+NA:Z$=""
```

Listing continued

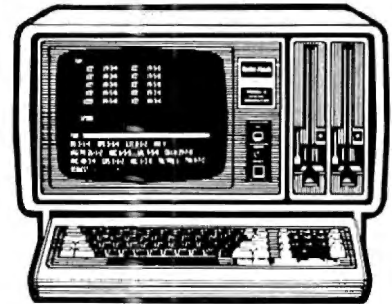
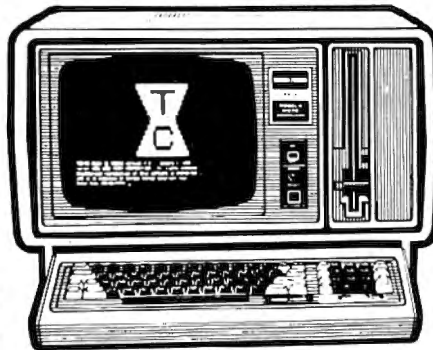
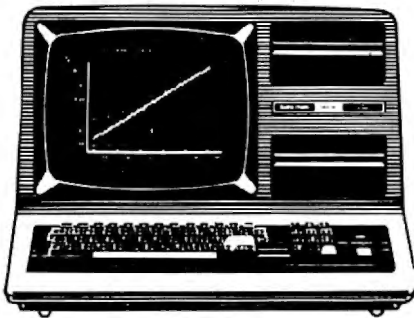
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```
2060 X=LEN(B$(AL)):IFX=0PRINT"No more Addresses":AL=0:GOTO60
2070 CLS:IFA=13ORA=97ORGTHENPRINT"Putting Address"ELSE1990
2080 IFUNTHENM=X:X=1:Z=-1ELSEM=1:Z=1
2090 FORI=MTOXSTEPZ:A$=MID$(B$(AL),I,1)
2100 IFA$<>S$THENIFUNTHENZ$=A$+Z$:NEXTIELSEZ$=Z$+A$:NEXTI
2110 IFZ$=""NEXTI
2120 C=ASC(RIGHT$(Z$,1)):IPC=46ORC>VANDC<91THENZ$=""NEXTI
2130 M=0:FORI=FTTOFT+NA-1:A$(I)=B$(AL+M):M=M+1:NEXTI:B=A
2140 IFGTHENX$=Z$:X=LEN(Z$):GOTO2720ELSE1:Y$="" :GOSUB2740
2150 IFB=97THENY$=Z$:T=LEN(Z$):B=103:G=1:GOTO2800
2160 N=0:GOTO3200
2170 CLS:PRINT"Legal Commands are:":PRINT ' HELP
2180 PRINT"A ADD","B BLANK","C COMPILE","D DELETE",
"E EDIT","F FORMAT","G GET ADDR.,"H HELP","I INSERT",
"J JUSTIFY","K KILL","L LOAD","M MOVE","N NEW FILE",
"O OVERLAY","P PRINT","R REPLACE","S SAVE","V VIDEO",
"X EXIT"
2190 PRINT"Y YOUR L'HEAD":PRINT
2200 PRINT"Key 'Shift-@' twice to return from A,I,L,R,S to Comma
nd mode"
2210 PRINT"From E & R only, press <ENTER> to return":GOTO60
2220 L=N:IFL<0ORL>LAGOTO80 ' INSERT
2230 IFNL=LA+1PRINT"FILE FULL":GOTO60ELSEIFRGOTO60
2240 FORI=LATOLSTEP-1:A$(I+1)=A$(I):NEXTI
2250 A$(L)="" :LA=LA+1:L=L-1:IFITRETURNELSEI=L:IT=1:GOTO120
2260 CLS:PRINT"Justifying Line":FORL=0TOLA:GOSUB3440 ' JUSTIFY
2270 PRINT@16,L:IFY<2ORY>=LLGOTO2370
2280 IFA=2ORA=3ORA=10ORA=95THEN2370ELSEJ=0:FORI=1TOY
2290 Q=INSTR(I,A$(L),S$):IFQ=0THENI=Y:GOTO2310
2300 IFQ>ITHENS(J)=Q:J=J+1:I=Q
2310 NEXTI:IFJ=0GOTO2370
2320 K=RND(J)-1:IFINT(J/2)=J/2ORJ=1THENN=1ELSEN=2
2330 FORI=1TOLL-Y:T(K)=T(K)+1:K=K+N:IFK>J-1THENK=J
2340 NEXTI:FORI=J-1TO0STEP-1:A$=STRING$(T(I),S$):T(I)=0
2350 A$(L)=LEFT$(A$(L),S(I))+A$+RIGHT$(A$(L),LEN(A$(L))-S(I))
2360 NEXTI
2370 NEXTL:N=0:GOTO3200
2380 CLS:PRINT"Really Kill (Y/N)? ";:GOSUB3510 ' KILL
2390 IFA=121THENRUNELSE60
2400 GOSUB3160:IFA=96THEN60ELSEPRINT"Loading "; ' LOAD
2410 Q=LA+1:OPEN"1",1,FSS:PRINTFSS;
2420 INPUT#1,LA,LL,S,N$,FL,LP,LM,PL,PS,PN$,FP,PL$,P$,M$,PT,NA,H$
,T$
2430 IFH$<>"IFASC(H$)=1THENH$=""
2440 IPLA+Q<NLTHENLA=LA+Q:LP=LA:GOTO2460
2450 CLS:PRINT"Text too long":LA=Q-1:LP=LA:GOTO3150
2460 FORL=QTOLA:LINEINPUT#1,A$(L):GOSUB3440:NEXTL:GOTO3140
2470 F=1:INPUT"First Line to Move";F:IFP<0THENF=0 ' MOVE
2480 Z=0:INPUT"Last Line to Move";Z:IFZ>LATHENZ=LA
2490 IFP>ZTHEN80ELSEN=0:INPUT"Insert before Line";N:IN=N
2500 IFN<0ORN>LAORN>=FANDN<=ZTHEN80ELSEIT=1:FORM=FTOZ:CLS:R=0
2510 PRINT"Moving":GOSUB2220:IFIN<FTHENK=M+1ELSEK=F
2520 A$(N)=A$(K):A$(K)="" :IFIN<FTHENN=N+1
2530 R=1:GOSUB620:NEXTM:N=0:GOTO3200
2540 CLS:PRINT"Current File = ";T$;"", ' NEW FILE
2550 PRINT"Exchange Files (Y/N)? ";:GOSUB3510:PRINT
2560 IFA<>121GOTO60ELSEIFLA>L2THENJ=LAELSEJ=L2
2570 CLS:PRINT"Exchanging Files"
2580 FORI=0TOJ:A$=B$(I):B$(I)=A$(I):A$(I)=A$:NEXTI:L1=LA:A$=T$
2590 F1=FSS:LA=L2:T$=T2$:FSS=F2$:L2=L1:T2$=A$:F2$=F1$:LP=LA
2600 CLS:PRINT"Back File = ";T2$
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2610 IFT$<>"PRINT"Front File = ";T$:GOTO60
2620 IFASC(A$)=65THENT$="TEXT"ELSET$="ADDRESS"
2630 LA=-1:GOTO60
2640 CLS:PRINT,"OVERLAY":PRINT ' OVERLAY
2650 PRINT"Search or Replace (S/R)? ";
2660 GOSUB3510:PRINT:PRINT:IFA=114THEN2700ELSEIFA<>115GOTO80
2670 PRINT"Word to Search for? ";:GOSUB3460
2680 Y$=X$:IT=1:GOSUB2740:PRINT:IFZ=0PRINT"Word not found"
2690 GOTO60
2700 CLS:PRINT"Old Word to Overlay? ";:GOSUB3460
2710 PRINT"New Word to Replace old Word? ";:T=X:Y$=X$:GOSUB3460
2720 IFX*T=0THEN80ELSECLS:PRINT"Overlaying":Z$=X$:GOSUB2740
2730 IFGTHEN=LEN(X$):Y$=X$:GOTO2800ELSE60
2740 FORL=0TOLA:Z=1
2750 Z=INSTR(Z,A$(L),Y$):IFZTHENX=LEN(A$(L)):Z=Z+1ELSE2790
2760 IFIT=0THENA$(L)=LEFT$(A$(L),Z-2)+Z$+RIGHT$(A$(L),X-T-Z+2)
:GOSUB3370:GOTO2750
2770 A=U:N=L:GOSUB1010:PRINT:PRINT"Continue Search (Y/N)? ";
2780 H=1:GOSUB3510:Z=P+1:IFA=121THEN2750ELSEL=LA
2790 NEXTL:RETURN
2800 GOSUB3550:IFRGOTO60 ' PRINT
2810 X=FP:M=FL:R=1:GOSUB620:R=0:IFLP>LATHENLP=LA
2820 IFM$="y"THENPOKEL6422,150:POKEL6423,255
ELSEPOKEL6422,PEEK(-95):POKEL6423,PEEK(-94)
2830 CLS:I=M+PL-1:PRINT"Printing";T$;
2840 IFPN$="n"ORP1$="n"ANDX=1GOTO2870
2850 LPRINTTAB(LM)H$;STRING$(LL-7-LEN(H$),U);
2860 LPRINT"Page";USING"###";X:LPRINT
2870 FORP=MTOI:IFP>LPGOTO2990
2880 M=M+1:IFSLPRINTSTRING$(S-1,13)
2890 LPRINTTAB(LM);:IFN$="y"LPRI NTUSINGF$;P;:R=4
2900 Q$=RIGHT$(A$(P),1):IFQ$<>U$LPRI NTAS(P):GOTO2980
2910 O$=A$(P):X$="" :O=LEN(O$)
2920 GOSUB3030:IFQ$<>"",THENX$=Q$+X$:GOTO2920
2930 N=VAL(X$):X$=""
2940 GOSUB3030:IFQ$<>U$THENX$=Q$+X$:GOTO2940
2950 D=VAL(X$):GOSUB3030:LPRINTES;"A";CHR$(133);E$;"2";
2960 LPRINTO$;LPRINTES;"1";STRING$(D+LM+R,U);STRING$(N,45)
2970 LPRINTTAB(LM)E$;"A";CHR$(140);E$;"2";
2980 IFASC(Q$)<>2NEXTPELSEIFI>=MLPRINTSTRING$(I-M,13)
2990 IFPSLPRI NTSTRING$(PS-1,13)
3000 IFP$="y"THENW$="new page":CLS:GOSUB3500
3010 IFP>LPGOTO3140
3020 X=X+1:GOTO2830
3030 O=O-1:O$=LEFT$(O$,O):Q$=RIGHT$(O$,1):RETURN
3040 IFN<0ORN>LATHEN80ELSECLS:N$="y":L=N:GOSUB3370 ' REPLACE
3050 PRINT:PRINT"Really Replace Line";N;"(Y/N)? ";:GOSUB3510
3060 IFA=121THENR=1:A$(N)="" :I=N-1:GOTO120ELSE60
3070 GOSUB3160:IFA=96THEN60ELSEPRINT"Saving "; ' SAVE
3080 IFH$=""THENH$=CHR$(1):GOTO3100
3090 IFRIGHT$(H$,1)=S$THENH$=LEFT$(H$,LEN(H$)-1):GOTO3080
3100 R=1:GOSUB610:OPEN"O",1,FSS:CLS:PRINT"Saving ";FSS;
3110 PRINT#1,LA;LL;S;N$;"",;FL;LP;LM;PL;PS;PN$;"",;FP;P1$;"",;
P$;"",;M$;"",;PT;NA;H$;"",;T$
3120 FORL=0TOLA:IFASC(RIGHT$(A$(L),1))=10THENA$(L)=A$(L)+S$
3130 PRINT#1,A$(L):NEXTL
3140 PRINT" Completed"
3150 IFGPRINT:A=B:GOTO2050ELSE60
3160 IFPS$=""IFT$<>"THENFSS$=T$+"/BWP"ELSEFSS$="TEXT/BWP"
3170 PRINT"Current Filespec = ";FSS;"",:LINEINPUT"New =? ";A$
3180 IFA$<>"THENA=ASC(A$):IFA=96THENRETURNELSEFSS$=A$
```

Listing continued

The Whole Earth Computer

This 4-bit computer uses no electricity—
just knock down the dominoes and start calculating.

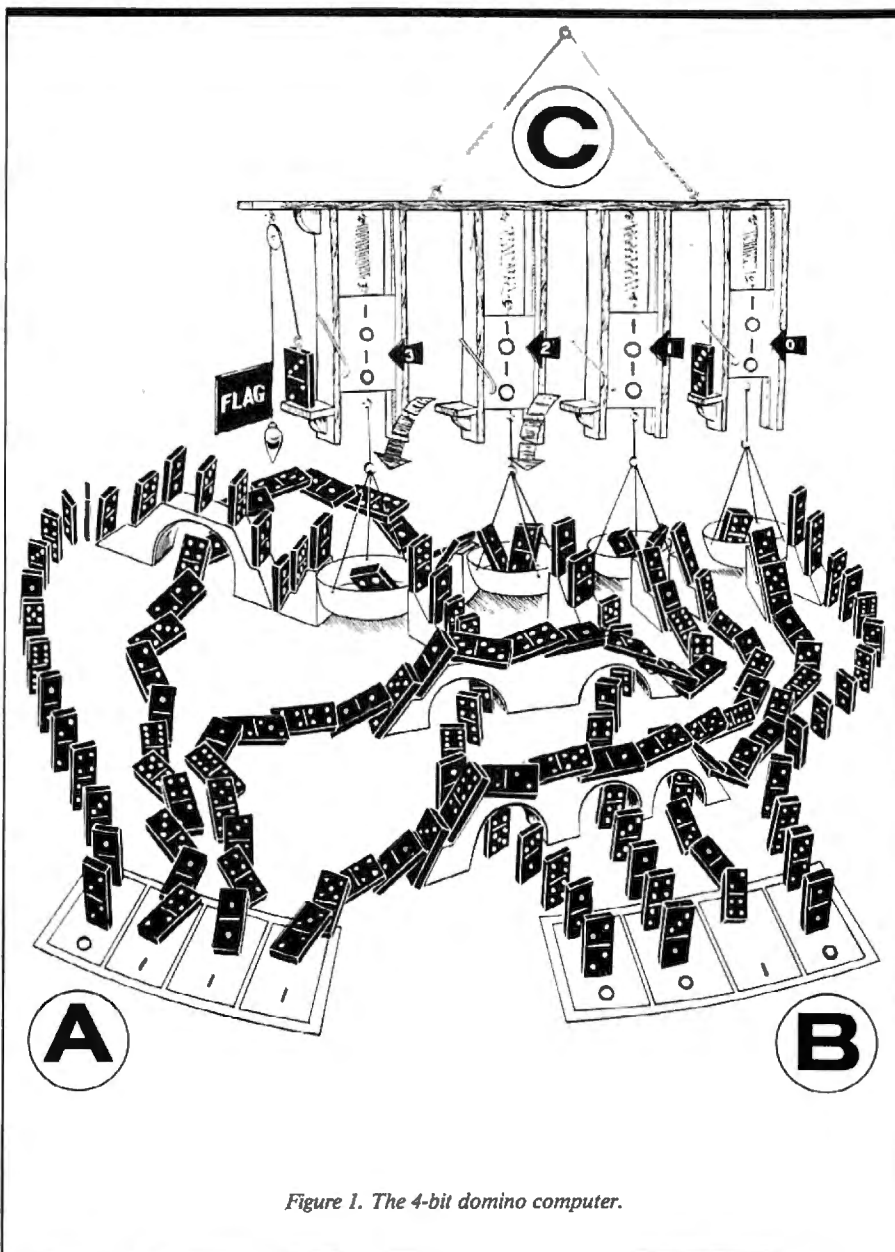


Figure 1. The 4-bit domino computer.

In 1894, Charles Babbage invented what he called the analytic engine, the predecessor to the modern computer. Compared to today's calculating machines, Babbage's was an unwieldy contraption that made all its calculations mechanically. Executing any mathematical function, like addition, required a host of moving parts, clanking out the correct answer.

Archaic though Babbage's invention may now be, it demonstrated two important concepts. Because all the parts in his machine moved, it was easy to trace the flow of calculating logic. And it showed that sources of energy other than electricity can power a computer.

To demonstrate these ideas, I built a computer that is powered by gravity and uses dominoes in place of one and zero bits. I'll explain how you can build the 4-bit domino computer. All you need is some string, four small plastic containers, some scraps of wood, and five boxes of dominoes.

Overview

A gravity-powered computer can operate anywhere on earth. The domino computer uses rows of dominoes as the conduit for the transfer of gravitational power.

Like the electronic computer, the domino uses a binary number system. It represents zero binary as a standing domino, and 1 binary as a toppled domino (see Fig. 1).

For the sake of simplicity, I limited the size of the domino computer to 4 bits. This means that it can compute results of up to 15 decimal (1111 binary). Displaying a number larger than 15 requires more than 4 bits.

The domino computer has three 4-bit registers: A, B, and C. Registers A and B store the two numbers used in an addition problem. Register C shows the results of the addition.

Construction

Figure 1 gives you an idea of how the finished domino computer should look. Each bit position in register C is a sliding panel suspended on a spring. This wood panel moves within grooves, similar to a window sliding in its casing.

I labeled each panel from top to bottom with the binary numbers 1, zero, 1, and zero, respectively. A numbered pointer sits to the right of these numbers, fixed to the frame. The number indicates the bit position; three is the most significant bit position (MSB) and zero is the least significant bit position (LSB). Each pointer indicates the binary value of its register.

Small plastic buckets hang by strings under the sliding panel to catch falling dominoes. The various tunnels and bridges in Fig. 1 allow for each row of dominoes access to its particular bit in the C register. You can construct the bridges with wood scraps and suspend the C register frame from your dining room chandelier with a stout cord.

Programming and Running the Computer

Figure 1 shows the state of the computer after it adds seven and two. To simulate this calculation, set all the dominoes in a vertical position, trailing them as shown in Fig. 2.

Notice that I connected bit position zero in register A to bit position zero in register B to position zero in register C, and so on for all other bit positions. Register A holds the number seven (0111 binary), and register B holds the number two (0010 binary).

I added the two numbers in binary format from right to left, the same as you would in the decimal system. Bit position zero (LSB) holds zero binary in register B and 1 binary in register A. Tipping over the first domino at bit position zero in register A makes the row of dominoes fall, with the last one landing in the bucket at bit position zero in register C.

Do not tip over the domino at bit position zero in register B, since it con-

Register	Decimal	Binary
A	7	0111
B	+2	+0010
C	9	1001

Table 1. Calculating seven plus two on the domino computer.

Register	Decimal	Binary
A	9	1001
B	+8	+1000
C	1	0001

Table 2. Overflow error on the domino computer.

tains a zero. Also, before performing any operation, the pointer at bit position zero in register C must point to the lowest zero on the sliding panel. The weight of the domino pulls the bucket down to the second number (a 1).

The computer has now added 1 binary to zero binary and displays a result of 1 binary. Bit position 1 of register A contains a 1, and bit position 1 of register B contains a 1, so you topple both files of dominoes.

After the operation, the bucket at position 1 in register C contains two dominoes. The weight of these dominoes pulls the sliding panel down to the third number from the bottom (zero). When you add 1 binary to 1 binary as described, you get 10 binary.

The computer shows the result of the addition in 2-bit format. It needs a way to carry the calculation to the next most significant bit position (position 2 in this case), so I installed a stiff wire fixed to the face of the sliding panel and extending to the left.

When the dominoes drop into the bucket, the weight pulls the sliding panel down and the wire bumps a domino standing on a small shelf. This domino falls into the bucket to its left, executing the desired carry to the next most significant bit.

The computer is now ready to add bit positions in registers A and B. Bit position 2 in register A contains 1 binary and position 2 in register B contains zero binary. Topple the dominoes at bit position 2 in register A, but not B.

If not for the carry from bit position 1, the result would be one domino at bit position 2 in register C. The two dominoes in this bit position make the wire bump a carry domino into the bucket at position 3.

The computer can now finish the operation by adding bit position 3 (MSB) of register A. This position contains zero binary in register A, and zero binary in register B, so no operation oc-

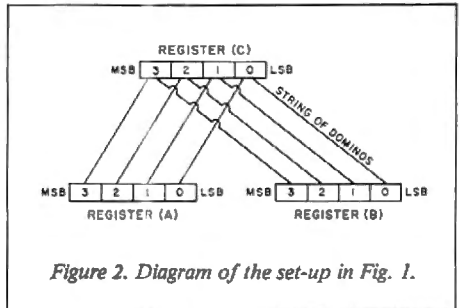


Figure 2. Diagram of the set-up in Fig. 1.

urs at this bit position. The resulting calculation appears in Table 1.

The domino computer also has error-handling capabilities. For example, if you want to add nine and eight, the computer cannot display 17 (10001 binary) as the correct answer because that would require 5 bits.

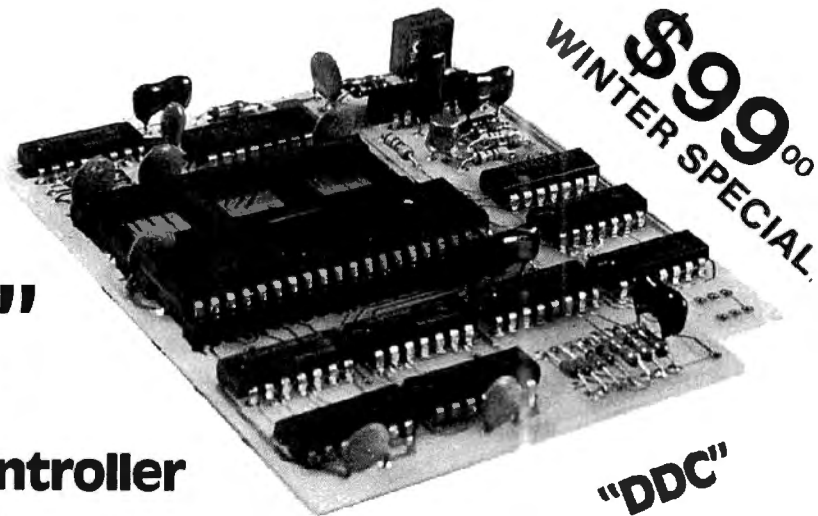
Adding nine and eight with the domino computer produces the wrong answer, as shown in Table 2. Running this calculation results in an overflow (OV) message similar to that on the TRS-80. The overflow is a result of a carry from bit position 3.

The wire on the sliding panel at bit position 3 bumps the overflow domino. Figure 1 shows the overflow domino suspended from a pulley with a carpenter's plumb bob as a counterweight. When the carry domino drops, it indicates an OV error by raising a cardboard flag connected to the string between the plumb bob and domino.

The domino model demonstrates the operation of CPU registers and binary numbers in processing information. Although the domino is limited to addition, it accurately simulates processing in your TRS-80. It also shows that there is more than one way to construct and power a computer. ■

Michael O'Reilly is currently working on a 16-bit domino computer that adds, subtracts, and divides. You can reach him at Condominio El Pueblo #102, Apartado 284, 1100 Tibas, Costa Rica.

Aerocomp's Proven Best-By Test! The "DDC"



Double Density Controller

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★ Test Proven

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 TFD100 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.

★ Features

TRS80 Model I owners who are ready for reliable double density operation will get (1) 80% more storage per diskette, (2) single and double density data separation with far fewer disk I/O errors, (3) single density compatibility and (4) simple plug-in installation. Compatible with all existing double density software.

★ TEST RESULTS ★

MFR & PRODUCT	SECTORS LOCKED OUT (AVG)
AEROCOMP "DDC"	0
PERCOM "DOUBLER II"	18
PERCOM "DOUBLER A"	250
LNW "LNDOUBLER"	202

Note: test results available upon written request. All tests conducted prior to 8-25-81

Aerocomp's 14 day money back guarantee applies to hardware only. Specials will be prorated. Shipping \$2.00 in Cont. U.S. See opposite page for details. Add \$4.00 shipping & handling for DDC & DOS.

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The advances that make the "DDC" great are incorporated in the new AEROCOMP Single Density Data Separator ("SDS") and Double Density Data Separator ("DDS").

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MFR. & PRODUCT	SECTORS LOCKED OUT	
	WITHOUT "DDS"	WITH "DDS"
PERCOM "DOUBLER II"	18	1
PERCOM "DOUBLER A"	250	0
LNW "LNDOUBLER"	202	0

Note: Same test procedures as "DDC".
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** Trademark of LNW
*** Trademark of Tandy Corporation

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**See opposite
page** ▶▶▶▶▶



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- ★ DRIVE KIT (no drives)..... \$199
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- ★ TWO DRIVE SYSTEM..... \$539
- Shipping & handling \$8.00 per system
- ★ AEROCOMP DISK CONTROLLER ... \$119
- Shipping & handling \$2.00 per controller
- ★ MOUNTING KIT w/o Drives & Controller... \$99
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TRS80 Mod. I & III, IBM PC & TI 99/4A. Power supply & enclosure. Specify silver or almond. 5.25 inch.

- ★ 40 track single side (Tandon)..... \$199
- ★ 40 track SS "Flippy" (MPI)..... \$239
- ★ 40 track Dual Head (either)..... \$279
- ★ 80 track SS (MPI)..... \$299
- ★ 80 track SS "Flippy" (MPI)..... \$329
- ★ 80 track Dual Head (Tandon)..... \$379

Shipping & Handling \$5.00 per drive.

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Internal drives for TRS80 Mod. III, IBM PC, TI 99/4A, 5.25 in. (controller required)

- ★ 40 track Single Side (Tandon)..... \$169
- ★ 40 track Dual Head (either)..... \$249
- ★ 80 track SS (MPI)..... \$269
- ★ 80 track Dual Head (Tandon)..... \$339

Shipping & Handling \$4.00 Per Drive.

8 INCH DRIVES

Drive expansion box complete with power supply and fan. Tandon Slimline.

- ★ Two (2) 8" Single Side..... \$699
- ★ Two (2) 8" Double Side..... \$849
- ★ 8" Bare Slimline, SS..... \$260
- ★ 8" Bare Slimline, DS..... \$375

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MODEL I STARTER PACKAGE

One 40 track SS drive, 2-drive cable, TRSDOS 2.3 disk & manual, freight & insurance (Tandon).

\$249

MISCELLANEOUS GOODIES

- ★ TRSDOS 2.3 disk & manual..... \$20
- ★ LDOS (Mod. I or III)..... \$119
- ★ NEWDOS/80, 2.0 (Mod. I or III)..... \$129
- ★ Diskettes (10 in library box)..... \$23
- ★ 5.25" Drive Power Supply & case..... \$59
- ★ 2-Drive Cable..... \$24
- ★ 4-Drive Cable..... \$34
- ★ Extender Cable..... \$13

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In One Port and Out the Other

Clip and save this handy reference of Model 4 port assignments. It'll help you convert Model III Assembly-language programs.

To make writing Assembly-language programs that control peripheral devices easier, here is a port-by-port description of the Model 4's input/output (I/O) ports. Table 1 lists all port assignments. As you can see, the Model 4 either uses all ports from 80 hexadecimal (hex) to FF hex or reserves them for future expansion.

For the most part, the Model 4's port assignments are identical to those of the

Model III. However, a few important differences exist between the two machines. Therefore, don't automatically assume that a routine written for one machine works correctly on the other.

Table 2 presents information on video memory, keyboard memory, and ROM select bits. Table 3 outlines RAM bank select bits, and Table 4 lists Model 4 baud rates. ■

Contact Mark D. Goodwin at Star Route 79, Box 103, Orland, ME 04472.

The Key Box

Model 4

Table 1. Model 4 port assignments.

Port	In	Out
80H	Reserved	Graphics board option register
81H	Graphics board RAM read	Graphics board RAM write
82H	Reserved	Graphics board Y register
83H	Reserved	Graphics board X register
84H	Reserved	Model 4 options register
	Bit 0—Video memory, keyboard memory, and Model III ROM selects (see Table 2)	
	Bit 1—Video memory, keyboard memory, and Model III ROM selects (see Table 2)	
	Bit 2—Video display mode	
	0—64 by 16	
	1—80 by 24	
	Bit 3—Reverse video	
	Bit 4—RAM bank select (see Table 3)	
	Bit 5—RAM bank select (see Table 3)	
	Bit 6—RAM bank select (see Table 3)	
	Bit 7—Video page select (64 by 16 mode)	
0—page 0		
1—page 1		
85H-87H	Same as 84H	Same as 84H
88H	CRT Controller control register	CRT controller control register
89H	CRT controller control register	CRT controller data register
8AH	CRT controller	CRT controller

Port	In	Out
	control register	data register
8BH	CRT controller data register	CRT controller data register
8CH-8FH	Graphics board select 2	Graphics board select 2
90H	Reserved	Sound board options register
	Bit 0—Sound board output	
	0—Low	
	1—High	
Bits 1-7—not used		
91H-93H	Same as 90H	Same as 90H
94H-BFH	Reserved	Reserved
C0H	Hard disk write protect	Reserved
C1H	Hard disk control register	Hard disk control register
C2H-C3H	Hard disk device ID register	Reserved
C4H	Hard disk CTC channel 0	Hard disk CTC channel 0
C5H	Hard disk CTC channel 1	Hard disk CTC channel 1
C6H	Hard disk CTC channel 2	Hard disk CTC channel 2
C7H	Hard disk CTC channel 3	Hard disk CTC channel 3
C8H	Hard disk data register	Hard disk data register
C9H	Hard disk	Hard disk

Table 1 continued

Port	In	Out
	error register	write precompensation
CAH	Hard disk sector count	Hard disk sector count
CBH	Hard disk sector number	Hard disk sector number
CCH	Hard disk cylinder low	Hard disk cylinder low
CDH	Hard disk cylinder high	Hard disk cylinder high
CEH	Hard disk size, drive, and head	Hard disk size, drive, and head
CFH	Hard disk status register	Hard disk command register
D0H-DFH	Reserved	Reserved
E0H	INT status	INT mask
	Bit 0—Cassette 1500 baud rising edge interrupt	
	0—False	0—Disable
	1—True	1—Enable
	Bit 1—Cassette 1500 baud falling edge interrupt	
	0—False	0—Disable
	1—True	1—Enable
	Bit 2—Real time clock interrupt	
	0—False	0—Disable
	1—True	1—Enable
	Bit 3—I/O bus interrupts	
	0—False	0—Disable
	1—True	1—Enable
	Bit 4—RS-232 transmitter holding register empty interrupt	
	0—False	0—Disable
	1—True	1—Enable
	Bit 5—RS-232 receiver data register full interrupt	
0—False	0—Disable	
1—True	1—Enable	
Bit 6—RS-232 parity error, framing error, or data overrun error interrupts		
0—False	0—Disable	
1—True	1—Enable	
Bit 7—Not used		
E1H-E3H	Same as E0H	Same as E0H
E4H	NMI status	NMI mask
	Bits 0-4—not used	
	Bit 5—Reset	Bit 5—Not used
	0—False	
	1—True	
	Bit 6—Disk DRQ	
	0—False	0—Disable
	1—True	1—Enable
	Bit 7—Disk INTRQ	
0—False	0—Disable	
1—True	1—Enable	
E5H-E7H	Same as E4H	Same as E4H
E8H	Modem status	Master reset/enable
	Bit 0—Receiver input	
	Bit 1—UART control register enable	
	0—Disable	
	1—Enable	
	Bits 2-3—not used	
	Bit 4—ring indicator	
	Bit 5—carrier detect	
	Bit 6—data set ready	
	Bit 7—Clear to send	
E9H	Not used	Baud rate (see Table 4)
EAH	UART status	UART and modem control

Port	In	Out
	Bits 0-2—Not used	Bit 0—Request to send Bit 1—Data terminal ready Bit 2—Break 0 = disable transmit data
	Bit 3—Parity error	Bit 3—Secondary request to send *Parity inhibit
	0—False	0—Enable parity
	1—True	1—Disable parity
	Bit 4—Framing error	Bit 4—Secondary transmit data *Stop bit select
	0—False	0—1 stop bit
	1—True	1—2 stop bits
	Bit 5—Overrun error	Bit 5—Secondary unassigned *Word length select 2
	0—False	
	1—True	
	Bit 6—Transmitter holding register open	Bit 6—Not used *Word length select 1
	0—False	
	1—True	
	Bit 7—Data received	Bit 7—Not used *Parity
	0—False	0—Odd
	1—True	1—Even
EBH	RS-232 Receiver data register	RS-232 transmitter holding register
ECH	Any read resets the Real Time clock interrupt	Mode output latch
		Bit 0—not used
		Bit 1—Cassette motor control
		0—motor off
		1—motor on
		Bit 2—Double width video
		0—Normal (80 or 64)
		1—Double width (40 or 32)
		Bit 3—Alternate video character set
		0—Disable
		1—Enable
		Bit 4—I/O bus
		0—Disable
		1—Enable
		Bit 5—Video waits
		0—Disable
		1—Enable
	Bit 6—CPU clock speed	
	0—Slow	
	1—Fast	
	Bit 7—not used	
EDH-EFH	Same as ECH	Same as ECH
FOH	Floppy disk controller status register	Floppy disk controller command register
FIH	Floppy disk controller cylinder register	Floppy disk controller cylinder register
F2H	Floppy disk controller sector register	Floppy disk controller sector register
F3H	Floppy disk controller data register	Floppy disk controller data register

Port	In	Out
F4H	Reserved	Floppy disk drive select latch
		Bit 0—Drive 0
		0—No select
		1—Select
		Bit 1—Drive 1
		0—No select
		1—Select
		Bit 2—Drive 2
		0—No select
		1—Select
		Bit 3—Drive 3
		0—No select
		1—Select
		Bit 4—Disk side
		0—Side 0
		1—Side 1
		Bit 5—Write precompensation
		0—Disable
		1—Enable
		Bit 6—Wait state
		0—No wait state
		1—Generate wait state
		Bit 7—Density
0—Single (FM)		
1—Double (MFM)		
F5H-F7H	Same as F4H	Same as F4H
F8H	Printer status	Printer port
	Bits 0-3—Not used	Bits 0-7—Byte to send
	Bit 4—Printer fault	
	0—False	
	1—True	
	Bit 5—Printer select	
	0—False	
	1—True	
Bit 6—Paper out		

Port	In	Out
	0—False	
	1—True	
	Bit 7—BUSY	
	0—False	
	1—True	
F9H-FBH	Same as F8H	Same as F8H
FCH-FEH	Same as FFH	Same as FFH
FFH	Cassette in	Cassette out
	Bit 0—1500 Baud cassette bit	Bit 0—Cassette output level
	Bit 1—Cassette motor on	Bit 1—Cassette output level
	0—False	
	1—True	
	Bit 2—Double width video	
	0—False	
	1—True	
	Bit 3—Alternate video character set	
	0—False	
	1—True	
	Bit 4—I/O bus enabled	
	0—False	
	1—True	
	Bit 5—Video waits enabled	
	0—False	
	1—True	
Bit 6—CPU clock speed		
0—Slow		
1—Fast		
Bit 7—500 baud cassette bit		

*These are the operands performed when the UART register is enabled. (See Port E8H)

Bits	Model III	Video and Keyboard Status
1 0	ROMs Enabled	
0 0	Yes	Model III
0 1	No	Model III
1 0	No	Model 4 (In)
1 1	No	Model 4 (Out)

Note: 0 indicates off; 1 indicates on.

Table 2. Video memory, keyboard memory, and ROM select bits.

Bits	Lower 32K RAM	Upper 32K RAM
6 5 4		
0 0 0	Bank 0	Bank 1
0 1 0	Bank 0	Bank 2
0 1 1	Bank 0	Bank 3
1 1 0	Bank 2	Bank 1
1 1 1	Bank 3	Bank 1

Note: 0 indicates off; 1 indicates on.

Table 3. RAM bank select bits.

Baud Rate	Byte to Send
50	00H
75	01H
110	02H
134.5	03H
150	04H
300	05H
600	06H
1200	07H
1800	08H
2000	09H
2400	0AH
3600	0BH
4800	0CH
7200	0DH
9600	0EH
19200	0FH

Table 4. Baud rates.

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Parallel Driving

Daisy-wheel or dot-matrix, Radio Shack or not—here's a driver that lets you use SuperScript with any Centronics-compatible printer.

```

1 ;
2 ;           FIGURE 1           STANDARD/BAS
3 ;
10 REM INSTALL SUPERSCRIPIT PRINTER DVR
20 A$="STANDARD/CTL"
30 OPEN "O",1,A$
40 CHECKSUM = 0
50 FOR I = 1 TO 2 STEP 0
60 READ BYTE
70 IF BYTE = -1 THEN I=2 : GOTO 100
80 CHECKSUM = 2*(CHECKSUM AND 8191) + BYTE + (CHECKSUM AND 8192)/8
192
90 PRINT #1,CHR$(BYTE);
100 NEXT I
110 READ X
120 IF X = CHECKSUM THEN 140
130 PRINT "DATA CHECKSUM BAD. CHECK DATA"
140 CLOSE 1
150 PRINT A$ " IS INSTALLED. GOOD LUCK!"
1000 DATA 5 , 6 , 83 , 84 , 65 , 78 , 68 , 65 , 1 , 130
1001 DATA 211 , 186 , 90 , 10 , 9 , 9 , 9 , 9 , 9 , 9
1002 DATA 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9
1003 DATA 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9
1004 DATA 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9
1005 DATA 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9
1006 DATA 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9
1007 DATA 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9
1008 DATA 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9
1009 DATA 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9
1010 DATA 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 9 , 0
1011 DATA 0 , 0 , 195 , 118 , 187 , 195 , 125 , 187 , 195 , 138
1012 DATA 187 , 195 , 159 , 187 , 195 , 194 , 187 , 195 , 199 , 187
1013 DATA 195 , 204 , 187 , 195 , 209 , 187 , 195 , 214 , 187 , 195
1014 DATA 1 , 7 , 83 , 187 , 219 , 187 , 195 , 242 , 187 , 1
1015 DATA 130 , 115 , 187 , 255 , 187 , 10 , 205 , 219 , 187 , 200
1016 DATA 195 , 181 , 186 , 254 , 10 , 40 , 4 , 50 , 117 , 187
1017 DATA 201 , 62 , 127 , 198 , 1 , 201 , 205 , 187 , 186 , 216
1018 DATA 245 , 58 , 37 , 1 , 254 , 73 , 40 , 5 , 241 , 50
1019 DATA 232 , 55 , 201 , 241 , 211 , 248 , 201 , 229 , 197 , 197
1020 DATA 225 , 58 , 213 , 186 , 79 , 6 , 0 , 237 , 66 , 250
1021 DATA 190 , 187 , 62 , 32 , 205 , 187 , 186 , 216 , 205 , 219
1022 DATA 187 , 32 , 247 , 205 , 138 , 187 , 24 , 235 , 175 , 193
1023 DATA 225 , 201 , 62 , 127 , 198 , 1 , 201 , 62 , 127 , 198
1024 DATA 1 , 201 , 62 , 127 , 198 , 1 , 201 , 62 , 127 , 198
1025 DATA 1 , 201 , 62 , 127 , 198 , 1 , 201 , 197 , 71 , 58
1026 DATA 37 , 1 , 254 , 73 , 40 , 5 , 58 , 232 , 55 , 24
1027 DATA 2 , 219 , 248 , 230 , 240 , 254 , 48 , 120 , 193 , 201
1028 DATA 254 , 1 , 14 , 243 , 187 , 10 , 40 , 4 , 50 , 117
1029 DATA 187 , 201 , 62 , 127 , 198 , 1 , 201 , 2 , 2 , 0
1030 DATA 0 , -1 , 6511
1031 END

```

Program Listing 1. Standard/BAS.

Anyone who has tried to use Radio Shack's SuperScript word processing software with a printer other than Tandy's own knows he can't print normal characters. I wrote this Model I/III universal printer driver so that SuperScript owners can print documents with any Centronics-compatible printer. The driver is essentially dumb, and so makes no assumptions about your printer.

The Universal Printer Driver

The universal printer driver doesn't trigger any of your printer's built-in features, such as underlining or bold-face. But since this driver passes on all control codes, special features are invoked with SuperScript's user-programmable keys.

Installing the Driver Using Basic

The driver is installed using either Basic or an editor/assembler and requires only one granule of disk space. You create the printer driver in Basic with Program Listing 1. Put SuperScript in drive zero, making sure that

The Key Box



Models I and III
32K RAM Disk Basic
or Assembly Language
Centronics-compatible Printer
Editor/Assembler Optional
Alcor Pascal Optional

at least one granule of memory is available. Put a disk with Basic in drive 1.

Next, execute Basic and type in Listing 1. Save the program using the command SAVE"STANDARD/BAS":1.

Run the program. If the message STANDARD/CTL INSTALLED appears, the load and save operations were successful. Otherwise, go into the program, make the necessary corrections, and save the corrected program.

When the program runs without flaws, exit from Basic with the Save command. Execute Scripsit and select the Open Documents option from the main menu. Define STANDARD as the printer type and set the printer pitch to 10. Be sure there are no half-space lines (indicated by a +) in the text.

Press the enter key to record your setup options, then hit the break key to return to the main menu.

Call up your Scripsit files and change the printer type to STANDARD. If you like, kill all the other printer drivers in your system (see Fig. 1). You can also kill the disk format program and the back-up program.

Installing the Driver Using an Assembler

From the DOS READY prompt invoke your editor/assembler. Type in the Standard/ASM Assembly-language listing (Program Listing 2). You need not enter the extensive comments.

Save the source to a disk file. Assemble the source. If errors are found, correct them and save the corrected program.

If you don't find any errors, create an object file called Standard/CTL on SuperScripsit in drive zero. Exit the editor/assembler and enter Scripsit. Create a document and specify STANDARD as the driver type.

Now try printing the document. If it works, copy both Standard/ASM (your

assembler source file) and Standard/CTL (the printer driver) on another disk as a back-up.

If it doesn't print, examine the source listing you typed in against the listing in the article. Check that the last location used by the driver is the same as yours. Return to your EDTASM and correct the source code. Then save the code to disk and try again.

Model I to Model III Transfer of Standard/CTL

Load a Model I data disk containing

only the user file Standard/CTL in drive 1 of your Model III. (Note that this is a single-density disk.) Put a Model III system disk that's not write-protected and has at least one granule free into drive zero of the Model III. (This is a double-density disk.)

Use the CNVRT command to copy the Standard/CTL file from drive 1 to drive zero. Since Standard/CTL is the only file on the top disk driver, only one file is converted to double-density format on the drive-zero disk. Note that the SuperScripsit drive-zero disk doesn't

Program Listing 2. Standard/ASM.

```

00100 ; TITLE SUPERSCRIPISIT MODEL I/III PRINTER DRIVER
00110 ;***** FIGURE 2 *****
00120 ;*
00130 ;* STANDARD/ASM SUPERSCRIPISIT DRIVER FOR A *
00140 ;* STANDARD/CTL DUMB CENTRONICS COMPATIBLE *
00150 ;* PRINTER WITH 10 CPS PITCH. *
00160 ;* MODEL III COMPATIBLE *
00170 ;* WRITTEN BY JOHN BLOMMERS 17060-98 STREET *
00180 ;* EDMONTON, ALBERTA, CANADA T5X 3G5 *
00190 ;*
00200 ;* THIS DRIVER DOES NOT SUPPORT THE FOLLOWING *
00210 ;* FEATURES: *
00220 ;* - SET PITCH (FIXED AT 10 CPI) *
00230 ;* - BACKSPACE PRINTER *
00240 ;* - UNDERSCORING *
00250 ;* - BOLD FACING *
00260 ;* - DOUBLE UNDERSCORING *
00270 ;* - STRIKE THROUGH *
00280 ;* - SUPERSCRIPITING *
00290 ;* - SUBSCRIPITING *
00300 ;*
00310 ;* IT WAS INTENDED THAT ANYBODY COULD USE THIS *
00320 ;* SUPERSCRIPISIT DRIVER AS LONG AS HE HAS A *
00330 ;* CENTRONICS PARALLEL INTERFACE IN USE. *
00340 ;* THE DRIVER DOES NOT ASSUME THE PRINTER HAS *
00350 ;* A BUFFER IN IT. THE DRIVER WILL TEST FOR A *
00360 ;* PRINTER READY CONDITION EVEN WHEN CALLED *
00370 ;* TO PRINT MULTIPLE SPACES. THE SPECIAL *
00380 ;* FEATURES ABOVE REQUIRE PRINTER-SPECIFIC *
00390 ;* CONTROL CHARACTERS, SO THEY WERE NOT *
00400 ;* INCLUDED FOR THAT REASON. *
00410 ;*
00420 ;* THE DRIVER'S TEST-FOR-READY AND OUT-CHARACTER*
00430 ;* ROUTINES TEST FOR A MODEL I OR MODEL III *
00440 ;* ENVIRONMENT AND ACT ACCORDINGLY AND VERY *
00450 ;* AUTOMATICALLY - THE USER NEEDN'T TELL IT! *
00460 ;*
00470 ;*****
00480 ; PAGE
00490 ;
00500 ; PRSTOP, PRERR AND PRPAUS ARE superSCRIPISIT
00510 ; DOCUMENTED ENTRY POINTS
00520 ;
00530 PRSTOP EQU 0BABBH ; TEST FOR BREAK & PAUSE
00540 PRERR EQU 0BAB5H ; ERROR MESSAGE
00550 PRPAUS EQU 0BAB8H ; PAUSE PRINTING & WAIT Y/N
00560 ;
00570 PRINTR EQU 037E8H ; MODEL I PRINTER ADDRESS
00580 ;
00590 ORG 0BAD3H ; FIXED START ADDRESS FOR ALL
00600 ; SUPERSCRIPISIT PRINT DRIVERS
00610 ;
00620 INCSIZ DEFB 90 ; 90 DOTS/INCH ASSUMED
00630 PITCH0 DEFB 10 ; 10 CHAR/INCH ASSUMED
00640 ;
00650 ; superSCRIPISIT WILL CONSULT WIDTBL WHEN IT IS
00660 ; DETERMINING HOW MUCH SPACE (IN DOTS) A CHARACTER
00670 ; WILL OCCUPY ON A LINE OF TEXT.
00680 ; NOTE THAT INCSIZ/PITCH0=WIDTHS OF ALL CHARACTERS.
00690 ;
00700 WIDTBL EQU $ ; CHARACTER WIDTH TABLE
00710 WIDSPC DEFB 9 ; SPACE WIDTH
00720 DEFB 9 ; !
00730 DEFB 9 ; "
00740 DEFB 9 ; #

```

Listing 2 continued

Filespec	Printer name or type
LP4/CTL	Line Printer IV
LP8/CTL	Line Printer VIII
S/CTL	Serial Printer Line Printer VIII
DW2/CTL	Daisy Wheel II
DWP410/CTL	Daisy Wheel DWP-410
DMP400/CTL	DMP-400 Printer
DMP2000/CTL	DMP-2000 Printer

Figure 1. Filespecs for various printers so you can kill unneeded SuperScripsit printer drivers.

```

00750 DEF B 9 ; $
00760 DEF B 9 ; %
00770 DEF B 9 ; &
00780 DEF B 9 ; ' APOSTROPHE
00790 DEF B 9 ; (
00800 DEF B 9 ; )
00810 DEF B 9 ; *
00820 DEF B 9 ; +
00830 DEF B 9 ; , COMMA
00840 DEF B 9 ; - MINUS SIGN
00850 DEF B 9 ; . PERIOD
00860 DEF B 9 ; /
00870 DEF B 9 ; 0 ZERO
00880 DEF B 9 ; 1
00890 DEF B 9 ; 2
00900 DEF B 9 ; 3
00910 DEF B 9 ; 4
00920 DEF B 9 ; 5
00930 DEF B 9 ; 6
00940 DEF B 9 ; 7
00950 DEF B 9 ; 8
00960 DEF B 9 ; 9
00970 DEF B 9 ; : COLON
00980 DEF B 9 ; ; SEMICOLON
00990 DEF B 9 ; <
01000 DEF B 9 ; = EQUALS
01010 DEF B 9 ; >
01020 DEF B 9 ; ?
01030 DEF B 9 ; @ COMMERCIAL AT SIGN
01040 DEF B 9 ; A CAPITAL A
01050 DEF B 9 ; B
01060 DEF B 9 ; C
01070 DEF B 9 ; D
01080 DEF B 9 ; E
01090 DEF B 9 ; F
01100 DEF B 9 ; G
01110 DEF B 9 ; H
01120 DEF B 9 ; I
01130 DEF B 9 ; J
01140 DEF B 9 ; K
01150 DEF B 9 ; L
01160 DEF B 9 ; M
01170 DEF B 9 ; N
01180 DEF B 9 ; O LETTER OH
01190 DEF B 9 ; P
01200 DEF B 9 ; Q
01210 DEF B 9 ; R
01220 DEF B 9 ; S
01230 DEF B 9 ; T
01240 DEF B 9 ; U
01250 DEF B 9 ; V
01260 DEF B 9 ; W
01270 DEF B 9 ; X
01280 DEF B 9 ; Y
01290 DEF B 9 ; Z
01300 DEF B 9 ; [ LEFT SQUARE BRACKET
01310 DEF B 9 ; \ BACK SLASH
01320 DEF B 9 ; ] RIGHT SQUARE BRACKET
01330 DEF B 9 ; ^ CARAT OR CIRCUMFLEX
01340 DEF B 9 ; _ UNDERSCORE
01350 DEF B 9 ; ` GRAVE ACCENT
01360 DEF B 9 ; a LOWERCASE
01370 DEF B 9 ; b
01380 DEF B 9 ; c
01390 DEF B 9 ; d
01400 DEF B 9 ; e
01410 DEF B 9 ; f
01420 DEF B 9 ; g
01430 DEF B 9 ; h
01440 DEF B 9 ; i
01450 DEF B 9 ; j
01460 DEF B 9 ; k
01470 DEF B 9 ; l
01480 DEF B 9 ; m
01490 DEF B 9 ; n
01500 DEF B 9 ; o LOWERCASE OH
01510 DEF B 9 ; p
01520 DEF B 9 ; q
01530 DEF B 9 ; r
01540 DEF B 9 ; s
01550 DEF B 9 ; t
01560 DEF B 9 ; u
01570 DEF B 9 ; v
01580 DEF B 9 ; w
01590 DEF B 9 ; x
01600 DEF B 9 ; y
01610 DEF B 9 ; z
01620 DEF B 9 ; { LEFT CURLY BRACKET

```

support the CNVRT command.

Replace the single-density disk in drive 1 with the disk from drive zero, which contains Standard/CTL in Model III-compatible double-density format. Put SuperScripsit's drive-zero disk in drive zero. Type COPY STANDARD/CTL:1 STANDARD/CTL:0.

Test the driver by running Scripsit, creating a document, specifying STANDARD as the driver type and printing the document.

Writing Standard/BAS

While writing this article, I realized that many TRS-80 owners have no interest in purchasing an editor/assembler

*Many TRS-80 owners
have no interest
in purchasing
an editor/assembler,
so I offer
a Basic program
that creates
Standard/CTL.*

just to enter a short Assembly-language program. Therefore, in addition to offering the fully commented Assembly-language source code, I decided to offer a Basic program that creates Standard/CTL.

Since the driver program is subject to human error in entering the data statements, I wanted an automatic means to take the Standard/CTL object code file produced by my EDTASM from the debugged Standard/ASM source code and produce Standard/BAS.

Because I'm interested in Pascal programming, I used my Alcor Pascal package to write Standard/PCL (see Program Listing 3), a program that converts the Standard/CTL object file into the Standard/BAS Basic file.

Note that Standard/PCL uses AND16 (see Program Listing 4), a function that takes the bit-for-bit logical AND of two 16-bit arguments and returns a 16-bit result. Internal to this function is a string of 7 bytes that are machine language instructions taken from the And/ASM Assembly-language listing shown in Program Listing 5. ■

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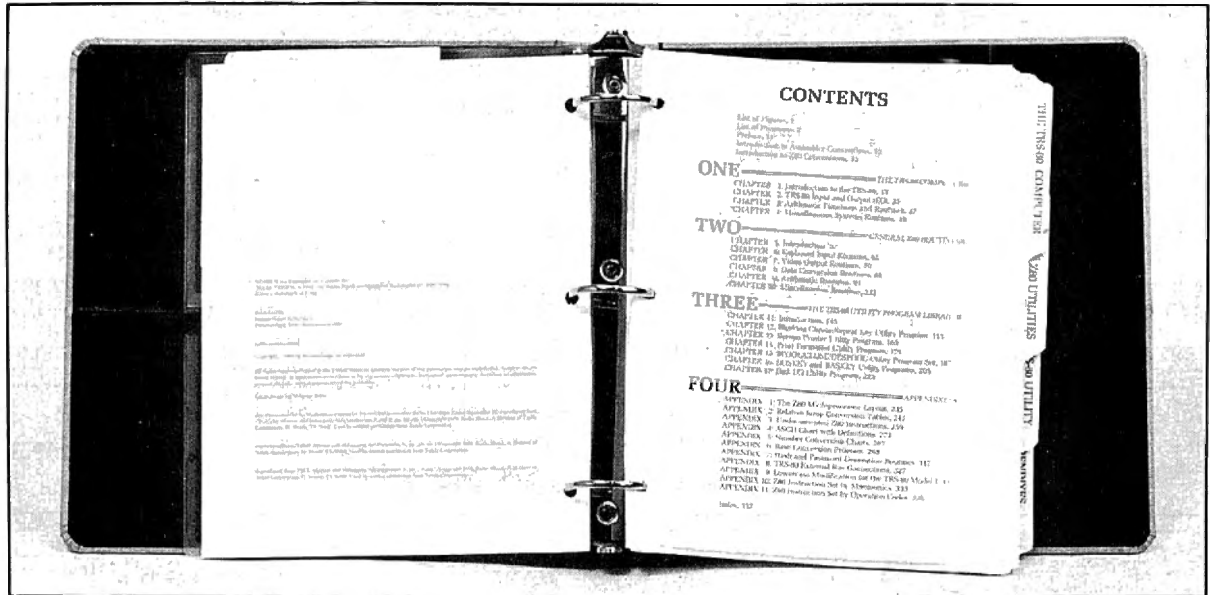
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Many of the programs also run on the Model III, and

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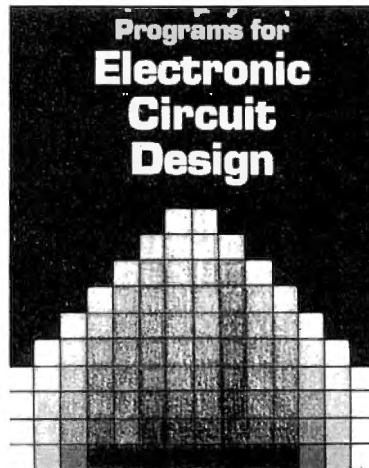
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01630 DEFB 9 ; VERTICAL BAR
01640 DEFB 9 ; RIGHT CURLY BRACKET
01650 DEFB 9 ; TILDE
01660 DEFB 0 ; DELETE CHARACTER (0 WIDTH)
01670 ENDTAB EQU $-1 ; END OF WIDTH TABLE
01680 SIZTAB EQU ENDTAB-WIDTBL+1 ; SIZE OF TABLE
01690 ;
01700 SUPLF DEFB 0 ; 0= NO LF AFTER CR ISSUED
01710 NUMNUL DEFB 0 ; # NULLS SENT AFTER CR
01720 ;
01730 ;*****
01740 ;*
01750 ;* THE FOLLOWING ARE TO BE IN ORDER AND ARE *
01760 ;* JUMP VECTORS INTO THE DRIVER. NOTE THAT *
01770 ;* 9 OF THE JUMP VECTORS ARE RESERVED. *
01780 ;*
01790 ;*****
01800 ;
01810 JP PRINT ; INITIALIZE PRINTER
01820 JP SETPCH ; SET PRINTER'S PITCH
01830 JP PRTCHR ; PRINT A CHARACTER
01840 JP PRTSPC ; PRINT UNIT SPACES
01850 JP BACKSP ; ISSUE A BACKSPACE
01860 JP TOGFEA ; TOGGLE SPECIAL FEATURE
01870 JP EKFEA ; EXECUTE SPECIAL FEATURE
01880 JP HAFFOR ; DO HALF FWD LINE FEED
01890 JP HAFREV ; DO HALF REV LINE FEED
01900 JP RDYTST ; TEST FOR PRINTER READY
01910 JP SETTBL ; SET UP WIDTH TABLE FOR MONO
01920 DEFS 27 ; RESERVE ROOM FOR 9 VECTORS
01930 ; FOR FUTURE COMPATIBILITY
01940 DEFW NEXT ; NEXT ADDRESS AVAILABLE FOR
01950 ; TEXT STORAGE FOR SUPERSCRIPIT
01960 ;
01970 ;*****
01980 ;*
01990 ;* END OF FIXED FORMAT SECTION. SUBROUTINES NOW *
02000 ;*
02010 ;*****
02020 ;
02030 MODSTO DEFB 10 ; STORAGE FOR ASSUMED PITCH
02040 ; PAGE
02050 PRINT EQU $ ; INITIALIZE PRINTER
02060 ;*****
02070 ;* INITIALIZE PRINTER HARDWARE. ALL THAT'S *
02080 ;* REQUIRED IS TO TEST THE PRINTER STATUS WITH *
02090 ;* A CALL RDYTST, WHICH RETURNS THE Z FLAG. IF *
02100 ;* THE PRINTER IS READY, A RET Z RETURNS GOOD *
02110 ;* STATUS, ELSE A JP PRERR IS EXECUTED TO *
02120 ;* DISPLAY A 'PRINTER NOT READY' MESSAGE FROM *
02130 ;* superSCRIPIT. NO OTHER INITIALIZATION IS *
02140 ;* TYPICALLY DONE BY THE SHACK'S STOCK DRIVERS. *
02150 ;* HOWEVER, THE CAN CHARACTER COULD BE ISSUED *
02160 ;* TO CLEAR THE PRINTER BUFFER (SMART PRINTER *
02170 ;* CONSIDERATIONS HERE ARE FOR INFORMATION ONLY)*
02180 ;* LONG LINES SHOULD BE PROGRAMMED IN CASE THE *
02190 ;* PRINTER IS IN SHORT LINE MODE, THE 10 CPS *
02200 ;* SHOULD BE INVOKED, AND THE PRINTER'S TOF SET *
02210 ;* COULD BE DONE. *
02220 ;*
02230 ;* ENTRY: ALL REGISTERS MEANINGLESS *
02240 ;* EXIT : CARRY (CY) SET IF PRINTOUT ABORTED *

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02250 ;* : ONLY A REGISTER MAY BE CHANGED *
02260 ;*****
02270 CALL RDYTST ; CHECK PRINTER STATUS
02280 RET Z ; EXIT HERE IF READY
02290 JP PRERR ; ELSE SHOW BUSY.
02300 ; PAGE
02310 SETPCH EQU $ ; SET PRINTER'S PITCH
02320 ;*****
02330 ;* INITIALIZE THE PRINTER HARDWARE TO THE PITCH *
02340 ;* IN THE A-REGISTER AS SPECIFIED IN THE 'OPEN *
02350 ;* DOCUMENT' PARAMETERS. A=0 MEANS PROPORTIONAL *
02360 ;* SPACING SUPPORTED BY THE SHACK'S DAISY WHEEL *
02370 ;* PRINTERS. DUMB PRINTERS ARE ASSUMED TO HAVE *
02380 ;* PITCH=10 cpi. NO OTHER PITCH IS ALLOWED. *
02390 ;*
02400 ;* ENHANCEMENTS OF THIS DRIVER WOULD SUPPORT *
02410 ;* 16.5, 10.0, 8.3 AND 5.0 cpi PITCHES. THE *
02420 ;* PITCH IS STORED LOCALLY AT MODSTO FOR USE *
02430 ;* LATER. SINCE DIFFERENT PRINTERS REQUIRE *
02440 ;* DIFFERENT CONTROL CHARACTERS TO TURN ON THE *
02450 ;* VARIOUS PITCHES, THIS SUBROUTINE WOULD BE *
02460 ;* DIFFERENT FOR DIFFERENT SMART PRINTERS. *
02470 ;* FOR DUMB PRINTERS, WE ASSUME 10cpi. THEREFORE*
02480 ;* NO PRINTER I/O IS DONE HERE, BUT THE PITCH *
02490 ;* MUST BE 10 OR THE CARRY IS SET ON EXIT. *
02500 ;*
02510 ;* ENTRY: A REGISTER = PITCH REQUIRED *
02520 ;* = 0 PROPORTIONAL PITCH *
02530 ;* EXIT : A-REGISTER = DON'T CARE *
02540 ;* ; OTHER REGISTERS NOT CHANGED *
02550 ;* : PRINTER H/W SET TO INDICATED PITCH *
02560 ;*****
02570 CP 10 ; IS PITCH =10 ?
02580 JR Z,BADPCH ; BAD EXIT IF NOT
02590 LD (MODSTO),A ; SAVE GOOD PITCH
02600 RET ; AND RETURN.
02610 BADPCH LD A,127 ; SET THE
02620 ADD A,1 ; CARRY FLAG AND
02630 RET ; SHOW ERROR CONDITION
02640 ; PAGE
02650 PRTCHR EQU $ ; PRINT CHARACTER IN A-REG
02660 ;*****
02670 ;* SEND THE CHARACTER IN THE A-REGISTER TO THE *
02680 ;* PRINTER. THIS MAY BE A CONTROL CHARACTER OR *
02690 ;* A PRINTABLE CHARACTER. A CALL TO PRSTOP MUST *
02700 ;* BE DONE BEFORE THE CHARACTER IS PRINTED SO *
02710 ;* THAT THE USER CAN INTERRUPT THE PRINTING *
02720 ;* BY PRESSING THE BREAK KEY. IF BREAK WAS *
02730 ;* PRESSED, THE CARRY IS SET, THE CHARACTER *
02740 ;* IS NOT PRINTED AND A RETURN WITH CARRY (CY) *
02750 ;* SET IS DONE TO SHOW ABORT. THE USER EITHER *
02760 ;* INDICATES YES OR NO WHEN PROMPTED WHETHER *
02770 ;* HE WANTS TO CONTINUE PRINTING. *
02780 ;* TO MAKE THIS SUBROUTINE COMPATIBLE WITH THE *
02790 ;* MODEL III, IT SENSES ROM ADDRESS 293 *
02800 ;* FOR A 73 (ASCII CODE FOR "I") DENOTING MODEL *
02810 ;* III, AND USE THE I/O PORT 0F8H FOR THE *
02820 ;* PRINTER. *
02830 ;*
02840 ;* ENTRY: A-REGISTER = CHARACTER TO PRINT *
02850 ;* EXIT : A-REGISTER = DON'T CARE BUT IT IS NOT *
02860 ;* CHANGED HERE *

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02870 ;*      : OTHER REGISTERS NOT DISTURBED      *
02880 ;*      : CARRY (CY) SET IF PRINTOUT ABORTED  *
02890 ;*****
02900 CALL   PRSTOP ; USER PRESSED BREAK KEY ?
02910 RET    C      ; EXIT IF CARRY SET
02920 PUSH  AF     ; SAVE CHAR & FLAGS
02930 LD    A,(293) ; IS THIS
02940 CP    'I'    ; A MODEL III
02950 JR    Z,MODIII; JR IF MODEL III
02960 POP  AF     ; RESTORE CHAR & FLAGS
02970 LD    (PRINTR),A ; PRINT CHARACTER
02980 RET
02990 MODIII POP  AF     ; RESTORE CHAR & FLAGS
03000 OUT  (0F8H),A ; PRINT CHARACTER
03020 RET
03030 ; PAGE
03040 PRTPC EQU  $      ; PRINT UNIT SPACES
03050 ;*****
03060 ;* PRINT AS MANY UNIT SPACES AS INDICATED BY THE*
03070 ;* BC REGISTER. A UNIT SPACE IS THE WIDTH OF A *
03080 ;* SINGLE DOT IN THE DOT MATRIX PRINTERS, AND IS*
03090 ;* THE HORIZONTAL RESOLUTION ON DAISY WHEEL
03100 ;* PRINTERS. FOR NON-PROPORTIONAL PRINTING
03110 ;* BC WILL CONTAIN SOME MULTIPLE TO THE WIDTH
03120 ;* OF A SPACE, WHICH IS 9 IN THIS DRIVER.
03130 ;* superSCRIPSIIT SEEMS TO CALL THIS ROUTINE
03140 ;* ONLY WHEN IT HAS MORE THAN ONE BLANK TO
03150 ;* PRINT. THIS SUBROUTINE WILL PRINT ONE SPACE
03160 ;* AND PRINT NONE AT ALL IF BC <= 0.
03170 ;* THE ROUTINE SIMPLY SUBTRACTS (WIDSPC) FROM
03180 ;* BC AND EXITS IT THE RESULT IS NEGATIVE OR
03190 ;* SENDS A=32 TO THE PRTPCHR ROUTINE IS NOT.
03200 ;*
03210 ;* ENTRY: BC= # UNIT SPACES TO PRINT
03220 ;* EXIT : A = DON'T CARE
03230 ;*      : CY SET IF PRINTOUT ABORTED (DONE VIA
03240 ;*      ( THE CALL PRTPCHR)
03250 ;*      : OTHER REGISTER UNDISTURBED
03260 ;*****
03270 PUSH  HL     ; SAVE HL
03280 PUSH  BC     ; SAVE BC
03290 PUSH  BC     ; EXCHANGE BC
03300 POP   HL     ; INTO HL. HL=# SPACES
03310 LD   A,(WIDSPC); BC=WIDTH OF A SPACE
03320 LD   C,A
03330 LD   B,0
03340 MORE SBC   HL,BC ; DECREMENT COUNTER
03350 JP   M,DONE ; NEGATIVE? JP IF SO
03360 LD   A,32   ; LOAD UP A BLANK
03370 WAIT CALL  PRSTOP ; USER WANTS BREAK ?
03380 RET    C     ; EXIT IF SO
03390 CALL  RDTST ; IS PRINTER READY ?
03400 JR    NZ,WAIT ; LOOP TIL READY.
03410 CALL  PRTPCHR ; AND PRINT IT
03420 JR    MORE  ; DO IT AGAIN.
03430 DONE XOR   A     ; CLEAR CARRY & Z FLAGS
03440 POP  BC
03450 POP  HL     ; RESTORE REGISTERS
03460 RET
03470 ; PAGE
03480 BACKSP EQU  $      ; BACKSPACE BC MANY UNITS

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03490 ;*****
03500 ;* DAISY WHEEL PRINTERS BACKSPACE TO DO SUCH
03510 ;* THINGS AS UNDERLINING, STRIKE THROUGH, AND
03520 ;* BOLDFACING. BC INDICATES HOW MANY UNITS TO
03530 ;* BACKSPACE. THIS ROUTINE HAS TO KNOW HOW TO
03540 ;* PROGRAM THE PRINTER TO PERFORM THIS BACK-
03550 ;* SPACING, BUT SINCE DUMB DOT-MARTIX PRINTERS
03560 ;* DON'T DO THIS, WE JUST SET THE CARRY (CY)
03570 ;* BIT AND EXIT. NOTE THAT THE DAISY WHEEL
03580 ;* PRINTER BOLDFACES BY BACKSPACING ABOUT TWO
03590 ;* LESS THAN THE WIDTH OF THE CHARACTER, AND
03600 ;* PRINTING THE SAME CHARACTER AGAIN. DOT MATRIX*
03610 ;* PRINTERS DO IT BY REPEATING EACH COLUMN OF
03620 ;* DOTS ONCE.
03630 ;*
03640 ;* ENTRY: BC= # UNITS TO BACKSPACE, BUT THIS
03650 ;* ROUTINE IGNORES THIS REGISTER
03660 ;* EXIT : A=DON'T CARE
03670 ;*      : OTHER REGISTERS UNDISTURBED
03680 ;*      : CY SET IF ABORT, AND HERE WE HAVE
03690 ;*      THIS ALWAYS SET. NO I/O DONE.
03700 ;*****
03710 LD   A,127  ; CANNOT BACKSPACE SO
03720 ADD  A,1    ; SET THE CARRY TO SHOW
03730 RET                ; ERROR AND EXIT.
03740 ;
03750 ; PAGE
03760 TOGFEA EQU  $      ; TOGGLE SPECIAL FEATURE
03770 ;*****
03780 ;* TOGGLE THE SPECIAL PRINTER FEATURE INDICATED *
03790 ;* IN THE A-REGISTER. THE INTENT IS TO ISSUE
03800 ;* ANY CONTROL CODES TO THE PRINTER REQUIRED
03810 ;* TO ACCOMPLISH THIS. IN THE CASE OF THE DAISY *
03820 ;* WHEELS, NO ACTION IS REQUIRED BECAUSE ALL THE*
03830 ;* SPECIAL FEATURES ARE DONE VIA BACKSPACING.
03840 ;* THE SHACK DOES AN 'XOR A' AND A 'RET' TO SAY *
03850 ;* THAT THE FEATURE HAS BEEN TOGGLED. DOT MATRIX*
03860 ;* PRINTERS REQUIRE A SPECIAL CONTROL CODE BE
03870 ;* ISSUED TO TURN ON UNDERLINING OR BOLDFACING.
03880 ;* BUT THIS DRIVER IS SUPPOSED TO BE DUMB, AND
03890 ;* DIFFERENT PRINTERS REQUIRE DIFFERENT CONTROL
03900 ;* CODES TO ACTIVATE SPECIAL FEATURES, SO THIS
03910 ;* SUBROUTINE WILL SET CARRY (CY) TO SHOW THAT
03920 ;* SPECIAL FEATURES CANNOT BE TOGGLED.
03930 ;*
03940 ;* ENTRY: A="-" toggle underscoring
03950 ;*      ="+" toggle bold facing
03960 ;*      ="=" toggle double underscoring
03970 ;*      ="/" toggle strike-through
03980 ;*      NONE OF THESE WILL WORK HERE
03990 ;* EXIT : A= DON'T CARE
04000 ;*      : OTHER REGISTERS UNDISTURBED
04010 ;*      : CARRY SET IF PRINTOUT ABORTED
04020 ;*      ALWAYS SET IN THIS DRIVER
04030 ;*****
04040 LD   A,127  ; CAN'T TOGGLE FEATURES SO
04050 ADD  A,1    ; SET THE CARRY (CY)
04060 RET                ; AND RETURN
04070 ; PAGE
04080 EXFEA EQU  $      ; EXECUTE SPECIAL FEATURE

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04090 ;*****
04100 ;* EXECUTE A SPECIAL PRINT FEATURE. THE CODE IN *
04110 ;* THE A-REGISTER (SEE TOGFEA) INDICATES WHICH *
04120 ;* FEATURE IS REQUIRED. B CONTAINS THE UNIT *
04130 ;* WIDTHS THE OF THE CHARACTER LAST PRINTED AND *
04140 ;* C CONTAINS THE UNITS WIDTHS OF THE SPACE *
04150 ;* THAT FOLLOW THIS LAST CHARACTER (0=NONE). *
04160 ;* D HOLDS THE ASCII CODE OF THIS LAST CHARACTER*
04170 ;* PRINTED. SO YOU'VE GOT THE INFORMATION ABOUT *
04180 ;* WHERE THE PRINT HEAD IS RELATIVE TO THE LAST *
04190 ;* CHARACTER - GOOD INFO IF YOU'RE USING THE *
04200 ;* DAISY WHEEL PRINTER. SINCE OUR DUMB DOT *
04210 ;* MATRIX PRINTER HAS NO SPECIAL FEATURES TO *
04220 ;* EXECUTE, WE'LL SET THE CARRY (CY) BIT TO *
04230 ;* LET superSCRIPSIT KNOW. *
04240 ;* *
04250 ;* ENTRY: A=SPECIAL FEATURE (SEE TOGFEA) *
04260 ;* : B=WIDTH OF LAST CHARACTER PRINTED *
04270 ;* : C=WIDTH OF SPACE AFTER THIS CHARACTER *
04280 ;* : D=ASCII CODE OF LAST CHARACTER PRINTED*
04290 ;* EXIT : A=DON'T CARE *
04300 ;* : OTHER REGISTERS UNDISTURBED *
04310 ;* : CARRY SET IF PRINTOUT ABORTED *
04320 ;* ALWAYS SET BY THIS DRIVER *
04330 ;*****
04340 LD A,127 ; CANNOT EXECUTE SPECIAL
04350 ADD A,1 ; FEATURE SO SET CARRY BIT
04360 RET ; AND RETURN WITH ERROR
04370 ; PAGE
04380 HAFFOR EQU $ ; DO HALF FWD LINEFEED
04390 ;*****
04400 ;* CAUSE PRINTER TO EXECUTE A FORWARD HALF LINE *
04410 ;* FEED, FOR THE PURPOSE OF SUBSCRIBING, AND *
04420 ;* SET THE CARRY FLAG IF THIS ATTEMPT FAILED. *
04430 ;* DUMB DOT-MATRIX PRINTERS DON'T SUPPORT THIS *
04440 ;* FEATURE AND THIS DRIVER ALWAYS SETS THE CY. *
04450 ;* *
04460 ;* ENTRY: REGISTERS ARE MEANINGLESS *
04470 ;* EXIT : A=DON'T CARE *
04480 ;* : OTHER REGISTERS UNDISTURBED *
04490 ;* : CARRY (CY) SET IF PRINTOUT ABORTED *
04500 ;* ALWAYS SET BY THIS DRIVER *
04510 ;*****
04520 LD A,127 ; CANNOT HALF FWD LINEFEED
04530 ADD A,1 ; SO SET CARRY BIT AND
04540 RET ; RETURN WITH CY SET.
04550 ; PAGE
04560 HAFREV EQU $ ; DO HALF REVERSE LINEFEED
04570 ;*****
04580 ;* CAUSE PRINTER TO ISSUE A HALF REVERSE LINE *
04590 ;* FEED FOR THE PURPOSE OF SUPERSCRIBING, AND *
04600 ;* RETURN WITH CARRY (CY) SET IF THIS FAILED. *
04610 ;* THIS DRIVER DOES NOT SUPPORT THIS FEATURE, SO*
04620 ;* CARRY IS ALWAYS SET. *
04630 ;* *
04640 ;* ENTRY: REGISTERS MEANINGLESS *
04650 ;* EXIT : A=DON'T CARE *
04660 ;* : OTHER REGISTERS UNDISTURBED *
04670 ;* : CARRY (CY) SET IF PRINTOUT ABORTED *
04680 ;* ALWAYS SET BY THIS DRIVER *
04690 ;*****

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04700 LD A,127 ; CANNOT HALF REV LINEFEED
04710 ADD A,1 ; SET CARRY BIT AND
04720 RET ; RETURN WITH CY SET.
04730 ; PAGE
04740 RDYTST EQU $ ; TEST FOR PRINTER READY
04750 ;*****
04760 ;* TEST FOR THE PRINTER READY CONDITION AND SET *
04770 ;* THE Z-BIT IF READY, CLEAR Z-BIT IF NOT READY *
04780 ;* AND SET THE CARRY (CY) IF PRINTOUT ABORTED. *
04790 ;* SEE PRCHR FOR MODEL III CONSIDERATIONS. *
04800 ;* THE STATUS BYTE RETURNED BY THE PRNTER IS: *
04810 ;* *
04820 ;* BIT MEANING *
04830 ;* 7 PRINTER IS BUSY PRINTING IF BIT SET *
04840 ;* 6 PRINTER IS OUT OF PAPER IF BIT SET *
04850 ;* 5 PRINTER IS ON LINE IF THIS BIT SET *
04860 ;* 4 NO PRINTER FAULTS IF THIS BIT SET *
04870 ;* 3-0 MEANINGLESS AND USUALLY SET *
04880 ;* *
04890 ;* IN OTHER WORDS, A STATUS OF 0011XXXX MEANS *
04900 ;* IT'S OKAY TO TRY TO PRINT. *
04910 ;* THE SHACK'S SPECS SAY THIS SUBROUTINE MAY *
04920 ;* CHANGE THE A-REGISTER, BUT IT IS SPECIALY *
04930 ;* PRESERVED HERE, AS THEIR DRIVERS DO THIS TOO.*
04940 ;* *
04950 ;* ENTRY: A IS SUPPOSED TO BE MEANINGLESS BUT IT*
04960 ;* CONTAINS THE CHARACTER TO BE OUTPUT *
04970 ;* : OTHER REGISTERS MEANINGLESS *
04980 ;* EXIT : A=DON'T CARE BUT IT IS PRESERVED HERE *
04990 ;* : REMAINING REGISTERS UNDISTURBED *
05000 ;* : Z=1 MEANS PRINTER READY *
05010 ;* =0 MEANS PRNTER NOT READY *
05020 ;* : CY=1 MEANS PRINTOUT ABORTED *
05030 ;*****
05040 PUSH BC ; SAVE BC
05050 LD B,A ; SAVE CHARACTER
05060 LD A,(293);TEST FOR
05070 CP 'I' ;MODEL III
05080 JR Z,MDLIII,JP IF MODEL III
05090 LD A,(PRINTR) ; GET STATUS OF PRINTER
05100 JR COMM ; COMPLETE STATUS CHECK
05110 MDLIII IN A,(0FBH) ; GET PRINTER STATUS
05120 COMM AND 0F0H ; IGNORE LOWER NIBBLE
05130 CP 30H ; ESTABLISH Z FLAG
05140 LD A,B ;RESTORE A-REG
05150 POP BC ; RESTORE BC
05160 RET ; Z RETURN FLAG
05170 ; PAGE
05180 SETBL EQU $ ; ADJUST WIDTBL FOR MONOSPACE
05190 ;*****
05200 ;* INITIALIZE THE CHARACTER WIDTH TABLE AS PER *
05210 ;* THE PITCH IN THE A-REGISTER. A=0 MEANS THAT *
05220 ;* superSCRIPSIT WANTS DO DO PROPORTIONAL *
05230 ;* SPACING AS INDICATED IN THE "OPEN DOCUMENT" *
05240 ;* PARAMETERS. THE SHACK'S DW2/CTL DRIVER *
05250 ;* ASSUMES THAT THE WIDTH TABLE IS ALREADY SET *
05260 ;* UP IF A=0 AND JUST EXITS. THIS IS TRUE WHEN *
05270 ;* A FRESH COPY OF THE DRIVER HAS BEEN LOADED. *
05280 ;* WHEN MONO SPACING IS INDICATED WITH A=PITCH *

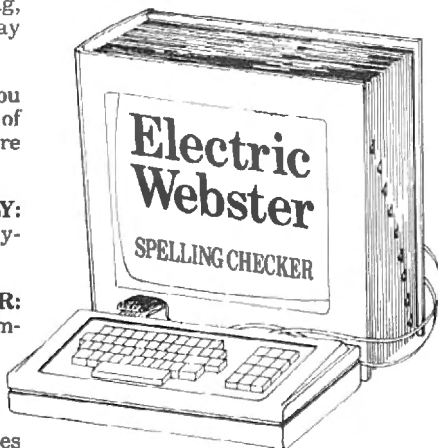
```

Listing 2 continued

```

05290 * IN cpi, ALL CHARACTERS IN THE TABLE ARE SET
03300 * TO THE SAME WIDTH AS THE SPACE CHARACTER.
03310 * THUS superSCRIPT LOADS A FRESH COPY OF THE
03320 * DRIVER IF THE PITCH PARAMETER CHANGES.
03330 * THIS DRIVER ASSUMES 10 cpi. DW2/CTL SUPPORTS
03340 * MANY PITCHES, AND REQUIRES THE #UNITS/INCH
03350 * STORED AT INCSIZ TO CALCULATE CHAR WIDTH
03360 * = INCSIZ/PITCH0.
03370 * THE LP8/CTL DRIVER REVEALS THE FOLLOWING:
03380 * INCSIZ WIDSPFC
03390 * PITCH (cpi) INCSIZ WIDSPFC
03400 * 16 200 12
03410 * 8 200 12
03420 * 5 200 12
03430 * 10 120 12
03440 * NOTE THAT 16 cpi ----> 16.5 cpi
03450 * 8 cpi ----> 8.3 cpi
03460 * THE MICROLINE82 PARAMETERS ARE:
03470 * PITCH (cpi) INCSIZ WIDSPFC
03480 * 5 90 18
03490 * 8 149 18
03500 * 10 90 9
03510 * 16 149 9
03520 * NOTE THAT 149=90*16.5/10.0. THE MICROLINE
03530 * MATRIX IS 9x7 (WIDTHxHEIGHT) DOTS OVERALL,
03540 * AND CHARACTERS ARE FORMED ON A 5x7 INTERNAL
03550 * GRID, THE REST FORMS THE SPACING BETWEEN
03560 * LINES AND CHARACTERS.
03570 * WITH BOTH LP8 AND MICROLINE82 PRINTERS THE
03580 * 16 AND 8 cpi PITCH PRINT LOOKS DARKER DUE TO
03590 * THE DOUBLE PRINTING OF THE VERTICAL COLUMNS.
03600 * DUMB MATRIX PRINTERS SUCH AS THIS DRIVER
03610 * SUPPORTS HAS PITCH=10cpi. AS LONG AS THE
03620 * INCSIZ AND WIDSPFC PARAMETERS ARE CONSISTENT
03630 * WITH PITCH=10, THEY ARE ARBITRARY HERE.
03640 * PITCH<10 CAUSES AN ABORTIVE RETURN.
03650 * ENTRY: A=0 FOR PROPORTIONAL PITCH
03660 * : A=PITCH DESIRED (ONLY 10 ALLOWED HERE)
03670 * EXIT : A=DON'T CARE
03680 * : OTHER REGISTERS UNDISTURBED
03690 * : PITCH0=PITCH NOW IN VOGUE
03700 * : WIDTBL SET UP FOR MONOSPACE
03710 * : INCSIZ CURRENT #DOTS/INCH
03720 * : CARRY (CY) DON'T CARE
03730 * *****
03740 * CP 10 ; PITCH=10 ?
03750 * JR Z,BAD ; BAD IF NOT
03760 * LD (MODSTO),A ; SAVE IT IF GOOD
03770 * RET ; AND EXIT CLEAN
03780 * LD A,127 ; SET THE
03790 * ADD A,1 ; CARRY FLAG
03800 * RET ; AND EXIT
03810 * NEXT EQU $
03820 * 05820 ; FIRST WORD AVAILABLE FOR TEXT
03830 * 05830 ; STORAGE BY superSCRIPT.
03840 * 05840 ; TYPICALLY ABOUT 16 KBYTES ONLY.
03850 * 05850 ;
03860 * 05860 ; ENTRY POINT UNIMPORTANT.
    
```

- **DISPLAYS CORRECT SPELLINGS:** If you don't know the correct spelling, EW will look it up for you, and display the dictionary.
- **VERIFIES CORRECTIONS:** If you think you know the correct spelling of a word, EW will check it for you before making the corrections.
- **HYPHENATES AUTOMATICALLY:** (Optional). Inserts discretionary hyphens throughout text.
- **GRAMMAR & STYLE CHECKER:** (Optional). Identifies 22 types of common errors. Makes suggested corrections with the stroke of a key. Runs within EW.
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Program Listing 3. Standard/PCL.

```

100 :
110 : [ FIGURE 3          STANDARD/PCL
120 : Alcor Pascal program reads in STANDARD/CTL and produces a
series of BASIC DATA statements which can be used to reconstruct
130 : the
140 : STANDARD/CTL superSCRIPSIT printer driver file, which is i
n
150 : object file format :
160 :
170 :   (01) (# data bytes) (LSB) (MSB) (BYTE1) (BYTE2) - - - (BY
TE n)
180 :
190 :
200 :
210 :
220 :   (02) (02) (LSB) (MSB)
230 :
240 : The BASIC DATA statements are of the format :
250 :
260 :   NNNN DATA nnn, nnn, nnn, nnn, nnn, nnn, nnn, nnn, nnnn, n
nn }
270 :
280 : PROGRAM STANDARD;
290 :
300 : type   BYTE = 0..255 ;
310 : var obj_standard : file of BYTE; { object file treated th
us }
320 :   bas_standard : text           ; { BASIC DATA statement f
ile }
330 :   code : BYTE;
340 :   num : BYTE;
350 :   data : BYTE;
360 :   line_num : integer;
370 :   checksum : integer;
380 :   pos_in_line : BYTE;
390 :
400 : function AND16(op1, op2 : integer) : integer ; external ;
410 :
420 : procedure BASIC_LINE(value:BYTE);
430 : { Accept a value byte and add it to the current DATA state
ment
440 : being built. There are ten values per DATA statement.
450 :
460 : {globals: pos_in_line      position in the DATA statement
470 :           line_num        line number of the DATA stateme
nt
480 :
490 :           bas_standard     output file holding DATA lines
500 :           checksum        shift-and-add checksum all byte
s }
510 :
520 : BEGIN
530 :   checksum := 2*AND16(checksum,8191) + value           { checks
um
540 :   + (AND16(checksum,8192) DIV 8192) ;
550 :   if pos_in_line = 0 then write(bas_standard,         { put in
line_num:4,           { BASIC

```

Listing 3 continue

Listing 3 continued

```

560 '          ' DATA ' '); { syntax
570 ' write(bas_standard,value:3); { add va
580 ' pos_in_line := pos_in_line + 1; { anothr
590 ' if pos_in_line = 10 then begin
600 '     writeln(bas_standard); { force
610 '     pos_in_line := 0; { start
620 '     line_num := line_num + 1 { bump 1
630 '     end
640 '     else write (bas_standard,' '){ data s
650 ' end { of BASIC_LINE }; { return
660 '
670 ' begin { main processing begins here }
680 '
690 ' rewrite(bas_standard) { open the output file };
700 ' reset (obj_standard) { open the superSCRIPSIT driver obje
710 ' writeln(bas_standard,' 10 REM INSTALL SUPERSCRIPSIT PRINTE
720 ' writeln(bas_standard,' 20 A$="STANDARD/CTL" '
730 ' writeln(bas_standard,' 30 OPEN "O",1,A$ '
740 ' writeln(bas_standard,' 40 CHECKSUM = 0 '
750 ' writeln(bas_standard,' 50 FOR I = 1 TO 2 STEP 0 '
760 ' writeln(bas_standard,' 60 READ BYTE '
770 ' writeln(bas_standard,' 70 IF BYTE = -1 THEN I=2 : GO TO 10
780 ' writeln(bas_standard,' 80 CHECKSUM = 2*(CHECKSUM AND 8191)
790 '     ' + (CHECKSUM AND 8192)/8192 '
800 ' writeln(bas_standard,' 90 PRINT ##1,CHR$(BYTE); '
810 ' writeln(bas_standard,'100 NEXT I '
820 ' writeln(bas_standard,'110 READ X '
830 ' writeln(bas_standard,'120 IF X = CHECKSUM THEN 140 '
840 ' writeln(bas_standard,'130 PRINT "DATA CHECKSUM BAD. CHECK
850 ' writeln(bas_standard,'140 CLOSE 1 '
860 ' writeln(bas_standard,'150 PRINT A$" IS INSTALLED. GOOD LUC
870 ' pos_in_line := 0; { initialize }
880 ' line_num := 1000; { variables }
890 ' checksum := 0; { right off }
900 '
910 ' repeat read(obj_standard,code) ; BASIC_LINE(code) ;
920 ' case code of
930 '     1,2,5: begin

```

```

940 '         read(obj_standard,num) ; BASIC_LINE(num) ;
950 '         for i := 0 to num-1 do begin
960 '             read(obj_standard,d
970 '                 BASIC_LINE(data)
980 '             end { of do }
990 '         end { of 1,2,5 }
1000 '         otherwise begin
1010 '             code := 255 ;
1020 '             writeln(output,'object file input err
1030 '                 end { of otherwise }
1040 '         end { of case }
1050 ' until (code=2) or (code = 255) ;
1060 '
1070 ' writeln(bas_standard,-1:3,' ',checksum:5) ; { terminate
1080 ' line_num := line_num + 1 ; { last line with -1 and checks
1090 ' writeln(bas_standard, line_num:4, ' END');{ add END state
1100 ' close (bas_standard) ;
1110 ' close (obj_standard)
1120 '
1130 ' end.
1140 '

```

End

```

100 ' PROGRAM sixteenbitAND ;
110 '
120 ' (* REFERENCE: ALCOR'S FIRST NEWSLETTER PP 41-42 *)
130 ' (* *)
140 ' (* AND16 16-BIT LOGICAL AND OF ARGUMENTS *)
150 ' (* *)
160 '
170 ' TYPE
180 ' CODEARRAY = PACKED ARRAY (. 1..8 .) OF CHAR;
190 ' BYTE = 0..255;
200 '
210 ' PROCEDURE CALL$(ADDRESS:INTEGER; VAR A:BYTE;
220 '     VAR BC, DE, HL, IX, IY : INTEGER); EXTERNAL;
230 '
240 ' FUNCTION AND16(OP1, OP2 : INTEGER): INTEGER;
250 ' VAR
260 '     CODE : CODEARRAY;
270 '     A : BYTE;
280 '     BC, DE, HL, IX, IY : INTEGER;
290 ' BEGIN
300 '     DE := OP1;
310 '     HL := OP2;
320 '     CODE := '#7C#A2#67#7D#A3#6F#C9 ' ;
330 '     CALL$(LOCATION(CODE),A,BC,DE,HL,IX,IY) ;
340 '     AND16 := HL;
350 ' END; (*AND16*)
360 '
370 ' BEGIN
380 '     (*$NULLBODY*)
390 ' END.
400 '

```

Program Listing 4. AND16/PCL.


```

00010 ;
00020 ; AND/ASM
00030 ;
00100 ;*****
00110 ;*16 BIT AND SUBROUTINE DOES A LOGICAL BIT-FOR-BIT AND
00120 ;* ON THE DE AND HL REGISTER PAIRS AND RETURNS THE
00130 ;* RESULT IN THE HL REGISTER. DE IS UNDISTURBED AND THE
00140 ;* A REGISTER IS DESTROYED.
00150 ;*****
00160 ;
00170 ;
00180 ;
00190 ;
00200 ;
00210 ;
00220 ;
00230 ;
00240 ;
00250 ;
00260 ;
00265 ;
00270 ;

ORG 0000 ; ARBITRARY ORIGIN, THE ROUTINE
LD A,H ; IS RELOCATABLE.
LD D ; AND THE MOST SIGNIFICANT BYTES
LD H,A ; IN THE D AND H REGISTERS AND
; PUT IT INTO THE H REGISTER.
LD A,L ; AND THE LEAST SIGNIFICANT
AND E ; BYTES IN E AND L REGISTERS AND
LD L,A ; PUT IT INTO THE L REGISTER.
RET ; BACK TO CALLER WITH HL
END ; MEANINGLESS STARTING ADDRESS.

```

FIGURE 5

Program Listing 5. And/ASM.

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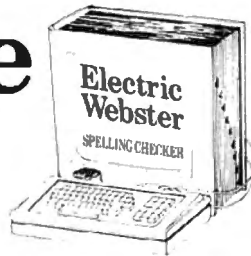
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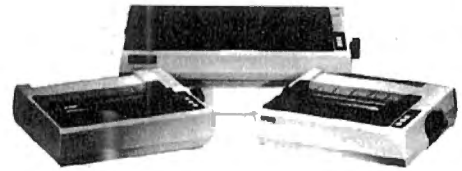
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I wrote Pieplot as a subroutine. You enter from two to eight values in the

program, and it prints a pie-shaped segment for each value.

The program builds the pie chart one line at a time. First it draws the outside circle on paper. The program stores the equation for the outside circle in the form of constants, with only 1/4 of the circle represented. That quarter circle is mirrored left to right and top to bottom to make a full circle.

Pieplot then adds all required segment boundaries. If any segment titles are required on this line, the program inserts them. It determines placement of

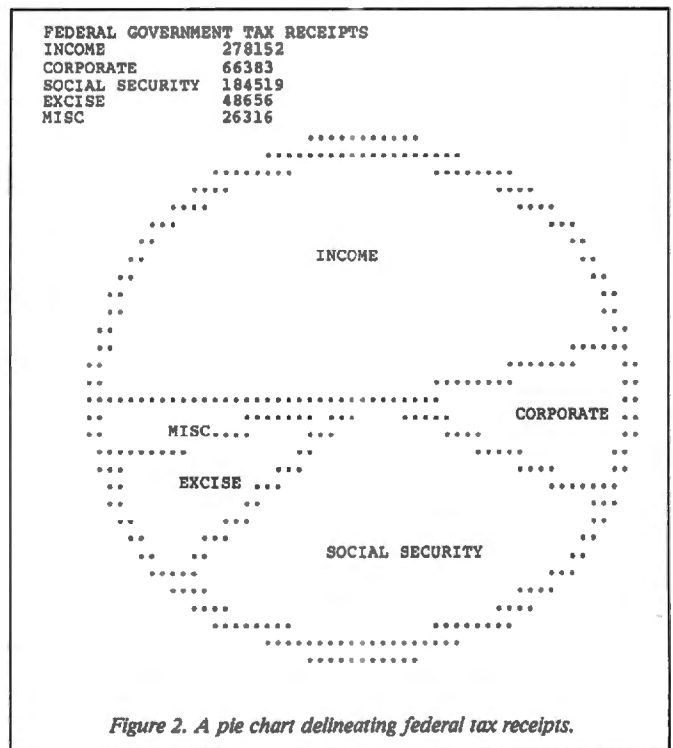
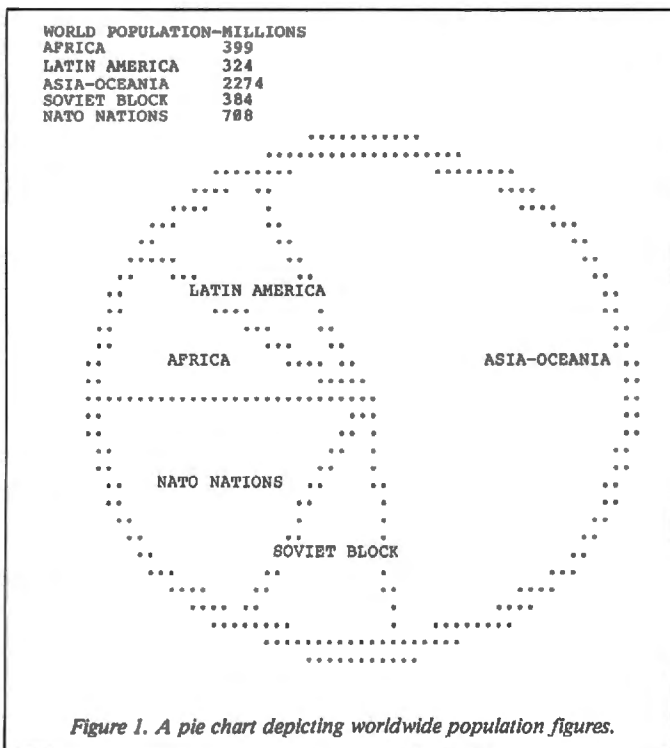
the radial lines and the segment titles using trigonometric calculations. ■

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Program Listing. Pieplot.

```

5 CLEAR 500
10 REM EXAMPLE ROUTINE TO CALL PIEPLOT SUBROUTINE
15 DIM PX(16)
17 INPUT "ENTER PIE CHART TITLE";A$
20 PRINT "ENTER UP TO 8 TITLES AND VALUES"
30 FOR I=1 TO 8
35 INPUT "ENTER TITLE";PW$(I)
40 INPUT "ENTER VALUE";PD(I)
50 NEXT I
54 LPRINT A$
55 IF PD(1)=0 STOP
56 FOR I=1 TO 8
57 IF PD(I)=0 GOTO 60
58 LPRINT PW$(I),PD(I)
59 NEXT I
60 GOSUB 40000
70 RUN
40000 REM PIEPLOT SUBROUTINE - CALL WITH UP TO 8 ENTRIES IN VALU
E ARRAY PD ( ) AND TITLE ARRAY PW$( )
40002 FOR PI=1 TO 8:IF PD(PI)=0 GOTO 40006
40004 PV=PV+PD(PI):NEXT PI
40006 PS=PI:PA(0)=0
40008 FOR PI=1 TO PS:PA(PI)=360*PD(PI)/PV+PA(PI-1):NEXT PI
40012 FOR PI=1 TO PS:PH(PI)=((PA(PI)-PA(PI-1))/2)+PA(PI-1): PL(P
I)=16-INT(1.50*SIN(.0174533*PH(PI))*6):PZ(PI)=32-(INT(LEN(PW$(PI
))/2)+1)-INT(1.75*COS(.0174533*PH(PI))*10):NEXTPI
40018 PX(1)=505:PX(2)=909:PX(3)=1408:PX(4)=1604:PX(5)=1804:PX(6)
=2003:PX(7)=2102:PX(8)=2202:PX(9)=2302:PX(10)=2402:PX(11)=2402:P
X(12)=2502:PX(13)=2502:PX(14)=2602:PX(15)=2602:PX(16)=2602
40020 FORPI=1TO31
40022 PK=PI:IFPI>16THENPK=32-PI
40024 PP=INT(PX(PK)/100)
40030 PL=PX(PK)-(PP*100)
40040 IF PK>2THENPC$=" "ELSEPC$="."
40050 IF PI>16 GOTO 40080
40060 FORPJ=1TOPS-1:IF PA(PJ)=90THENPC$="."
40070 NEXTPJ:GOTO 40100
40080 FORPJ=1 TOPS-1:IFPA(PJ)=270THENPC$="."
40090 NEXTPJ
40100 IF PI=16 THENPA$=" " +STRING$(27,".")+STRING$(24," ")+"
." :GOTO 40150
40110 PA$=STRING$(30-PP," ") +STRING$(PL,".")+STRING$(PP-PL," ") +
PC$+STRING$(PP-PL," ") +STRING$(PL,".")
40150 IFPI>16 GOTO 40190
40160 FORPJ=1TOPS-1:IFPA(PJ)=PA(PJ+1)GOTO 40180
40165 IFPA(PJ)<90THENPT=TAN(.0174533*(90-PA(PJ))):GOSUB 40260
40170 IFPA(PJ)>90 AND PA(PJ)<181 THEN PT=TAN(.0174533*(270-PA(PJ
))):GOSUB40260
40180 NEXTPJ:IFPI=16 THEN GOTO 40190 ELSE GOTO 40220
40190 FOR PJ=1TOPS-1:IFPA(PJ)=PA(PJ+1)GOTO 40210
40195 IFPA(PJ)>270THENPT=TAN(.0174533*(PA(PJ)-270)):GOSUB40260

```

Listing continued

```

1980 PRESIDENTIAL ELECTION
REAGAN          4.32012E+07
CARTER          3.49133E+07
ANDERSON        5.58138E+06
CLARK-COMMONER 1.1027E+06

```

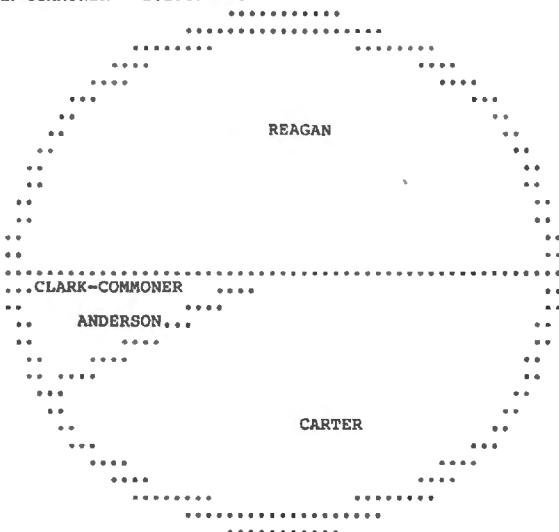


Figure 3. A pie chart detailing results of the 1980 presidential race.



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Listing continued

```
40200 IFPA(PJ)>180ANDPA(PJ)<270 THEN PT=-TAN(.0174533*(450-PA(PJ
))) :GOSUB40260
40210 NEXTPJ
40220 FOR PJ=1 TOPS-1:IF PI<>PL(PJ) THEN GOTO 40230
40222 PB$=LEFT$(PA$,PZ(PJ))+PW$(PJ)+RIGHT$(PA$,LEN(PA$)-PZ(PJ)-L
EN(PW$(PJ)))
40224 PA$=PB$
40230 NEXTPJ
40240 LPRINT PA$
40250 NEXT PI
40255 RETURN
40260 PA=INT(10*(17-PK)*PT/6)
40270 PB=INT(10*(16-PK)*PT/6)
40280 IF ABS(PB) > PP GOTO 40350
40290 IF PA=PB GOTO 40330
40300 IF PA<0 THEN GOTO 40360
40310 IF PA>PP THEN PA=PP
40320 IF PA>PB THEN PB$=LEFT$(PA$,30-PA)+STRING$(PA-PB+1,".")+RI
GHT$(PA$,LEN(PA$)-(31-PB)):GOTO 40340
40330 PB$=LEFT$(PA$,30-PA)+". "+RIGHT$(PA$,LEN(PA$)-'31-PA)
40340 PA$=PB$
40350 RETURN
40360 IF ABS(PA)>PP THEN PA=-PP
40370 IF ABS(PA)<=ABS(PB) GOTO 40330
40380 PB$=LEFT$(PA$,30-PB)+STRING$(ABS(PB-PA)+1,".")+RIGHT$(PA$,
LEN(PA$)-(31-PA))
40390 GOTO 40340
```

Variable	Use and Meaning	PK	Count of lines to nearest top or bottom edge. Used to mirror the top half to the bottom half.
PD(1)-PD(8)	Data variables provided by the calling program. The first zero value stops the value scan.	PL	Number of points needed on given line to make outside circle.
PA()	Angle in degrees of each radial line to be drawn.	PP	Length from circle center to circle edge for this line.
PH()	Angle in degrees of line bisecting each pie segment.	PJ	Subscript.
PL()	Line number that represents one half the apparent length of the bisecting radial. Used for placement of the segment title.	PS	Number of segments needed.
PZ()	Starting string position for each segment title.	PC\$	Character printed at pie line center. Used if radial is exactly 90 or 270 degrees.
PX(1)-PX(16)	A user DIMensioned array that holds the constants used to draw the outside circle.	PT	Tangent of angle formed by the radial.
PW\$()	Segment titles.	PA	Position in line for points in radial.
PI	Line counter. Each Pieplot takes 31 lines.	PB	Position in adjoining line for points in radial. Used to get radial line length.
		PA\$	String for print line.
		PB\$	Workspace string for line.

Table. List of variables.

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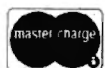
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MOD III

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Using Data Files—Part II

Store and retrieve data simultaneously by opening a random-access file.

Last June's article ("Using Data Files—Part I," *80 Micro*, June 1983, p. 258) covered the creation and use of sequential data files on a Model I, II, or III. This month I'll tackle random- or direct-access files.

You may recall that sequential-access files don't allow simultaneous data input to or output from a file. Direct-access files, on the other hand, let you get data from or put data into any file at the same time. Except for the Open and Close statements, random-access files use different instructions from sequential files.

Once you open a random-access file, you can manipulate it without having to write a special program. Random-access data files are separated into distinct, individual sections, called records, that let you change their contents easily and quickly.

Formatting the Disk

New disks are unformatted. Their recording surface lacks the proper environment to receive data. When you issue a Format command, the read/write head electronically prepares the disk to record data.

During the formatting process, the computer divides the disk surface into tracks. Model I and III disks accept 35 or 40 tracks; Model II disks are divided into 77 tracks. These tracks are further divided into sectors: 10 sectors for the Models I and III, 26 sectors for the Model II. Each sector stores 256 bytes of data.

Each of the sectors on a random-access disk is treated as a record by the random-access file. (These sectors occur on sequential-file disks as well, but the

computer ignores them, placing data across sector boundaries.)

Allocating Disk Space

Writing data in sectors is an advantage in that it permits fast access to data. But it can be a disadvantage, too: If your data does not fill an entire sector, you have a lot of wasted space on your hands.

You can circumvent this problem by carefully allocating disk space. Determine (approximately) how much disk space a file requires and specify this length before you open the file. For example, for a record length of 128 bytes for a new file, type:

```
OPEN "R", 1, "NEWFILE", 128
```

This command lets you put two files on a single sector. All TRS-80s support limited record lengths of fewer than 256 bytes.

Random-access files require more planning than sequential files, but once you establish their file structure, programming them is simpler.

Initializing the File

Initialize the random-access file in the same way as a sequential file. The only difference is that you use the buffer assigned to the file for both input and output.

The first statement used to create a file is the Open statement. In the random-access file, the Open statement

```
00010 OPEN "R", 1, "NEWFILE"
```

does the same thing as the sequential file

Open statement. The R refers to random access and is used by the Models I, II, and III. (The Model II also uses a D, which refers to direct access.)

The number 1 is the buffer assignment. It is the same as in the sequential files.

NEWFILE is the file name. A file name can have from one to seven characters in it and it can be followed by /EXT to add three characters for file identification. If the file name already exists, the computer opens the file for both input and output.

Field Statements

The next statement is the Field statement. It divides the record into the number and type of parts needed to store data. The statement

```
00020 FIELD 1 128 AS A$, 128 AS B$
```

is an example of a Field statement. 00020 FIELD provides access to the random, or direct, file buffer.

The number 1 assigns the buffer to the file; it must match the number used in the Open statement. If you open more than one file at a time, you must be careful to assign the Field statement to the proper Open statement.

The next segment (128 AS A\$, 128 AS B\$) divides the record into parts.

The Key Box

Models I, II, and III
32K RAM
Disk Basic


```

10 REM SEQUENTIAL FILE CONVERSION(SQFILCON/BAS)
15 REM
20 REM AUTHOR JESSE W. BAKER
25 REM
30 REM THIS PROGRAM CONVERTS SEQUENTIAL FILES TO RANDOM
ACCESS FORMAT.
35 REM
40 REM OCTOBER 11, 1982
45 REM
100 ' *** VARIABLE IDENTIFICATION SECTION ***
110 '
120 ' S$ = NAME OF SEQUENTIAL FILE
130 ' R$ = NAME OF RANDOM ACCESS FILE
140 '
150 ' *** INPUT FILE NAMES FOR CONVERSION ***
160 CLS:PRINT"TO USE THIS PROGRAM, USE 'SAMPLE/FIL' AS THE NAME
OF THE SEQUENTIAL FILE"
170 PRINT
180 PRINT"YOU WISH TO CONVERT TO RANDOM ACCESS."
190 FOR T=1 TO 2000
200 NEXT T
210 CLS
220 INPUT"ENTER NAME OF SEQUENTIAL FILE";S$
230 PRINT
240 INPUT"ENTER NAME OF RANDOM FILE";R$
250 '
260 ' *** FILE INITIALIZATION ***
270 '
280 OPEN "I", 1, S$
290 OPEN "R", 2, R$
300 FIELD 2, 2 AS Z$, 2 AS Y$, 2 AS X$
310 '
320 ' *** READ SEQUENTIAL FILE ***
330 '
340 IF EOF(1) THEN 520
350 INPUT #1, A,B,C
360 '
370 ' *** COPY SEQUENTIAL FILE DATA TO BUFFER ***
380 '
390 LSET Z$=MKI$(A)
400 LSET Y$=MKI$(B)
410 LSET X$=MKI$(C)
420 '
430 ' *** WRITE DATA TO RANDOM ACCESS FILE ***
440 '
450 PUT 2
460 GOTO 360
470 '
480 ' *** CLOSE ALL FILES ***
490 '
500 CLOSE 1,2
510 CLS
520 PRINT"COPY COMPLETED"
530 END
540 SAVE"SQFILCON/BAS",A

```

Program Listing. This program converts sequential files to random-access files.

- | | |
|--------|---|
| Field | A statement that specifies the size and content of a record. It can hold up to 256 bytes of information. |
| GET | The opposite of the Put statement, it tells the computer to get the data from the disk and insert it into the specified buffer. |
| LOF(n) | This is used in random-access files to get the end-of-file record number through the specified buffer. |
| PUT | This term tells the computer to take the data from the buffer and place it in the file on the disk. |
| Record | A term used to describe a smaller collection of data that will become part of a file. The Open statement determines the logical record length (LRL) of each record. |

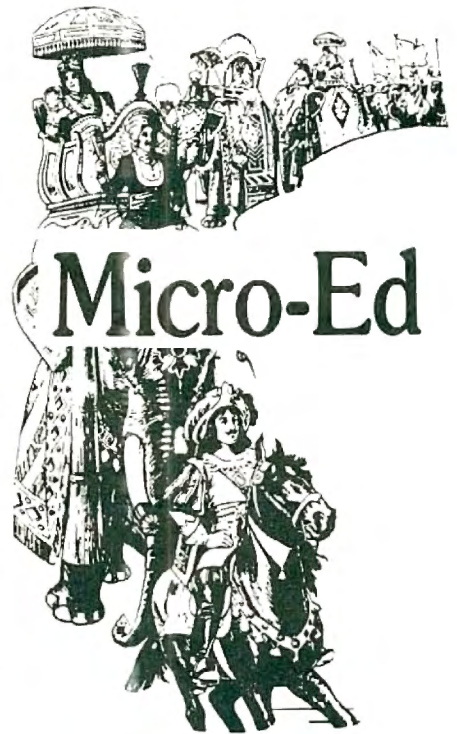
Table 1. Glossary of Terms

This expression tells the computer to allow 128 bytes of space for the variable A\$ and 128 bytes for B\$, thus creating two fields per sector.

You can establish a record of any size. You could give A\$ a field of 30

bytes if this is all you want in the record. Then each sector would contain one field of 30 bytes, leaving 225 bytes unused in that sector. To avoid wasting this valuable space on your disk, you should specify the record length when

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you open your file.

A\$ and B\$ are included because you can assign only string variables to the fields, not numeric variables.

Buffer Fields

The next statement moves the data items into the buffer fields previously defined by the Field statement. You have your choice of two buffer fields: LSET for left set and RSET for right set. If you use LSET, the data is moved into the buffer beginning in the leftmost position of the field. If you use RSET, the last character of the string occupies the rightmost position of the field.

For example, 00020 LSETA\$ = "JOHN DOE" places JOHN DOE in the buffer starting at the leftmost position, as follows: - | JOHN DOEbbbbbbb. The letter b represents unused spaces in the buffer, and in this example there are 247 such spaces.

If you RSET the string variable, the computer places the name as follows: bbbbbbbbJOHN DOE | -. In this example there are 247 leading blanks.

Writing to Disk

After the data is LSET or RSET, you can write it to disk using a Put statement

such as PUT 1. The word "put" tells the computer to take the data that has been LSET or RSET and write it to the disk. The number tells the computer which buffer to use and it must match the one used in the Open statement. This example writes the contents of the buffer to the file and if there are no other items there, it gives the file the number 1.

If you want to put record number 6 into an existing file, you must first see to it that the file holds a number of records. If the file already has 10 records in it and you need to replace record number 6 with new data, use the statement PUT 1, 6. This places the contents of buffer 1 in record position 6 on the disk file.

Close Statements

After you complete the output of data to the file, you must close it. For example, the statement: 00100 CLOSE 1 ensures that any information left in the buffer is written to the disk and that the file is sealed.

The number 1 makes the computer close only those files that use buffer 1. A close without a specific number closes all open files.

Altering the Program

After assembling these lines together, your program looks like this:

```
00010 OPEN "R", 1, "NEWFILE", 10
00020 FIELD 1, 10 AS A$
00030 LSET A$ = "JOHN DOE"
00040 PUT 1
00050 CLOSE 1
```

This program opens a variable-length (VLR) file called NEWFILE, allocates it 10-byte records, and then stores one record called JOHN DOE in it. To read the contents of this file you must change only two lines in this example. Delete lines 30 and 40 and add a line that gets the contents of the file, such as 00030 GET 1, n.

This Get statement lets you read a record previously written to the disk file. The 1 is the same buffer number used in the Open statement, and the n stands for the record number you wish to see. If you don't specify a number, the current record is read. If this is the first time the program accesses the file, the current record is number 1. If it is the third time, the current record number is 3.

Once you get the record, you must add another line that prints the record

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on the screen: 00040 PRINT A\$.

The new program to read the contents of the file looks like this:

```
00010 OPEN "R", 1, "NEWFILE",10
00020 FIELD 1, 10 AS A$
00030 GET 1
00040 PRINT A$
00050 CLOSE 1
```

In the sequential files, you had to use EOF as an end-of-file error-trapping routine. You must do the same thing with random-access files, but you use a different statement before the Get statement: 00040 IF R% => LOF(1) THEN 80.

LOF, length of file, indicates the number of the last record used in the file. In essence this line states, "If the last record number in this file is greater than the length of file, go to line 80 and close the buffer and file.

The program with LOF error-trapping looks like this:

```
00010 OPEN "R", 1, "NEWFILE"
00020 FIELD 1, 255 AS A$
00030 FOR R% = 1 TO LOF(1)
00040 IF R% => LOF(1) THEN 80
00050 GET 1, R%
00060 NEXT R%
00070 PRINT A$
00080 CLOSE 1
00090 END
```

The For...Next loop reads each record in sequence until the last record is reached. As it does this it compares the record number to see if it is greater than or equal to the length of file. When this condition is true, it closes the file.

Conclusion

Random-access files are easy to handle. The above examples should help you get started. The key to developing an understanding of file-handling techniques is to keep things simple from the beginning.

The short programs I provided here write only one record to a file, but you can change this by adding a For...Next loop that permits multiple entries, as in the previous example. You have to place this loop in both the Put and Get programs.

The Program Listing I've provided is a short, self-documenting utility that lets you convert the sequential file created in my previous article into a random-access file. ■

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Sneak a PEEK, Invoke a POKE

Learn some elementary uses of PEEK and POKE commands by applying them to a game program. You'll find them faster than string graphics.

If you've mastered PRINT @ graphics, you know they run slowly. And sometimes, particularly when working with a game like Asteroids, you need to tell if a ship runs into something.

You have two options to circumvent this type of problem. First, you can assign variables to the positions of the various obstacles and compare the player's PRINT@ positions with the variables. The problems with this method are obvious: It is painfully slow (see Program Listing 1), it gobbles up memory, and it complicates programs. In short, this method isn't practical.

The second method, using PEEKs and POKEs, sounds more complicated than it really is, and the results are well worth your effort. I'll explain some of the reasoning behind it. Get your computer into Basic and follow along so you can see the results.

What Are POKE and PEEK?

Everything on the screen is stored as ASCII numbers in a block of memory, 1 byte for each PRINT@ position, located from addresses 15360 to 15360 + 1023 (for a total of 1,023 PRINT@ positions) = 16383. (Before that is system memory.) Assume you have the message HI! on the top of the screen with the H at print position zero. The ASCII value for H is 72, which would then be at print position plus 15360 = 15360, 73 (for I) at 15361, 33 at 15362, and 32 at 15363. The rest of the screen is blank, so the rest of video RAM (VRAM) is filled with spaces.

Two commands in Basic let you work directly with the memory: POKE and PEEK. PEEK returns the value in a certain memory location. In the previous example, PEEK(15360) would return 72, the ASCII value for H. POKE puts values into a certain location. For in-

stance, if you want to change the I in our example to an E, you would use the command POKE 15360,69. Using the appendix in the back of the TRS-80 owner's manual, POKE the message to read HELLO!.

Now that you have the idea, you can try POKEing messages onto the screen. But don't use an address of less than 15360 or greater than 16383: you'll have to reset the computer.

PEEK and POKE Used and Explained

To explain how to use POKE and PEEK to their best advantage in your programs, I'll walk you through the development of a game program that uses the two P's.

First, you have to decide exactly what the program will do. I've already done that for you. This program resembles Pac-Man, except that the Pac character and monsters are single characters rather than graphics strings, and the maze consists of randomly generated obstacles.

If you are improving a fast game, you need to put the initialization at the very back, so choose a number, such as 1000, for the initialization routine (see Program Listing 2). On all programs where speed is important, you should have a Define Integer (DEFINT) statement, so put that in. The player character is an asterisk, so assign that (even though it's a constant). If all constants are in variables, you can change them throughout the program with a single correction.

Notice that I use PC = ASC("*") instead of PC = 42. Until you're familiar with the ASCII codes, and even then, indicate what PC is used for. Another advantage of POKEs over PRINT@ commands is that numbers take up less space in memory than strings, and every

byte of program code you can eliminate speeds up the program.

Indicate when the monster can eat the player and when the player can eat the monster. You also need two characters for the monster: one for when it can eat the player, the other for when the player can eat it. Each time the player eats an energy dot, the monster's status changes, so assign a variable (chase) as equal to one so that, when the player eats an energy dot, CHASE = -CHASE. The way to have two characters, then, is to put them in an array as M(0) and M(2), so that MC = M(1 - CHASE).

In some cases, however, printing can be a lot faster than POKEing—witness the first part in line 1040 where PRINT STRING\$(64,D1) fills the screen with dot characters rather than POKEs. As a general rule of thumb, printing is better when you have to deal with a large quantity of data on the screen, and POKEing is better with less data. (In order to keep it from scrolling, I POKEd the last line of the screen.)

Next, assign the player position (PP) somewhere on the middle line on the screen, and put the monster at a home position at the beginning of the second line, although you may change its formula to resemble the player's.

Now the energy-dot character is in DC and the obstacle character is in BC, so put in a sprinkling of energy dots and obstacle characters in line 1050, and

The Key Box



Model III
16K RAM Cassette Basic
32K RAM Disk Basic

you've completed the initialization. Note that you cannot use a GOSUB and Return sequence with the initializing routine, as it clears in the beginning, wiping out all GOSUB pointers.

You may also have noticed that it's frustrating to keep pressing a key over and over again. Here is another advantage of PEEKing. The keyboard is actually an eight- by eight-square matrix of normally open switches located in memory from 14337 to 14467 (see Table 1). The computer stores any pressed key there as a 1 in its table position, so you can read it by PEEKing at those locations. Since you use the arrow keys in this particular game, you need only PEEK at 14400 to find out which one has been pressed: 32 equals left arrow, 64 equals right arrow, and so on. If you have Disk Basic, you can store a line 2000 PK=14400:UA=8:DA=16:LA=32:RA=64, and then merge and renumber it to fit your program so that you do not have to remember the values.

In this game, use the variable A to indicate what you want to add to the player's position. Line 90 keeps the player from moving out of the video RAM, since going out of it, even by accident, could have disastrous results. Unfortunately planning puts memory vital to Basic in an area subject to VRAM overflows, so you must be especially careful to stay inside VRAM.

This is where PEEKing provides an advantage. Since the next position the player occupies is PP+A, simply PEEK at (PP+A) to see what's there, and act accordingly. If an obstacle blocks that position, stop the player from running into it. If it holds an energy dot, change the status of Chase and add two points to the score. If it is a regular dot, just add one point to the score.

You can see how much easier that is than first comparing PP+A with all of the obstacle positions, then the energy dot positions, then the regular dot positions.

If you decide to add something to the player position, you have to move the player and erase the last space. Note that IFATHEN... means the same as IFA<>0THEN, but takes up less memory, and therefore runs somewhat faster. Leaving out the IFATHEN gives you a blinking player, which is not at all desirable. In order to avoid the blink, put the player character at its new location and then erase the old one.

Lines 160-190 are fairly self-explanatory; they make the monster follow the player. Line 200 checks to see if something blocks the way and, if so, tries to

```

0 CLS
10 DIMOB(100),B(100),C(100)
20 FORI=1TO100:OB(I)=RND(14*64):PRINT@OB(I),CHR$(191):NEXT
30 FORI=1TO100:B(I)=RND(14*64):PRINT@B(I),"*";NEXT
40 FORI=1TO100:C(I)=RND(14*64):PRINT@C(I),"*";NEXT
50 PRINTCHR$(21);P$=CHR$(255)
60 I$=INKEY$:IFI$="U"THENA=-64
70 IFI$="D"THENA=64
80 IFI$="L"THENA=-1
90 IFI$="R"THENA=1
100 IFPP+A<@ORPP+A>1023THENA=0
110 FORI=1TO100:IFPP=OB(I)THENA=0ELSENEXT
120 FORI=1TO100:IFPP=B(I)THENA=0ELSENEXT
130 FORI=1TO100:IFPP=C(I)THENA=0ELSENEXT
140 PRINT@PP," ";PP=PP+A:PRINT@PP,P$;GOTO60

```

Program Listing 1. Prog 1.

	1	2	4	8	16	32	64	128
14337	@	A	B	C	D	E	F	G
14338	H	I	J	K	L	M	N	O
14340	P	Q	R	S	T	U	V	W
14344	X	Y	Z	-	-	-	-	-
14352	0	!	"	#	\$	%	&	'
.....		1	2	3	4	5	6	7
14368	()	*	+	<	=	>	?
.....		8	9	:	;	,	-	/
14400	EN	CL	BK	UA	DA	LA	RA	SP
14464	LS	RS	-	-	-	-	-	-

EN=Enter CL=Clear BK=Break UA=Up arrow
DA=Down arrow LA=Left arrow RA=Right arrow SP=Space
LS=Left shift RS=Right shift

Note: Model I treats both shifts the same.

Table 1. Keyboard matrix.

Program Listing 2. Munchies.

```

10 REM*****MUNCHIES
20 REM***** (C) 1982 BY TAD KERSHNER
30 GOTO1000
40 P=PEEK(PK)
50 IFP=LATHENA=-1
60 IFP=RATHENA=1
70 IFP=UATHENA=-64
80 IFP=DATHENA=64
90 IFPPS+A>V2ORPPS+A<V1THENA=0
100 IFPEEK(PPS+A)=BCTHENA=0
110 IFPEEK(PPS+A)=DCTHENCHASE=-CHASE:SC=SC+2:DL=DL-1:MC=M(1-CHASE)
120 IFPEEK(PPS+A)=D1THENSC=SC+1
130 IFATHENPPS=PPS+A:POKEPPS,PC:POKEPPS-A,SP:A=0
140 IFCHASE=-1THEN250
150 MA=0
160 IFMPS>PPS+64THENMA=-64
170 IFMPS<PPS-64THENMA=64
180 IFMPS>PPSTHENMA=MA-1
190 IFMPS<PPSTHENMA=MA+1
200 IFPEEK(MPS+MA)=BCTHENIFABS(MA)<>64THENMA=SGN(MA)*-64:GOTO200EL
SEMA=0
210 IFMPS=PPSTHEN1060
220 IFQ=PCTHENQ=32
230 IFMPS+MA>V1ANDMPS+MA<V2THENPOKEMPS,Q:MPS=MPS+MA:Q=PEEK(MPS):PO
KEMPS,MC:GOTO40
240 IFQ=PCTHENSTOP
250 MA=0:IFMPS>PPS+64THENMA=-64
260 IFMPS<PPS-64THENMA=64
270 IFMPS>PPSTHENMA=MA+1
280 IFMPS<PPSTHENMA=MA-1
290 IFRND(2000)=1THENCHASE=1:MC=63
300 IFPEEK(MPS+MA)=PCTHENMA=-MA
310 GOTO200
320 END
1000 CLEAR500:DEFINTA-Z:DIMM(2):PC=ASC("**"):MC=234:DC=ASC("#"):BC=

```

Listing 2 continued

move straight instead of diagonally. At line 230, you can see an easy way to have the monster move and leave the background untouched: Store the original contents of MP in Q, and then put

them back after the monster passes.

That explains the program for the most part. Now I'll give you some hints on how to create your own programs with PEEK and POKE.

Using the Two P's in Programs (Some Utilities)

One problem in using the memory is finding out exactly which location you want to use. Program Listing 3 is a short utility that lets you move a cursor about the screen to an appropriate place, and then look at the number at the top of the screen to determine the cursor's position. Also, if you want to convert an old program from one that uses the Set command to draw borders and background material to one using the memory directly, this program is useful to see what characters the Sets put in.

You may have noticed another advantage of POKE graphics: no messy PRINT CHR\$(21)s, and an accessibility to characters 1-31 that cannot be used with the Print command. Although I've found very little use for these characters, it's nice to know that they're available. If you do want to use Print commands for a character greater than 191, POKE 16420 with a 1 to turn on the graphics, and with a zero to turn on space compression.

Now try something offbeat: type in A=16419 and press the enter key. Then, POKE A,32. Where did the cursor go? POKE A,252 if you're not sure what you want to do; POKE A,255 if you like rockets. Next, POKE A,36 for typing in money. Notice something? That's right—16419 holds the cursor character in ASCII format.

Programming with the Two P's: Hints and Misses

When writing programs using POKES always type IF X>V1 AND X<V2 THEN POKE X,Y ELSE STOP. You can edit this line out after debugging. Always put it on the same line as your POKE, to avoid skipping over it with a GOTO.

Think of (and refer to in your programs) a position in VRAM as V1+PRINT@ position rather than, say, 16106. Unless you have the kind of a mind that thinks in ones and zeros, 16106 is unlikely to have any significance for you unless you look it up in a table somewhere. I find PRINT@ positions much easier to visualize. However, if you are the kind of person who has the whole memory map of your computer in your head, go for it with 16106! ■

Tad Kershner can be reached at 10579 Rainbow Ridge, Grass Valley, CA 95945.

Listing 2 continued

```
238:D1=46:M(0)=234:M(2)=252
1010 CLS
1020 CHASE=1:V1=15360:V2=16383
1030 PK=14400:UA=8:DA=16:LA=32:RA=64
1040 CLS:FORI=1TO15:PRINTSTRING$(64,D1);:NEXT:FORI=V2TOV2-64STEP-1
:POKEI,D1:NEXT:PPS=V1+(1024/2+RND(64)):DL=1000:MPS=V1+64
1050 FORI=1TO50:POKEV1+RND(1023),DC:NEXT:FORI=1TO200:POKEV1+RND(10
23),BC:NEXT:GOTO40
1060 IFCHASE=-1THEN190ELSECLS:PRINT@476,"CHOMP. . .":FORDELAY=1TO
2000:NEXT
1070 SC=SC*10
1080 PRINTUSING"YOUR SCORE-----#####";SC
1090 IFSC>HSTHENPRINTUSING"OLD HIGH-----#####";HS:HS=SC:PR
INTUSING"NEW HIGH-----#####";HS:PRINTSTRING$(64,191);:PRIN
TTAB(21)"NEW HIGH SCORE!!!!!!":PRINTSTRING$(64,191);:GOTO1110
1100 PRINTUSING"HIGH SCORE-----#####";HS
1110 PRINT:INPUT"PLAY AGAIN (YorN)";PA$
1120 IFPA$="Y"ORPA$="y"THENSC=0:CHASE=1:MC=M(0):GOTO1040
1130 IFPA$="N"THENEND
1140 PRINT"WHAT WAS THAT?":GOTO1110
1150 END
1160 RETURN
1170 FORDELAY=1TO750:NEXT:CLS
1180 FORI=1TO15:PRINTSTRING$(64,191);:NEXT:RETURN
1190 CLS:PRINT@476,"YUM. . .":FORDELAY=1TO2000:NEXT:SC=SC+20:CHASE
=1:MC=M(0):GOTO1040
```

```
1000 REM * POKE UTILITY PROGRAM BY TAD KERSHNER
1010 V1=15360:V2=V1+1023
1020 PK=14400:PP=V1
1030 P=PEEK(PK):IFP=0THEN1030
1040 IFPAND8THENA=-64
1050 IFPAND16THENA=64
1060 IFPAND32THENA=A-1
1070 IFPAND64THENA=A+1
1080 IFPP+A<V1ORPP+A>V2THENA=0
1090 IFA=0THEN1030
1100 POKEPP,Q:PP=PP+A:Q=PEEK(PP):POKEPP,191:PRINT@0,PP,Q;
1110 A=0:GOTO1030
```

Program Listing 3. Utility.

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TELCOM II is an expanded version of this program for the most demanding telecommunications applications. The terminal mode has a help menu and large printer spooler for high baud rates. From within the terminal mode you can load disk files into the memory buffer, type into the buffer, transmit the buffer, or view the buffer or data that has already scrolled off the screen. It has 10 different programmable messages that can each be sent with a single command for auto log-on or auto dialing, and 5 different character translation tables.

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I wrote a program that lets you do just that. FORMGEN creates camera-ready copies of documents that include both text and the special graphics character set.

A large part of FORMGEN creates a rudimentary word-processing environment in which to work, but FORMGEN is not a true word processor. It generates simple documents, limited to 60 lines of text 60 columns wide. It prints the text one page at a time. FORMGEN has few editing functions, slow keyboard response, and slow printing speed.

I designed the program to run on an Epson MX-80 with Graftrax, but it should work with any compatible printer. You can change data lines 2150-2280 and alter FORMGEN's control codes to fit your printer's requirements.

Program Operation

FORMGEN is easy to use. After about 30 seconds of initialization, the menu appears. You can load text you've previously created with FORMGEN from disk, or create new files.

When working with new text, FORMGEN lets you assign a single key to each of the special characters. You can then enter those characters into your document directly from the keyboard with a single keystroke.

The FORMGEN program displays and prints the ASCII codes for all Model III special characters and block graphics on the screen (see Fig. 1). You

decide which characters you'd like to incorporate into documents and then assign the following letter keys to the ASCII codes for those characters: B, F, K, L, N, O, P, Q, R, S, T, V, W, X, Y, and Z.

In the course of writing or editing documents, pressing control (shift/down-arrow) and one of the assigned keys prints the special character on the screen and incorporates it into your text. Like shorthand, this feature lets you handle frequently used characters easily.

FORMGEN also lets you execute often-used commands, like those for scrolling the text window or returning to the main menu, by pressing control and a single key simultaneously (see Table 1).

You can save a document to disk and later recall it without having to reassign keys to the graphics characters—FORMGEN saves the initial assignments along with your document.

Alternatively, you can call a graphics character that doesn't have a letter key assigned to it by pressing control-G. FORMGEN then prompts you for the ASCII number of the character you want to include in the text. You have to rely on your memory or refer to a printout of the special characters available. FORMGEN provides the range of allowed numbers on the screen.

When you're finished editing, return to the menu (by pressing control-M) to print or save the document. Saving text to disk forces the program to reinitialize. You must reload the text to work with it again.

FORMGEN displays the commands and keyboard conventions on the screen for reference.

The program also provides a form worksheet that rules and numbers page lines, and displays along the margin the

special characters you can print (see Fig. 2).

Program Description

Frequently used subroutines are located near the beginning of the program, and I've marked all subroutines or major program divisions with asterisks.

The menu beginning in line 1690 controls program flow. FORMGEN is set up for disk storage; you should change lines 1120-1250 for tape storage. Line 1850 clears maximum string space for a 48K machine, but you can reduce string space for a 32K system. If you run into a memory shortage, try deleting program remarks or options.

You can change the nondestructive cursor (line 1890) to any character you want. It moves in four directions with the arrow keys, and the text window scrolls accordingly. You can also block-scroll 12 lines at a time.

The screen displays 12 of the total 60 text lines at a time, along with four lines of keyboard definitions and prompts. FORMGEN displays line numbers, but does not print them. Since the program has only 60 text lines, FORMGEN works with centered text one line at a time.

FORMGEN processes special characters before inserting them into, or printing them from, an array.

When you press a key, FORMGEN tests to see if its ASCII code is in the

The Key Box

Model III
32K Disk Basic
32K Cassette Basic (with changes)
Epson MX-80 with Graftrax
TRSDOS



Keys	Function
Control-M	Return to menu
Control-U	Scroll text window up 12 lines
Control-D	Scroll text window down 12 lines
Control-E	Expand text to include a new line
Control-C	Contract text to delete current line
Control-G	Provide graphics input

Table 1. Cursor control commands.

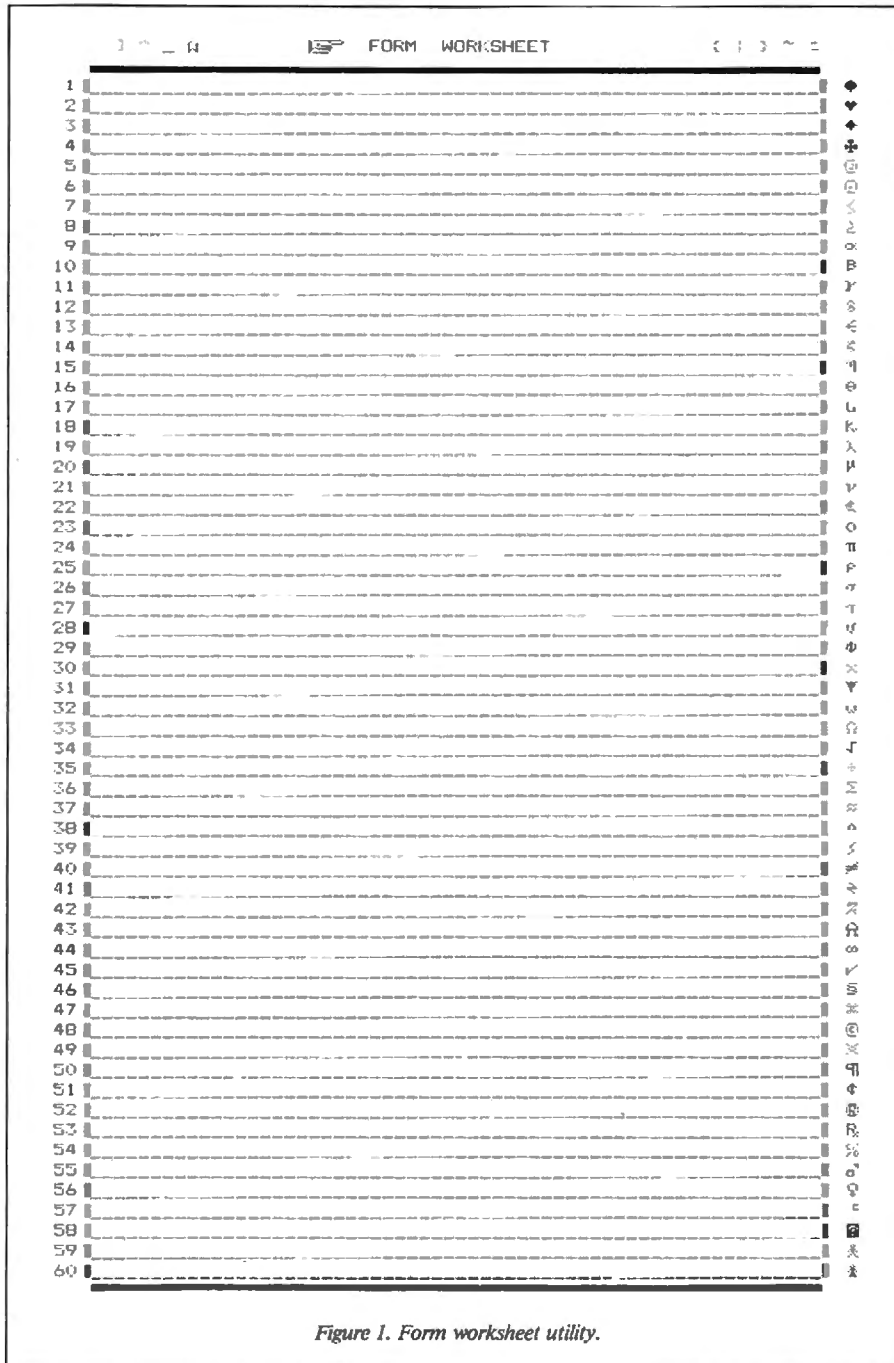


Figure 1. Form worksheet utility.

range of a normal character. If it is, the program displays the character and adds it to the appropriate string, TX\$(N).

If a character has a code number below 27, FORMGEN either processes

it as a cursor command or uses it to define a special character code. When you print the text, the reverse occurs.

FORMGEN defines special characters with a series of graphics commands that the printer reads as a dot-matrix

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pattern. Lines 2150-2280 define MX-80 characters 92-95, 127, and 192-255. Characters 123-126 are already programmed within the MX-80.

Each character defined in the data lines becomes one element of special character array SC\$(N). As you enter or

print text, the program evaluates each character, and prints either a CHR\$(N) or SC\$(N), depending on the character code value (N).

The program handles block graphics characters similarly, but their symmetrical nature makes them easier to

Variable	Function
A	Memory address of text string
CL	Column of cursor on screen
CN(N)	Numbers of some ASCII characters to be defined
CU	Cursor location on screen
CUS(0)	Current text character at cursor location
CUS(I)	Cursor character
FG	Test flag
FL	Text array element of first video text line
FL\$	File name of text
GR\$(N)	Pixel graphic blocks
LN	Current video text line of cursor
NS	String representation of graphics ASCII value
PCS	Printer code skeleton string, for special characters
PRS	Character to be LPRINTed
SC	Total number of defined keyboard characters
SC(N)	Keyboard defined character values
SC\$(N)	Special graphics characters
ST\$	Standard control codes for MX-80 graphics
TX\$(N)	Text array

Table 2. Program variables.

Control (Shift plus Down Arrow) plus 'G' opens for Graphics input

Graphics Symbols															
128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
Non-Graphics Symbols															
92	93	94	95	123	124	125	126	127							
192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

Figure 2. Special character reference guide.



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define. Lines 1390-1440 advance the printer paper a fraction of a line and overstrike to print the bottom third of each graphics block.

Whenever possible, FORMGEN POKEs characters into a string variable instead of concatenating them. This reduces the inevitable garbage-collection shut-down during string manipulation.

The program deactivates the break key on initialization to prevent an accidental control-A from stopping the program. You should set aside the CMD B, OFF command in line 1830 until you debug the program, since losing the break key during debugging is a nuisance.

I used an apostrophe in line 1830 to treat the deactivation command as a comment. Delete the apostrophe when you're ready to run the program.

FORMGEN doesn't support special

characters zero to 31 or Japanese characters (see page C/7 in the Model III manual).

Program comments and the variable notation in Table 2 should answer any remaining questions about program logic.

Problem Solving

Don't panic if you lose special characters when jumping back and forth between menu options. Remove your disks and shut the machine off. Wait a moment and turn the computer back on—the missing characters should reappear.

One last warning: FORMGEN's error-trapping is minimal. Try to avoid typing mistakes. ■

Contact Glenn Parkinson at 605 Manor Road, Severna Park, MD 21146.

Program Listing, FORMGEN.

```
10 'FORMGEN      WRITTEN BY GLENN PARKINSON  ***
20 GOTO 1830 : 'INITIALIZING AT END OF PROGRAM AND LOCATING FREQUENT
LY CALLED SUBROUTINES EARLY SPEED EXECUTION
30 'CALCULATE CURSOR POSITION  ***
40 IFLN>0GOTO60
50 LN=1:IFFL=1THENRETURN ELSE X=1:GOSUB190  :RETURN
60 IFLN<13GOTO80
70 LN=12:IFFL=49THENRETURN ELSE X=1:GOSUB210  :RETURN
80 IFCL<1GOTO130 ELSE IFCL<61GOTO170
90 LN=LN+1:IFLN<13GOTO110
100 IFFL=49THENLN=12:CL=60:RETURN
110 CL=1:GOSUB40  :RETURN
120 IFLN>FL+12THENFL=FL+1:GOSUB290  :LN=LN-1:CL=1:GOTO170 ELSE GOT
O170
130 LN=LN-1:IFLN>0GOTO150
140 IFFL=1THENLN=1:CL=1:RETURN ELSE X=1:GOSUB190  :RETURN
150 CL=60:GOSUB40  :RETURN
160 IFLN<FLTHENFL=FL-1:GOSUB290  :LN=LN-1:CL=1
170 P=LN+FL-1:GOSUB230  :CU$(0)=CHR$(PEEK(A+CL-1)):CU=(LN-1)*64+CL+
3:RETURN
180 'SCROLL UP X LINES  ***
190 FL=FL-X:P=FL+LN-1:GOSUB230  :CU$(0)=CHR$(PEEK(A+CL-1)):GOSUB29
0  :RETURN
200 'SCROLL DOWN X LINES  ***
210 FL=FL+X:P=FL+LN-1:GOSUB230  :CU$(0)=CHR$(PEEK(A+CL-1)):GOSUB290
:RETURN
220 'LOCATE STRING TX$(P) IN MEMORY  ***
230 A1=VARPTR(TX$(P)):IFA1>32767THENA1=-1*(65536-A1)
240 A=PEEK(A1+1)+256*PEEK(A1+2):IFA>32767THENA=-1*(65536-A)
250 RETURN
260 'INSERT CHARACTER INTO TEXT STRING  ***
270 P=LN+FL-1:GOSUB230  :POKEA-1+CL,R:RETURN
280 'DISPLAY 12 LINE TEXT WINDOW  ***
290 FORI=0TO11:IFFL+I<10THENN$=STR$(FL+I)ELSEN$=RIGHT$(STR$(FL+I),2
)
300 PRINT@64*I,N$,CHR$(170);:PRINT@64*I+4, TX$(FL+I);
310 NEXT:RETURN
320 'INPUT CHARACTER SELECTION FROM KEYBOARD  ***
330 N$="":IFR<>7THENPRINT@980,"Type in your selection";
340 R$=INKEY$:IFR$=""GOTO340
350 IFASC(R$)<48ORASC(R$)>57GOTO340
360 IFLEN(N$)>0GOTO380
370 IFR$<>"1"ANDR$<>"2"THENN$="09":GOTO340
380 N$=N$+RIGHT$(R$,1):IFLEN(N$)<3GOTO340
390 N=VAL(N$):RETURN
400 'DISPLAY SPECIAL CHARACTERS ON SCREEN  ***
410 PRINT@782,"Control (Shift and Down Arrow) plus...";
420 PRINT@836,"M=Menu U=Up D=Down E=Expand C=Contract G=Graphi
cs";
430 FORI=1TOSC
440 IFI=1ORI=13ORI=21ORI=40RI=50RI=30RI=90RI=80RI=100RI=7GOTO460
```

Listing continued


```

450 PRINT@896+4*(I-1),CHR$(I+64); "=";CHR$(SC(I));
460 NEXT:RETURN
470 'CREATE A NEW FORM ***
480 SC=SC+1:IFSC=27GOTO810
490 IFSC=10RSC=13ORSC=21ORSC=40RSC=50RSC=30RSC=90RSC=80RSC=100RSC=
GOTO480
500 CLS:PRINT@82,"DEFINE SPECIAL CHARACTERS";
510 PRINT@213,"Special Character ";CHR$(SC+64);
520 PRINT@402,"1. Non-keyboard character";
530 PRINT@466,"2. Graphics character";
540 PRINT@530,"3. No more characters";
550 PRINT@662,"Choose one (1-3)";
560 R$=INKEY$:IFR$=""GOTO560
570 IFASC(R$)<49ORASC(R$)>51GOTO560
580 ONVAL(R$)GOTO600 ,730 ,810
590 'SELECTING A SPECIAL NON-KEYBOARD CHARACTER ***
600 CLS:FORI=1TO9:PRINT@2+6*I,CHR$(CN(I));:PRINT@64+6*I,CN(I);:NEXT
610 FORI=1TO4
620 FORX=1TO16:N=16*(I-1)+X+191
630 PRINT@(-1+I)*192+4*(X-1)+193,CHR$(N);
640 PRINT@(-1+I)*192+4*(X-1)+256,RIGHT$(STR$(N),3);
650 NEXT
660 NEXT
670 GOSUB330 :IFN>191ANDN<256GOTO710
680 FG=0:FORI=1TO9:IFN<>CN(I)GOTO700
690 I=9:FG=1
700 NEXT:IFFG=0GOTO500
710 SC(SC)=N:GOTO480
720 'SELECTING A GRAPHICS CHARACTER ***
730 CLS:FORI=1TO4
740 FORX=1TO16:N=16*(I-1)+X+127
750 PRINT@(-1+I)*192+4*(X-1)+1,CHR$(N);
760 PRINT@(-1+I)*192+4*(X-1)+64,RIGHT$(STR$(N),3);
770 NEXT
780 NEXT
790 GOSUB330 :IFN<128ORN>191GOTO500
800 SC(SC)=N:GOTO480
810 SC=SC-1
820 'INITIAL SET-UP ***
830 FL=1:LN=1:CL=1:CLS:GOSUB290 :GOSUB410 :GOSUB40
840 'CURSOR INPUT ***
850 PRINT@CU,CU$(CC);
860 R$=INKEY$:IFR$=""THENCC=ABS(CC-1):PRINT@CU,CU$(CC);:GOTO860
870 R=ASC(R$):IFR<>91GOTO890
880 PRINT@CU,CU$(R);:LN=LN+1:GOSUB40 :GOTO850
890 IFR>31GOTO1090
900 ON R GOTO 850 ,1080 ,1010 ,960 ,980 ,1080 ,1040 ,940 ,930
,950 ,1080 ,1080 ,1690 ,1080 ,1080 ,1080 ,1080 ,1080 ,1080 ,1080 ,1080
0 ,1080 ,910 ,1080 ,1080 ,1080 ,1080 ,1080 ,1080 ,1080 ,1080 ,1080 ,10
80 ,1080 :'FILTER INPUT FOR CURSOR CONTROL
910 IFFL>=12THENX=12ELSEX=FL-1:'R=21
920 GOSUB190 :GOTO850
930 PRINT@CU,CU$(R);:CL=CL+1:GOSUB40 :GOTO850 :'R=9
940 PRINT@CH,CU$(R);:CL=CL-1:GOSUB40 :GOTO850 :'R=8
950 PRINT@CU,CU$(R);:LN=LN+1:GOSUB40 :GOTO850 :'R=10
960 IFFL<=36THENX=12ELSEX=48-FL+1:'R=4
970 GOSUB210 :GOTO850
980 P=FL+LN-1:FORI=60TOP+1STEP-1:'R=5
990 TX$(I)=TX$(I-1)
1000 NEXT:TX$(P)=BL$:CU$(0)=" ":GOSUB290 :GOTO850
1010 P=FL+LN-1:FORI=PTO59:'R=3
1020 TX$(I)=TX$(I+1)
1030 NEXT:TX$(60)=BL$:GOSUB40 :GOSUB290 :GOTO850
1040 GOSUB330 :IF(N<92ORN>255)GOTO850 :'R=7
1050 IFN>127THENR=N:GOTO1090
1060 FG=0:FORI=1TO9:IFN=CN(I)THENFG=1
1070 NEXT:IFFG=0GOTO850 ELSER=N:GOTO1090
1080 R=SC(R):'CHANGE TO SPECIAL CHARACTER
1090 PRINT@CU,CHR$(R);:GOSUB270
1100 CL=CL+1:GOSUB40 :GOTO850
1110 'SAVE FILE TO DISK ***
1120 CLS:PRINT"Insert destination disk, then press <ENTER>":GOSUB12
60
1130 CMD"D:0":PRINT:PRINT:POKE16409,1:INPUT"what is the name of the
file to be saved";FL$:POKE16409,0:'INPUT IN ALL CAPS
1140 FORI=1TO60:TX$(I)=CHR$(34)+TX$(I)+CHR$(34):NEXT:'ENCLOSE TEXT
IN QUOTES TO SAVE TO DISK
1150 OPEN"O",1,FL$
1160 FORI=1TO60:PRINT#1,TX$(I):NEXT
1170 PRINT#1,SC:FORI=1TOSC:PRINT#1,SC(I):NEXT
1180 CLOSE:CLS:PRINT"Insert program disk, then press <ENTER>":GOSUB
1260 :CLS:PRINT@409,"Re-initializing...":GOTO2290
1190 'LOAD FILE FROM DISK ***
1200 CLS:PRINT"Insert source disk, then press <ENTER>":GOSUB1260
1210 CMD"D:0":PRINT:PRINT:POKE16409,1:INPUT"what is the name of the
file you wish to load";FL$:POKE16409,0:'INPUT IN ALL CAPS
1220 OPEN"I",1,FL$

```

Listing continued

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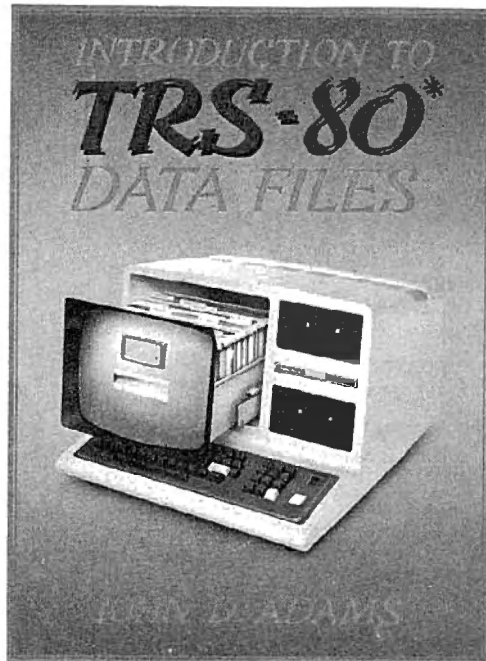
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```
1230 FORI=1TO60:INPUT#1, TX$(I):NEXT
1240 INPUT#1, SC:FORI=1TOSC:INPUT#1, SC(I):NEXT
1250 CLOSE:CLS:PRINT"Insert program disk, then press <ENTER>":GOSUB
1260 :GOTO1690
1260 R$=INKEY$:IFR$<>CHR$(13)GOTO1260 ELSERETURN
1270 'END SEQUENCE ***
1280 CLS:PRINT:PRINT:PRINTTAB(9);"Be sure printer is off, then pres
s <ENTER> to end."
1290 GOSUB1260 :PRINTCHR$(21);:POKE 16409,1:CMD"B", "ON":END:'SWITCH
OUT ALTERNATE CHARACTERS, GET UPPER CASE ONLY, ACTIVATE BREAK KEY
1300 'PRINT A FORM ON MX-80 ***
1310 LPRINTCHR$(27);"U";CHR$(1);:LPRINTCHR$(27);"E";:'UNIDIRECTIONA
L AND EMPHASIZED PRINTING
1320 GOSUB 1330 :GOTO1340
1330 CLS:PRINT:PRINT:PRINTTAB(6);"Be sure printer is on, then press
<ENTER> to continue.":GOSUB1260 :CLS:PRINT:PRINT:PRINTTAB(26);"Pri
nting....":RETURN
1340 FORI=1TO3:LPRINT:NEXT
1350 FORI=1TO60:P=I:GOSUB230 :LPRINTTAB(10);
1360 FORX=1TO60:'EVALUATE EACH CHARACTER IN TEXT STRING
1370 PR=PEEK(A+X-1):IFPR<127THENPR$=CHR$(PR) ELSE PR$=SC$(PR)
1380 LPRINTPR$;
1390 NEXT:LPRINTCHR$(27);"A";CHR$(136):LPRINTTAB(10);:'ADVANCE 8/7
2 INCH
1400 FORX=1TO60:'PRINT BOTTOM THIRD OF GRAPHICS BLOCKS
1410 PR=PEEK(A+X-1):IF(PR<128ORPR>191)THENPR$=" " ELSE PR$=SC$(PR
+128)
1420 LPRINTPR$;
1430 NEXT:LPRINTCHR$(27);"A";CHR$(132):LPRINTTAB(10);:'ADVANCE 4/7
2 INCH
1440 NEXT:LPRINTCHR$(27);"2";:'REESTABLISH NORMAL PRINT ADVANCE
1450 FORI=1TO3:LPRINT:NEXT:LPRINTCHR$(27);"@";:LPRINTCHR$(27);"U";C
HR$(0);:GOTO1690:'REESTABLISH REGULAR PRINT FUNCTIONS
1460 'PRINT A FORM WORKSHEET ***
1470 GOSUB1330 :LPRINTCHR$(27);"E";:LPRINTTAB(10);SC$(92);" ";SC$(93
);" ";SC$(94);" ";SC$(95);" ";SC$(255);" ";SC$(244);SC$(245
);SC$(246);" FORM WORKSHEET";" ";CHR$(123);" ";CHR$(1
24);" ";CHR$(125);" ";CHR$(126);" ";SC$(127)
1480 LPRINTTAB(10);:FORX=1TO60:LPRINTSC$(140);:NEXT:LPRINT
1490 FORI=1TO60:IFI<53THENS=C+I+191ELSESC=C+I+194
1500 LPRINTTAB(6);STRING$(3-LEN(STR$(I))," ");STR$(I);SC$(170);STR
ING$(60,95);SC$(149);" ";SC$(SC);:LPRINT
1510 NEXT:LPRINTTAB(10);:FORX=1TO60:LPRINTSC$(131);:NEXT:LPRINT:LPR
INTCHR$(27);"@";:LPRINT:LPRINT:GOTO1690
1520 'PRINT A REFERENCE SHEET
1530 GOSUB1330 :LPRINTCHR$(27);"E":FORX=1TO4:LPRINT:NEXT
1540 LPRINTTAB(24);"SPECIAL CHARACTER REFERENCE GUIDE":LPRINT:LPRIN
TTAB(8);"Control (Shift plus Down Arrow) plus 'G' opens for Graphic
s input":FORX=1TO4:LPRINT:NEXT
1550 LPRINTTAB(32);"Graphics Symbols":LPRINT
1560 FORI=128TO176STEP16
1570 LPRINTCHR$(27);"A";CHR$(136);" ";:FORX=ITOI+15:LPRINT
SC$(X);" ";:NEXT:LPRINT
1580 LPRINTCHR$(27);"A";CHR$(132);" ";:FORX=I+128TOI+143:L
PRINTSC$(X);" ";:NEXT:LPRINT
1590 LPRINTCHR$(27);"2";:LPRINT:LPRINTTAB(8);:FORX=ITOI+15:LPRINTR
IGHT$(STR$(X),3);" ";:NEXT:LPRINT:LPRINT
1600 NEXT:FORX=1TO4:LPRINT:NEXT
1610 LPRINTTAB(30);"Non-Graphics Symbols":LPRINT
1620 LPRINTTAB(23);:FORX=92TO95:LPRINTSC$(X);" ";:NEXT:FORX=123T
O126:LPRINTCHR$(X);" ";:NEXT:LPRINTSC$(127):LPRINT
```

```
1630 LPRINTTAB(22);:FORX=92TO95:LPRINTRIGHT$(STR$(X),2);" ";:NEXT:
FORX=123TO126:LPRINTRIGHT$(STR$(X),3);" ";:NEXT:LPRINT"127":LPRINT
1640 FORI=192TO255STEP16
1650 LPRINTTAB(9);:FORX=ITOI+15:LPRINTSC$(X);" ";:NEXT:LPRINT
1660 LPRINTTAB(8);:FORX=ITOI+15:LPRINTRIGHT$(STR$(X),3);" ";:NEXT:
LPRINT:LPRINT
1670 NEXT:LPRINTCHR$(27);"F";:LPRINTCHR$(27);CHR$(140);
1680 'MENU ***
1690 CLS:PRINTTAB(27);"FORM WRITER":PRINT:PRINT
1700 PRINTTAB(22);"1. Create a new form"
1710 PRINTTAB(22);"2. Load a form from disk"
1720 PRINTTAB(22);"3. Edit form"
1730 PRINTTAB(22);"4. Save form to disk"
1740 PRINTTAB(22);"5. Print form"
1750 PRINTTAB(22);"6. Print form worksheet"
1760 PRINTTAB(22);"7. Print reference sheet"
1770 PRINTTAB(22);"8. End program":PRINT:PRINT
1780 PRINTTAB(23);"Choose one (1 to 8)"
1790 R$=INKEY$:IFR$=" "GOTO1790
1800 IFASC(R$)<49ORASC(R$)>56GOTO1790
1810 ONVAL(R$)GOTO 480 , 1200 , 830 , 1120 , 1310 , 1470 , 1530 , 1280
1820 'INITIALIZATION ***
1830 CLS:POKE 16409,0:LPRINTCHR$(21);"CMD"B", "OFF":'GET UPPER/LOWER
CASE, ACTIVATE ALTERNATE CHARACTERS, DEACTIVATE BREAK KEY
1840 PRINT@410,"Initializing..."
1850 CLEAR 24000:DEFINTB-2:DEFNSGA:'CLEAR 8000 FOR 32K
1860 I=1:X=1:LN=1:CL=1:N=1:FL=1:FG=0:TX=1:SC=1:N=1:A=0:AI=0:CC=0:PR
=0:PS=1:SC=0:C=0:D=0:'DEFINING VARIABLES EARLY SPEEDS EXECUTION
1870 R$="":N$="":TX$="":N$="":PR$="
1880 DIM TX$(60),CN(9),SC(32),CU$(1),GR$(3),SC$(320)
1890 CU$(0)=" ":CU$(1)=CHR$(95):'CU$(1)=CURSOR, MAY BE ANY CHARACTER
1900 FORI=1TO9:READCN(I):NEXT
1910 DATA92,93,94,95,123,124,125,126,127
1920 FORI=1TO26:SC(I)=0:NEXT
1930 ST$=CHR$(27)+CHR$(76)+CHR$(6)+CHR$(8):'SET UP FOR MX-80 GRAPHI
CS MODE
1940 GR$(0)=STRING$(6,0):GR$(1)=STRING$(6,240):GR$(2)=STRING$(6,15)
:GR$(3)=STRING$(6,255) :'PATTERNS FOR TOP TWO THIRDS OF TRS-80 GRA
PHICS BLOCKS
1950 FORI=128TO143:'CREATE SPECIAL CHARACTERS FOR TRS-80 GRAPHICS B
LOCKS
1960 READC:READ:SC$(I)=ST$+GR$(C)+ST$+GR$(D)
1970 SC$(I+16)=SC$(I):SC$(I+32)=SC$(I):SC$(I+48)=SC$(I)
1980 NEXT
1990 FORI=256TO271:SC$(I)=ST$+GR$(0)+ST$+GR$(0):NEXT:'TRS-80 GRAPHIC
S BLOCKS REQUIRE ADDITIONAL SPECIAL CHARACTERS FOR THE BOTTOM THIRD
2000 FORI=272TO287:SC$(I)=ST$+GR$(1)+ST$+GR$(0):NEXT
2010 FORI=288TO303:SC$(I)=ST$+GR$(0)+ST$+GR$(1):NEXT
2020 FORI=304TO319:SC$(I)=ST$+GR$(1)+ST$+GR$(1):NEXT
2030 PC$=ST$+STRING$(6,32)+ST$+STRING$(6,32):'SKELETON STRING FOR S
PECIAL CHARACTERS
2040 FORI=92TO95:SC$(I)=PC$:GOSUB2080 :NEXT
2050 I=127:SC$(I)=PC$:GOSUB2080 :'CHARACTERS 123-126 ALREADY ARE IN
MX-80
2060 FORI=192TO255:SC$(I)=PC$:GOSUB2080 :NEXT
2070 GOTO2290
2080 AI=VARPTR(SC$(I)):IFAI>32767THENA1=-1*(65536-AI)
2090 A=PEEK(AI+1)+256*PEEK(AI+2):IFA>32767THENA=-1*(65536-A)
```

Listing continued

Listing continued

```

2100 FORK=1TO20:'DATA IS POKED INTO SKELETON STRINGS TO COMPLETE NO
N-GRAPHIC BLOCK SPECIAL CHARACTERS
2110 IFX=1ORX=11THENX=X+3:GOTO2130
2120 READC:POKEA+X-1,C
2130 NEXT:RETURN
2140 DATA 0,0, 1,0, 0,1, 1,1, 2,0, 3,0, 2,1, 3,1, 0,2, 1,2,
0,3, 1,3, 2,2, 3,2, 2,3, 3,3 :'TOP 2 GRAPHICS ROWS
2150 DATA 0,0,128,64,32,16,8,4,2,0,0,0, 0,0,0,130,130,130,130,25
4,0,0,0, 0,32,32,64,64,128,128,64,64,32,32,0, 1,1,1,1,1,1,1,1,1,1,
1,1 : '92 TO 95
2160 DATA 0,0,0,68,68,68,228,68,68,68,0,0 : '127
2170 DATA 24,56,60,124,124,255,255,124,124,60,56,24, 48,48,120,120
,124,62,62,124,120,120,48,48, 16,16,56,56,124,254,254,124,56,56,16
,16, 28,28,28,201,201,255,255,201,201,28,28,28, 60,66,129,137,165
,133,133,165,137,129,66,60 : '192 TO 196
2180 DATA 60,66,129,133,169,137,137,169,133,129,66,60, 0,0,17,17,4
1,41,69,69,131,131,0,0, 0,0,131,131,69,69,41,41,17,17,0,0, 24,24,
36,36,36,36,36,24,24,24,36,36, 0,1,254,254,164,164,164,164,164,88,
88,0 : '197 TO 201
2190 DATA 128,134,134,126,126,16,16,32,32,64,64,128, 0,0,100,100,1
54,154,146,146,76,76,0,0, 0,16,16,56,56,84,84,146,146,146,146,0,
0,0,152,152,42,42,202,202,196,196,0,0, 0,64,64,128,128,112,112,128
,128,254,254,0 : '202 TO 206
2200 DATA 0,56,56,84,84,146,146,84,84,56,56,0, 0,0,124,126,2,2,2,2
,14,14,0,0, 0,254,254,16,40,40,68,68,2,2,4,4, 0,2,130,132,120,120
,8,8,4,2,2,0, 0,0,254,254,8,8,8,240,240,8,8,0, 0,32,32,62,62,4,4,
8,8,48,48,0 : '207 TO 212
2210 DATA 0,40,40,84,84,213,213,69,69,2,2,0, 0,24,60,36,66,66,66,6
6,36,60,24,0, 0,32,64,64,126,126,64,64,126,126,64,0, 0,0,62,62,72
,72,72,72,48,48,0,0, 0,24,24,36,36,36,56,56,32,32,0, 0,16,16,3
2,32,32,62,62,32,32,0 : '213 TO 218
2220 DATA 0,32,60,60,2,2,2,60,60,64,64,0, 0,56,56,68,68,254,254,68
,68,56,56,0, 0,32,34,34,20,20,8,20,20,34,34,2, 128,128,96,112,16,
254,254,16,112,96,128,128, 0,28,28,34,2,4,4,2,34,28,28,0, 0,58,74
,78,128,128,128,128,78,74,58,0 : '219 TO 224
2230 DATA 0,8,8,4,4,254,254,128,128,128,128,0, 0,0,16,16,16,84,84,
16,16,16,0,0, 0,130,198,198,170,170,146,146,146,130,0, 0,36,3
6,72,72,72,36,36,36,72,72,0, 0,8,24,56,40,72,72,40,56,24,0,0, 0,0
,1,1,50,50,76,76,128,128,0,0 : '225 TO 230
2240 DATA 42,42,44,44,40,56,56,40,104,104,168,168, 0,16,16,152,152
,84,84,50,50,16,16,0, 2,66,164,164,200,136,144,164,170,202,196,128
, 57,57,79,79,136,136,136,136,79,79,57,57, 24,24,36,36,36,24,24,3
6,36,36,24,24 : '231 TO 235
2250 DATA 30,30,4,4,8,8,16,16,32,32,64,64, 0,82,82,170,170,170,170
,170,170,148,148,0, 68,68,170,170,84,40,40,84,170,68,68, 60,6
6,129,153,189,165,165,165,129,129,66,60, 130,130,84,84,40,40,40,40
,84,84,130,130 : '236 TO 240
2260 DATA 112,240,144,144,144,144,255,255,128,128,255,255, 0,56,56
,68,68,254,254,68,68,40,40,0, 60,66,129,255,201,201,201,207,179,12
9,66,60, 255,255,126,126,133,133,137,137,181,181,165,165, 149,149
,149,149,149,149,214,214,168,168 : '241 TO 245
2270 DATA 160,160,160,160,160,160,160,160,64,64,0, 0,254,254,1
44,144,144,157,157,98,98,5,5, 97,145,146,150,4,8,16,38,15,73,137,1
34, 6,15,9,9,9,9,15,158,160,192,192,224, 0,112,112,138,138,143,14
3,138,138,112,112,0 : '246 TO 250
2280 DATA 0,0,0,0,0,240,144,144,144,144, 255,255,223,223,191
,165,165,175,175,223,223,255, 0,9,9,82,82,188,188,82,82,9,9,0, 0,8
,9,83,87,191,191,87,83,9,8,0, 0,63,63,66,66,132,132,66,66,63,63,0
:'251 TO 255
2290 BLS=STRING$(60,32):FORI=1TO60:TX$(I)=BLS:NEXT:'RESERVE SPACE F
OR TEXT
2300 GOTO1690

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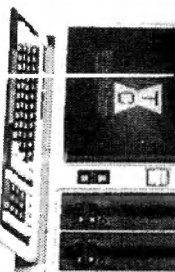
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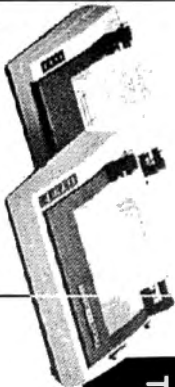
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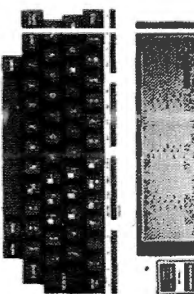
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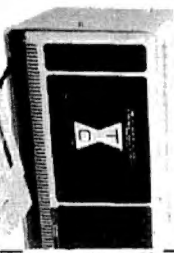


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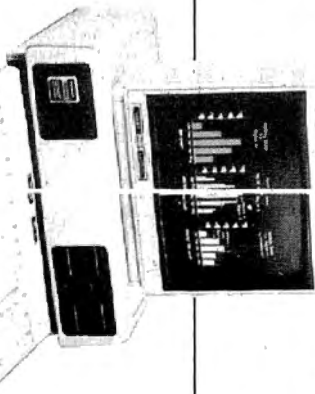


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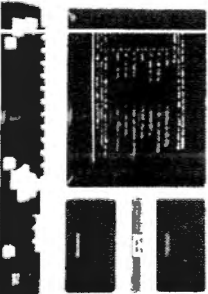
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MODEL 4



The Forgotten Interface

Use your Model III's input/output bus as an analog-to-digital converter.

Turn your Model III upside down and you'll see some familiar ports—the parallel printer output, the RS-232C serial port, and (around the corner) the

cassette port. Hardware hackers offer dozens of ways to interface peripherals to your Model III through these outlets. Yet strangely enough, they've ignored

that port in the middle, the built-in parallel input/output (I/O) bus.

I built an interface to take advantage of this bus. It incorporates 8-bit I/O ports along with digital-to-analog and analog-to-digital converters. You can use this interface to connect variable-voltage devices to your computer, such as a joystick that lets you draw on the screen.

I've included a program to test and troubleshoot the interface. Other programs measure the voltages at two voltage comparator inputs.

I/O Pin Description

The I/O bus is part of the main CPU board accessible through a 50-pin edge connector on the bottom of the Model III. According to the Model III manual, the I/O bus lets you easily and conveniently interface I/O devices to the Model III. The I/O bus supports all signals necessary to implement devices compatible with the Z80's I/O structure. For pin assignment, refer to Fig. 1.

Odd pins 1-15 transfer data bits zero to 7 to and from the processor when you enable the I/O bus properly.

Odd pins 17-31 are the address lines zero to 7, which let you select up to 256 input and output devices. Pin 33 is the IN* signal, indicating that input is in progress.

Pin 35 is the Out* signal, signifying output. Pin 37 is the system reset signal

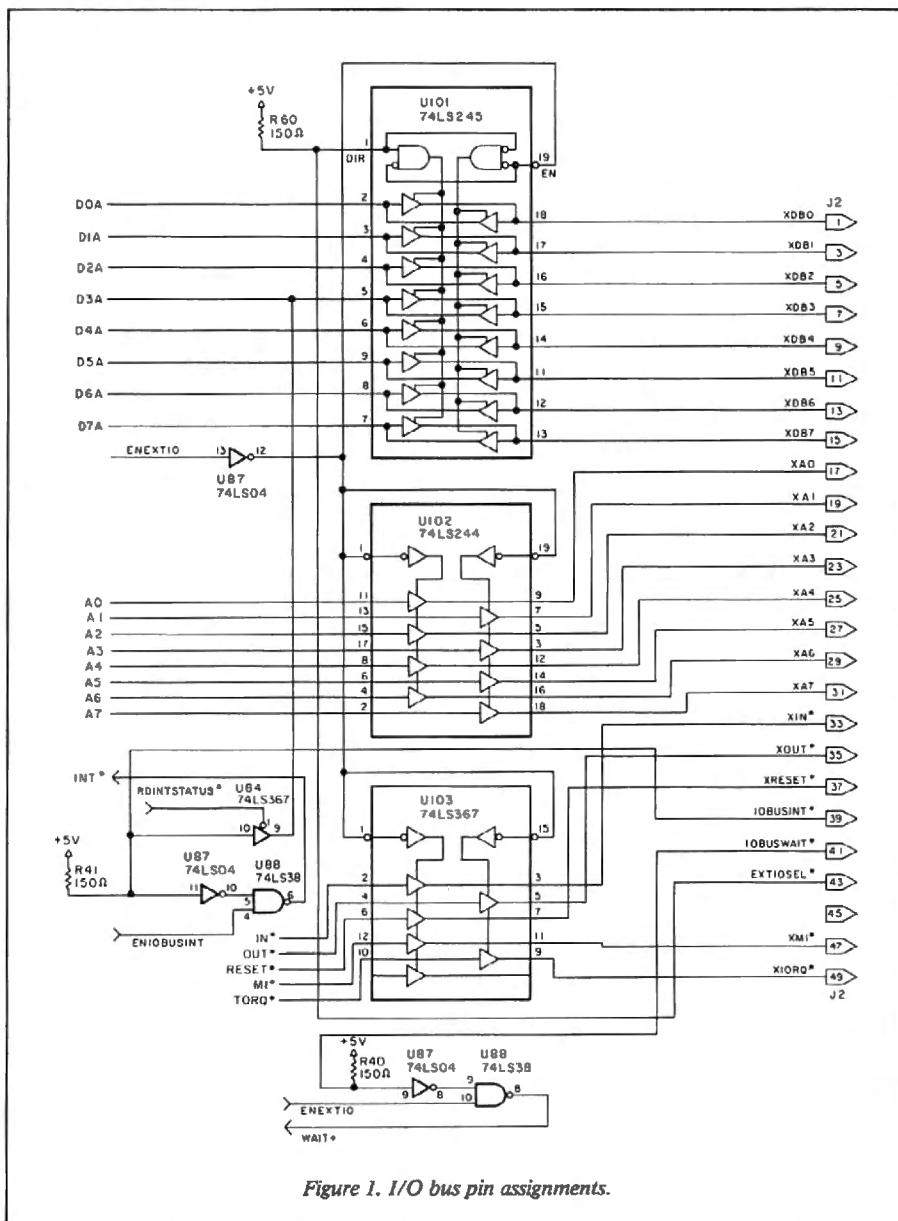


Figure 1. I/O bus pin assignments.

The Key Box

- Model III
- 16K RAM Cassette Basic
- 32K RAM Disk Basic
- Assembly Language
- Editor/Assembler

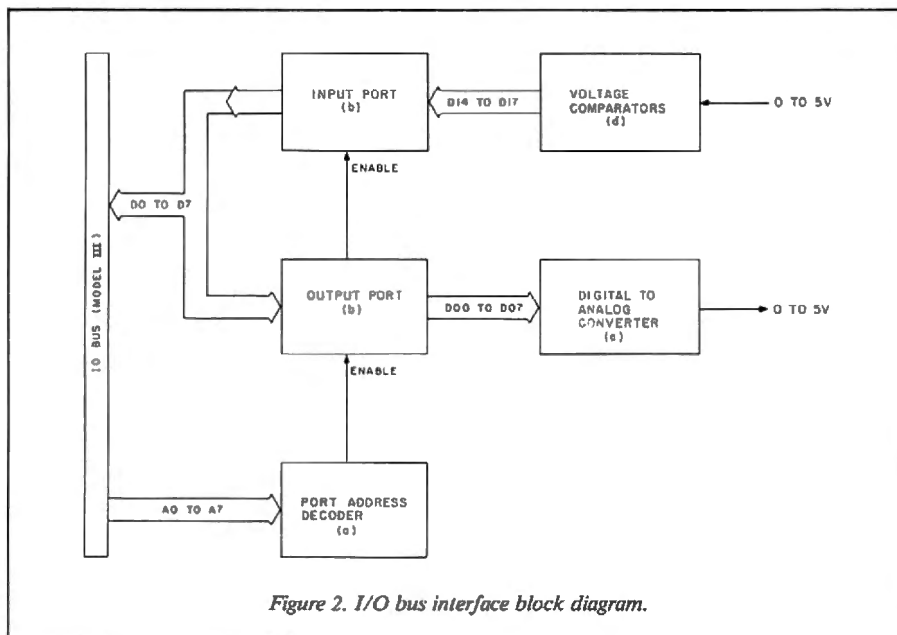


Figure 2. I/O bus interface block diagram.

Reset*, and pin 39 is the IOBUSINT*, signaling an interrupt from an I/O device.

Pin 41 is the IOBUSWAIT* input to the CPU wait line letting I/O devices force a wait state on the CPU. Pin 43 is the EXTIOSEL* input, which switches the I/O bus transceiver to allow input to the data lines of the I/O bus.

Pin 45 isn't used, and pins 47 and 49 are M1* and IORQ* standard Z80 signals, respectively. All even-numbered pins connect to ground.

Using the I/O Bus

The Model III CPU board is fully protected from external I/O devices. All the signals from the I/O bus are buffered and software control enables or disables them.

To use I/O devices with the I/O bus, you must meet certain requirements. First, enable the I/O bus by writing to port 0EC hexadecimal (hex) with bit 4 (OUT 236,16 in Basic). Second, to input data from an I/O device, switch the I/O bus data transceivers to receive by setting EXTIOSEL* low.

I/O Bus Interface

Figure 2 depicts the I/O bus interface. The interface has four sections: the port address decoder, the 8-bit input and output buffers and latches, the digital-to-analog converter, and the analog voltage comparators.

For a detailed schematic of these sections see Fig. 3. IC1 and IC2 decode port addresses 70-7F hex (112-127 decimal). Table 1 shows the positions the DIP switch, SW1, uses to select 16 port addresses.

The 8-bit buffer and latch IC3 estab-

lishes the output port. DS2 high enables the port at the selection of the proper port address, and Out* low pulls DS1 to low from the I/O bus during outputs.

In the same manner, IC4 connects as an input port, DS2 holds high at the proper address selection, and IN* low pulls DS1 low from the I/O bus during inputs. To input data, the I/O bus transceivers must be in the receive state. To accomplish this, IC5 ORs the IN* low and the port-enabled low to generate EXTIOSEL* low.

The digital-to-analog converter (DAC) consists of IC6, an 8-bit DAC. The 8 bits of the IC3 output buffer latch generate an analog voltage of zero to 5 volts at pin 2 of IC6. This voltage is available in 256 equal steps; each step represents approximately 20 millivolts.

Software with a voltage comparator feedback loop essentially produces the analog-to-digital converters. IC7 is a quad voltage comparator whose four outputs connect directly to bits 4-7 of the IC4 input buffer latch.

For experimental purposes, I connected a joystick to two of the voltage comparator inputs. You can use any other variable voltage source between zero and 5 volts, such as photocells, thermocouples, or photoresistors.

Construction

Depending on your application, you can choose to build part of this interface or expand on my design. In any case, you build the project as four components: the port address decoding circuits, output and/or input ports, the DAC, and the voltage comparators. You should test each construction step before proceeding to the next.

For this project, I use a hybrid technique of wire wrapping most circuits and leaving a section for breadboard experimentation (see the Photo). This technique makes error correction and modification simple, and allows plenty of space for expansion. As a matter of fact, I used the breadboard section while designing the DAC and the voltage comparator circuits.

You can choose a different construction technique since component layout isn't critical. Table 2 is a parts list. The Model III and the interface board connect through a 50-pin ribbon cable, fitted at both ends with a suitable card-edge connector (see Fig. 4).

The project requires three different voltages, +5 volts, +9 volts, and -9 volts. The output of a battery eliminator supplies the +9 volts required for the voltage comparators. The same +9 volts fed to IC8 (a +5V voltage regulator) supplies the +5 volts that most ICs use, and a 9V transistor battery supplies the -9 volts that the DAC requires.

Testing and Adjustment

With the computer and interface off, connect the interface to the computer by means of the 50-pin ribbon connector. You'll find the I/O bus edge connector for the Model III at the bottom center, toward the back of the computer. Make sure you properly orient the connectors.

Then turn on the computer. The usual prompts should appear. If they don't, turn off the computer at once and recheck connectors, cable, and interface. Note that this is unlikely to happen since the I/O bus isn't "alive"

SW1, switch position	Selected port address	
a b c d e f g h	(decimal)	(hex)
c o c o c o c o	112	70
o c c o c o c o	113	71
c o o c c o c o	114	72
o c o c c o c o	115	73
c o c o o c c o	116	74
o c c o o c c o	117	75
c o o c o c c o	118	76
o c o c o c c o	119	77
c o c o c o o c	120	78
o c c o c o o c	121	79
c o o c c o o c	122	7A
o c c o c o o c	123	7B
c o c o o c o c	124	7C
o c c o o c o c	125	7D
c o o c o c o c	126	7E
o c o c o c o c	127	7F

c = closed
o = open

Table 1. DIP-switch positions.

unless selected by an OUT236,16 command.

Power up the interface. Check to ensure that the computer behaves normally. At this stage testing proceeds in steps. Program Listing 1 takes you through a step-by-step approach. You'll need a voltmeter with a zero to 5 dc volts range.

Applications

Program Listing 2 reads the voltage at the inputs of TPAIN 3 and TPAIN 4. Program Listing 3 expands on this program and lets you use a joystick to draw on the video screen. Program Listing 4 is the machine-language version of Listing 3. These programs convert analog signals to digital signals.

Once you enable the I/O bus by writing 16 decimal into port 236, it generates a voltage sequence at the DAC output. The proper byte output to port 112 (for my port configuration) produces this voltage.

The program compares this voltage to that applied at TPAIN 3 or TPAIN 4. Based on the status of the comparison, established by feedback through reading bit 6 or 7 of port 112, the program alters the DAC voltage sequence.

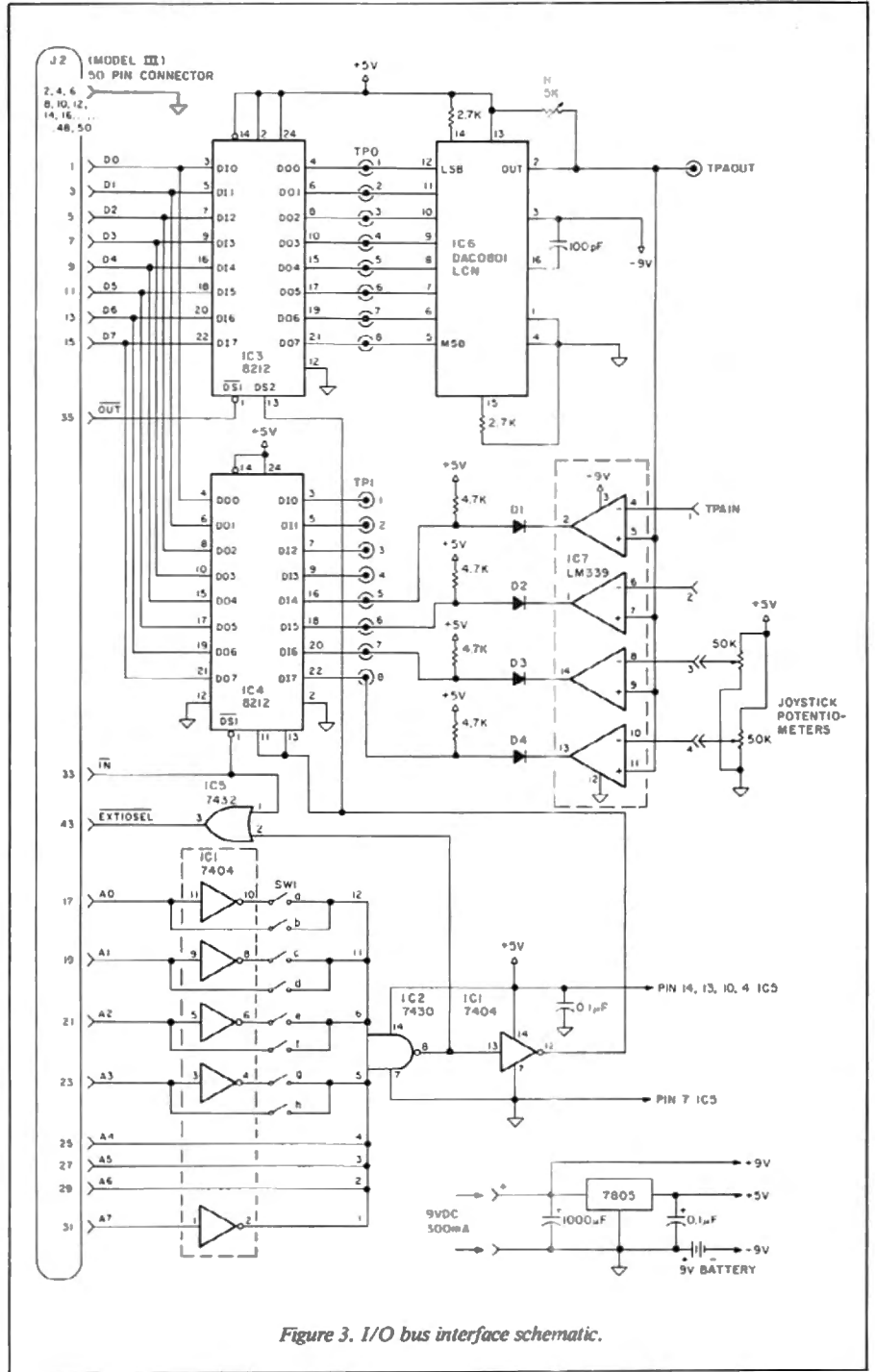


Figure 3. I/O bus interface schematic.

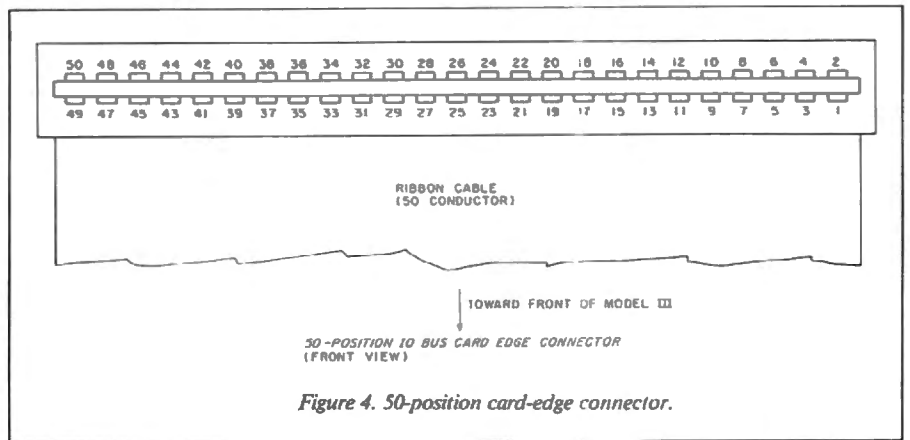



Figure 4. 50-position card-edge connector.

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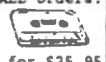
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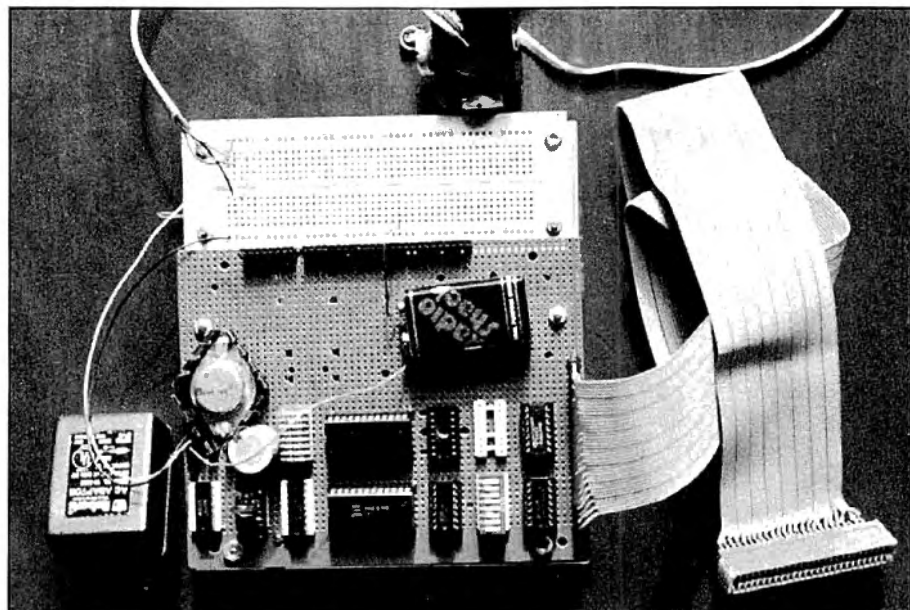


Photo. Parallel I/O bus interface.

After eight loops through this process, the voltage output of the DAC is equal to the one applied at the input of the voltage comparator. For each comparator, the program returns a 1-byte value between zero and 255, corresponding to the last output step of the DAC. These values in Listing 2 calcu-

late the voltage applied to TPAIN 3 and TPAIN 4. In Listings 3 and 4, these values position a pixel on the video screen. ■

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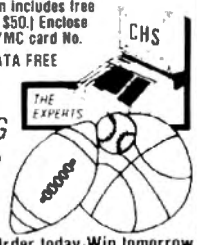
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Wire-wrap 24-pin IC socket	2	
Wire-wrap 16-pin IC socket	3	RC 276-1994
Wire-wrap 14-pin IC socket	5	RC 276-1993
Card-edge connector (50 pos.)	1	
Male wire-wrap header (25 pos.)	1	
Female wire-wrap header (25 pos.)	1	
Ribbon cable (50 conductor)	3 feet	
IC1 7404 hex inverter	1	RC 276-1802
IC2 7430 8-input NAND gate	1	
IC3-4 8212 8-bit I/O port	2	
IC5 7432 quad 2-input OR gate	1	RC 276-1915
IC6 DAC801 DAC	1	RC 276-1791
IC7 LM339 quad comparator	1	RC 276-1712
IC8 7805 +5 V voltage regulator	1	RC 276-1770
D1-D4 1N34A gen. purpose GE diode	4	RC 276-1123
2.7 k Ω 1/4 W resistor	2	
4.7 k Ω 1/4 W resistor	4	
5 k Ω 1/4 W adjustable resistor	1	
40-, 50-, or 100-k Ω joystick	1	RC 271-1706
1000 μ F 35 V capacitor	1	RC 272-1030
0.1 μ F capacitor	1	RC 272-1069
100 pF capacitor	1	
SPST DIP switch (8 pos.)	1	RC 275-1301
Battery eliminator 9 Vdc 300 mA	1	RC 273-1455
Transistor battery 9 V	1	

Miscellaneous: mounting hardware, plug for battery eliminator, plastic or metal base for perfboard and breadboard.

Table 2. Parts list.


```

1 ***** LISTING 1 *****
2
3
10 *** TESTING & ADJUSTMENT OF THE IO BUS INTERFACE ***
20 *** BY S. CALMETTES, FEB 19, 83 ***
30 CLS:PRINT"to select a port address, type 1"
40 PRINT"to test the Output Port, type 2"
50 PRINT"to test the Input Port, type 3"
60 PRINT"to adjust the DAC, type 4"
70 PRINT"to test the DAC, type 5"
80 PRINT"to test the Voltage Comparators, type 6"
90 PRINT"to quit, type 7"
100 PRINT:PRINT:INPUTM:ONMGOTO110 ,150 ,230 ,360 ,410 ,490 ,
570
110 CLS:PRINT"*** Selection of a Port Address from 112 to 127 (dec
imal) ***"
120 PRINT:PRINT:INPUT"Enter the address which correspond to
the setting of SW1";PA
130 PRINT:PRINT:INPUT"Press <ENTER> to return to the Menu";EN
140 GOTO30
150 CLS:PRINT"*** Testing of the Output Port for the selected addr
ess ***"
160 PRINT:PRINT:PRINT"Connect a voltmeter (or a logic probe), betw
een the ground
and any of TPO 1,2,3,4,5,6,7,8. The output of bit 0 high, will
turn TPO 1 high, the output of bit 1 high will turn TPO 2 high,
etc....."
170 PRINT:PRINT:OUT236,16:OUTPA,0:INPUT"Enter the bit # to output
(0 to 7)";BO
180 IFBO=0THENOUTPA,1:PRINT@960,"*****-----> Check TPO 1";
190 IFBO>0THENOUTPA,2[BO:PRINT@960,"*****-----> Check TPO";BO+1;
200 PRINT@832,"To reset the ouput to 0 and test other bit(s), type
1"
210 INPUT"to return to the Menu, type 2";EN
220 ONENGOTO170 ,30
230 CLS:PRINT"*** Testing of the Input Port for the selected addre
ss ***"
240 PRINT:PRINT:PRINT"Connect any of PTI 1,2,3,4,5,6,7,8 either to
ground or to
+5 volts (through a 4.7K resistor).
The bit number when high, will be displayed on the screen"
250 PRINT:PRINT:INPUT"Press <ENTER> when ready to start";EN::PRINT
:PRINT"to return to the Menu, Press M"
260 OUT236,16
270 BI=INP(PA):IFBIAND1THENPRINT@960,"*****-----> Bit # 0";
280 IFBIAND2THENPRINT@960,"*****-----> Bit # 1";
290 IFBIAND4THENPRINT@960,"*****-----> Bit # 2";
300 IFBIAND8THENPRINT@960,"*****-----> Bit # 3";
310 IFBIAND16THENPRINT@960,"*****-----> Bit # 4";
320 IFBIAND32THENPRINT@960,"*****-----> Bit # 5";
330 IFBIAND64THENPRINT@960,"*****-----> Bit # 6";
340 IFBIAND128THENPRINT@960,"*****-----> Bit # 7";
350 A$=INKEY$:IFA$="M"THEN30 ELSE270
360 CLS:PRINT"*** Adjustment of the DAC ***"
370 PRINT:PRINT:PRINT"Connect a voltmeter (scale 0-5VDC) between t
he ground
and TPAOUT. Adjust R (the 5K adjustable resistor) for a 0 volt
reading."
380 PRINT:PRINT:PRINT"to return to the Menu press M"
390 OUT236,16:OUTPA,0
400 A$=INKEY$:IFA$="M"THEN30 ELSE400
410 CLS:PRINT"*** Testing of the DAC ***"
420 PRINT:PRINT:PRINT"Connect a voltmeter (scale 0-5VDC) between t
he ground
and TPAOUT. The output voltage will be proportional to the
output bits to the DAC.
This voltage is approx. 20mV per step."
430 PRINT:INPUT"Enter the value to output to the DAC (0 to 255)";D
440 OUT236,16:OUTPA,D
450 PRINT:PRINT"The voltage should be approx.";D*2/100;" volts"
460 PRINT:PRINT"to continue this test, type 1"
470 INPUT"to return to the Menu, type 2";EN
480 ONENGOTO430 ,30
490 CLS:PRINT"*** Testing of Voltage Comparators ***"
500 PRINT:PRINT:PRINT"Connect a voltage source (0 to 5V) to
any of TPAIN 1,2,3,4. If necessary use a 10 to 100K
potentiometer between ground and +5V."
510 PRINT"Observe the change of the value displayed on the screen
as you vary the input voltage."
520 PRINT:INPUT"Press <ENTER> when ready to start";EN
530 PRINT:PRINT"Press M to return to the Menu"
540 OUT236,16
550 FORI=0TO255STEP5:OUTPA,I:PRINT@960,INP(PA);:NEXTI
560 A$=INKEY$:IFA$="M"THEN30 ELSE550
570 END

```

Program Listing 1. Step-by-step test.

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1 ***** LISTING 2 *****

```

2
3
10 **** DEMONSTRATION PROGRAM TO READ THE VOLTAGE FROM
20 *** THE VOLTAGE COMPARATORS INPUT TPAIN 3 AND 4
30 **** S. CALMETTES, FEB 20 1983
40 FORM=32512TO32592:READB:POKEM,B:NEXTM
50 CLS:OUT236,16
60 U$="#.##":POKE16526,0:POKE16527,127
70 A=USR(0)
80 B=PEEK(32591):C=PEEK(32592)
90 B=B*5/256:C=C*5/256
100 PRINT@," ";:PRINT"VOLTAGE OF INPUT A; ";:PRINTUSINGU$;B
110 PRINT@64," ";:PRINT"VOLTAGE OF INPUT B; ";:PRINTUSINGU$;C
120 GOTO70
130 DATA062,016,211,236,006,008,014,128,022,064,016,002,024,023,12
1,211,112,219,112,203,127,032,007,121,130,203,058,079,024,236,121,
146,203,058,079,024,229,121,050,079,127,006,008,014,128,022,064,01
6,002,024,023
140 DATA121,211,112,219,112,203,119,032,007,121,130,203,058,079,02
4,236,121,146,203,058,079,024,229,121,050,080,127,201,000,000
150 END
    
```

Program Listing 2. Voltage read.



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1 ***** LISTING 3 *****

```

2
3
10 **** DEMONSTRATION PROGRAM TO WRITE ON THE VIDEO SCREEN
20 **** WITH A JOYSTICK CONNECTED AT TPAIN 3 AND 4
30 **** S. CALMETTES, FEB 20, 83
40 FORM=32512TO32690
50 READB:POKEM,B:NEXTM
60 POKE16526,0:POKE16527,127:***ADDRESS OF USR ROUTINE***
70 CLS:PRINT"TO CLEAR THE SCREEN, PRESS CLEAR"
80 PRINT"TO ERASE, PRESS R (FOR RESET)"
90 PRINT"TO RETURN TO BASIC, PRESS BREAK"
100 PRINT:PRINT:INPUT"PRESS ENTER TO START";EN
110 U=USR(0)
120 DATA243,062,016,211,236,058,064,056,254,002,204,164,127,254,00
4,202,025,026,254,128,040,235,006,008,014,128,022,064,016,002,024,
023,121,211,112,219,112,203,127,032,007,121,130,203,058,079,024,23
6,121,146,203
130 DATA058,079,024,229,203,057,089,006,008,014,128,022,064,016,00
2,024,023,121,211,112,219,112,203,119,032,007,121,130,203,058,079,
024,236,121,146,203,058,079,024,229,203,057,203,057,081,058,004,05
6,254,004,032
140 DATA004,062,134,024,002,062,198,050,160,127,122,006,255,004,21
4,003,242,115,127,198,003,203,039,079,104,038,000,006,006,041,016,
253,022,000,203,059,048,001,012,025,017,000,060,255,203,033,203,03
3,203,033,058
150 DATA160,127,129,050,160,127,203,000,195,001,127,033,000,060,00
1,000,004,054,128,035,011,120,177,032,248,201
160 END
    
```

Program Listing 3. Draw by joystick.

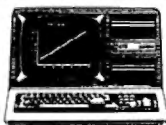
Program Listing 4. Draw-by-joystick source code.

```

00010 ;***** LISTING 4 *****
00020 ;
00030 ;
00100 ;ANALOG TO DIGITAL SOFTWARE CONVERTER
00110 ;FOR VOLTAGES 0 TO 5 VOLTS AT INPUTS TPAIN 3 AND 4
00120 ;
0070 00130 PORT EQU 112 ;CHANGE IF NECESSARY TO
00140 ;SATISFY YOUR OWN PORT ADDRESS
7F00 00150 ORG 7F00H
7F00 00160 DI
7F01 3E10 00170 START LD A,16 ;ENABLE I/O BUS
7F03 D3EC 00180 OUT (236),A
7F05 3A4038 00190 LD A,(3840H)
7F08 FE02 00200 CP 2 ;CHECK FOR CLEAR PRESSED

7F0A CCA47F 00210 CALL Z,CLS
7F0D FE04 00220 CP 4 ;CHECK FOR BREAK PRESSED
7F0F CA2D40 00230 JP Z,402DH ;BACK TO DOS ON BRK
00240 ; FOR NON-DISK SYSTEM USE 1A19H INSTEAD OF 402DH
7F12 FE00 00250 CP 128
7F14 28EB 00260 JR Z,START
    
```

Listing 4 continued



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Listing 4 continued

7F16 0608	00270	LD	B,8	;NB OF PASSES
7F18 0F80	00280	LD	C,128	;INITIAL VALUE TO DAC
7F1A 1640	00290	LD	D,64	;INITIAL VALUE TO ADD OR SUBS.
7F1C 1002	00300	LOOPX	DJNZ	
7F1E 1017	00310	JR	STOREX	
7F20 79	00320	OUTX	LD	A,C
7F21 D370	00330	OUT	(PORT),A	
7F23 DB70	00340	IN	A,(PORT)	;CHECK FOR TOO LOW OR HI
7F25 CB7F	00350	BIT	7,A	
7F27 2007	00360	JR	NZ,DOWNX	
7F29 79	00370	UPX	LD	A,C
7F2A 02	00380	ADD	A,D	
7F2B CB3A	00390	SRL	D	
7F2D 4F	00400	LD	C,A	
7F2E 18EC	00410	JR	LOOPX	
7F30 79	00420	DOWNX	LD	A,C
7F31 92	00430	SUB	D	
7F32 CB3A	00440	SRL	D	
7F34 4F	00450	LD	C,A	
7F35 18E5	00460	JR	LOOPX	
7F37 CB39	00470	STOREX	SRL	C
AXIS)				;DIVIDE BY 2 (NOT TO EXCEED SCREEN, X
7F39 59	00480	LD	E,C	;STORE X INPUT INTO REG. E
7F3A 0608	00490	STARTY	LD	B,8
7F3C 0E80	00500	LD	C,128	
7F3E 1640	00510	LD	D,64	
7F40 1002	00520	LOOPY	DJNZ	
7F42 1017	00530	JR	STOREY	
7F44 79	00540	OUTY	LD	A,C
7F45 D370	00550	OUT	(PORT),A	
7F47 DB70	00560	IN	A,(PORT)	
7F49 CB77	00570	BIT	6,A	
7F4B 2007	00580	JR	NZ,DOWNY	
7F4D 79	00590	UPY	LD	A,C
7F4E 02	00600	ADD	A,D	
7F4F CB3A	00610	SRL	D	
7F51 4F	00620	LD	C,A	
7F52 18EC	00630	JR	LOOPY	
7F54 79	00640	DOWNY	LD	A,C
7F55 92	00650	SUB	D	
7F56 CB3A	00660	SRL	D	
7F58 4F	00670	LD	C,A	
7F59 18E5	00680	JR	LOOPY	
7F5B CB39	00690	STOREY	SRL	C
AXIS)				;DIVIDE BY 4 (NOT TO EXCEED SCREEN,
7F5D CB39	00700	SRL	C	
7F5F 51	00710	LD	D,C	;STORE Y INPUT INTO REG. D
7F60 3A0438	00720	LD	A,(3804H)	;READ K/B FOR R (RESET)
7F63 FE04	00730	CP	4	
	00740			
	00750			;ROUTINE TO CONVERT JOYSTICK INPUTS STORED IN REG. DE TO SCREE
N COORDINATES	00760			
7F65 2004	00770	JR	NZ,SET	
7F67 3E86	00780	RESET	LD	A,86H
7F69 1002	00790	JR	TEST	
7F6B 3EC6	00800	SET	LD	A,0C6H
7F6D 32A07F	00810	TEST	LD	(INST+1),A
7F70 7A	00820	ADDRESS	LD	A,D
7F71 06FF	00830	LD	B,0FFH	
7F73 04	00840	LOOP	INC	B
7F74 D603	00850	SUB	3	
7F76 F2737F	00860	JP	P,LOOP	
7F79 C603	00870	ADD	A,3	
7F7B CB27	00880	SLA	A	
7F7D 4F	00890	LD	C,A	
7F7E 60	00900	LD	L,B	
7F7F 2600	00910	LD	H,0	
7F81 0606	00920	LD	B,6	
7F83 29	00930	LOOP3	ADD	HL,HL
7F84 10FD	00940	DJNZ	LOOP3	
7F86 1600	00950	LD	D,0	
7F88 CB3B	00960	SRL	E	
7F8A 3001	00970	JR	NC,CONT	
7F8C 0C	00980	INC	C	
7F8D 19	00990	CONT	ADD	HL,DE
7F8E 11003C	01000	LD	DE,3C00H	;VIDEO MEMORY
7F91 19	01010	ADD	HL,DE	
7F92 CB21	01020	SLA	C	
7F94 CB21	01030	SLA	C	
7F96 CB21	01040	SLA	C	
7F98 3AA07F	01050	LD	A,(INST+1)	
7F9B 81	01060	ADD	A,C	
7F9C 32A07F	01070	LD	(INST+1),A	
7F9F CB	01080	INST	DEFB	0CBH
7FA0 00	01090	DEFB	0	
7FAL C3017F	01100	JP	START	
7FA4 21003C	01110	CLS	LD	HL,3C00H
7FA7 010004	01120	LD	BC,1024	
7FAA 3600	01130	FILL	LD	(HL),80H
7FAC 23	01140	INC	HL	
7FAD 0B	01150	DEC	BC	
7FAE 78	01160	LD	A,B	
7FAF B1	01170	OR	C	
7FB0 20F8	01180	JR	NZ,FILL	
7FB2 C9	01190	RET		
7F01	01200	END	START	

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TRS-NUKE

by W. Mark Wright

Listing continued from p. 72

```
780 IFAH$="R"THENYC=4ELSEYC=0
784 REM
785 REM          FEED PUMP #1 STATUS
786 REM
790 IFAD>0THENYD=8ELSEYD=0
794 REM
795 REM          AUX FEED PUMP #1 STATUS
796 REM
800 IFAF>0THENYE=16ELSEYE=0
804 REM
805 REM          STEAM DUMP STATUS
806 REM
810 IFAN$="C"THENYF=32ELSEYF=0
814 REM
815 REM          SYNCHRONIZATION STATUS
816 REM
820 IFSY$="Y"THENYG=64ELSEYG=0
824 REM
825 REM          PRIMARY PORV STATUS
826 REM
830 IFAK=0THENYH=128ELSEYH=0
834 REM
835 REM          AUX FEED PUMP #2 STATUS
836 REM
840 IFAG>0THENYI=1ELSEYI=0
844 REM
845 REM          GRID BREAKER STATUS
846 REM
850 IFAL$="C"THENYJ=2ELSEYJ=0
854 REM
855 REM          REACTOR COOLANT PUMP #1 STATUS
856 REM
860 IFAA>0THENYK=4ELSEYK=0
864 REM
865 REM          FEED PUMP #2 STATUS
866 REM
870 IFAR>0THENYL=8ELSEYL=0
874 REM
875 REM          TURBINE STATUS
876 REM
880 IFAI$="R"THENYM=16ELSEYM=0
884 REM
885 REM          SECONDARY PORV STATUS
886 REM
890 IFAM=0THENYN=32ELSEYN=0
892 REM
893 REM          OUTPUT VALUES TO STATUS 8255 PPI
894 REM
895 REM          INPUT VALUES FROM A/D CONVERTER
896 REM          WA = GENERATOR VOLTAGE          NB = FEED VALVE #2 %
```

```
897 REM          WC = % SAFETY INJECTION          WD = GENERATOR LOAD
898 REM          WE = % THROTTLE VALVE
899 REM
900 QQ=YA+YB+YC+YD+YE+YF+YG+YH:OUT4,QQ:QQ=YI+YJ+YK+YL+YM+YN:OUT5
,QQ:OUT13,0:OUT13,8:OUT13,8:WA=INP(14):OUT13,1:OUT13,9:OUT13,1:W
B=INP(14):OUT13,2:OUT13,10:OUT13,2:WC=INP(14):OUT13,3:OUT13,11:O
UT13,3:WD=INP(14):OUT13,4:OUT13,12:OUT13,4:WE=INP(14):OUT13,5
903 REM
904 REM          INPUT VALUES FROM A/D CONVERTER
905 REM          WF = FEED VALVE #3 %          WG = % STEAM DUMP
906 REM          WH = FEED VALVE #1 %
907 REM
910 OUT13,13:OUT13,5:WF=INP(14):OUT13,6:OUT13,14:OUT13,6:WG=INP(
14):OUT13,7:OUT13,15:OUT13,7:WH=INP(14):WA=WA*GP:WB=WB*GQ:WD=WD*
GR:WE=WE*GQ:WF=WF*GQ:WG=WG*GQ:WH=WH*GQ:D(1)=D(1)+(AA-D(1))*GG:D(
2)=D(2)+(AB-D(2))*GG:D(3)=D(3)+(AC-D(3))*GG:D(4)=D(4)+(AD-D(4))*
GN
920 D(5)=D(5)+(AE-D(5))*GN:D(6)=D(6)+(AF-D(6))*GN:D(7)=D(7)+(AG-
D(7))*GN:D(8)=D(8)+(AK-D(8))*GG:D(9)=D(9)+(AM-D(9))*GG:WC=WC*GQ
924 REM
925 REM          IF GRID BREAKER IS OPEN THEN GENERATOR LOAD = 0
926 REM
930 IFAL$="O"THENWD=0
934 REM
935 REM          CALCULATIONS FOR STEAM DUMP
936 REM
940 IFAN$="O"THENSND=WC*BELSESD=0
944 REM
945 REM          CALCULATIONS FOR SAFETY INJECTION
946 REM
950 D(35)=D(35)+(SD-D(35))*GL:IFAJ$="S"THENS1=WC*GSESESI=0
954 REM
955 REM          CALCULATIONS FOR % PRIMARY FLOWRATE AND
956 REM          % PRIMARY MASS
957 REM
960 D(36)=D(36)+(SI-D(36))*GL:FP=4+D(1)+D(2)+D(3):D(11)=D(11)+(F
P-D(11))*GG:MP=MP-D(8)+D(36)-LB(1):D(12)=D(12)+(MP-D(12))*GG:IFD
(12)<0THEND(12)=0
964 REM
965 REM          CALCULATIONS FOR REACTOR POWER AND
966 REM          PRIMARY TEMPERATURE
967 REM
970 DP=D(11)*D(12)*AD/JH:D(14)=D(14)+(DP-D(14))*GG:TP=JP*D(11)/D
(12)+(D(14)-D(17)):D(15)=D(15)+(TP-D(15))*GG:IFD(15)<0THEND(15)=
0
974 REM
975 REM          CALCULATIONS FOR PRIMARY PRESSURE
976 REM
980 PP=4*D(12)*D(15)/D(11):D(16)=D(16)+(PP-D(16))*GG:IFD(16)<0TH
END(16)=0
```

```
984 REM
985 REM          CALCULATIONS FOR GENERATOR VOLTAGE AND
986 REM          TOTAL LOAD FROM SECONDARY SIDE
987 REM
990 D(31)=WA+JC:D(38)=D(38)+(WB-D(38))*GG:D(27)=D(27)+(WD-D(27))
*GG:D(39)=D(39)+(WE-D(39))*GG:D(37)=D(37)+(WH-D(37))*GG:D(40)=D(
40)+(WE-D(40))*GL:DS=D(35)+D(40)/JA+D(27)+D(9)-LB(2):D(17)=D(17)
+(DS-D(17))*GG:IFD(17)<0THEND(17)=0
993 REM
994 REM          CALCULATIONS FOR:
995 REM          TOTAL AVAILABLE FEED FOR STEAM GENERATORS
996 REM          FEED TO S/G #1, S/G #2, S/G #3
997 REM          S/G #1 LEVEL
998 REM          S/G #2 LEVEL
999 REM
1000 D(19)=D(4)+D(5)+D(6)+D(7)+F1-D(37)*D(19)/JG:D(42)=D(42)+(F1
-D(42))*GG:F2=D(38)*D(19)/JG:D(20)=D(20)+(F2-D(20))*GG:F3=D(39)*
D(19)/JG:D(21)=D(21)+(F3-D(21))*GG:S1=S1+D(42)-D(17)*GI:D(22)=D(
22)+(S1/HR-D(22))*GG:S2=S2+D(20)-D(17)*GH
1003 REM
1004 REM          CALCULATIONS FOR S/G #3 LEVEL,
1005 REM          SECONDARY TEMPERATURE
1006 REM
1010 D(23)=D(23)+(S2/HR-D(23))*GG:S3=S3+D(21)-D(17)*GJ:D(24)=D(2
4)+(S3/HR-D(24))*GG:ST=WC*D(15)/(D(9)+HB):D(25)=D(25)+(ST-D(25))
*GG:IFD(25)<0THEND(25)=0
1014 REM
1015 REM          CALCULATIONS FOR SECONDARY PRESSURE
1016 REM
1020 SP=(D(16)/HC)/(D(9)+HB):D(26)=D(26)+(SP-D(26))*GG:IFD(26)<0
THEND(26)=0
1024 REM
1025 REM          CALCULATIONS FOR MVARS AND CURRENT
1026 REM
1030 D(29)=D(31)-JE+JZ:D(30)=D(27)*JP/D(31):IFABS(D(29))>D(27)TH
ENGOSUB1560
1034 REM
1035 REM          CALCULATIONS FOR MEGAWATTS
1036 REM
1040 D(28)=SQR((D(27)*D(27))-D(29)*D(29)):IFAL$="O"THENGOSUB15
60
1044 REM
1045 REM          CALCULATIONS FOR TURBINE SPEED
1046 REM
1050 IFAV$="T"THENYU=0ELSEYU=JW+2*D(40)
1054 REM
1055 REM          CALCULATION FOR SYNCHRONIZATION
1056 REM
1060 D(33)=D(33)+(TU-D(33))*GG:IFD(33)>JXANDD(33)<JYTHENSY$="Y"
ELSEYSY$="N"
1064 REM
```

Listing continued



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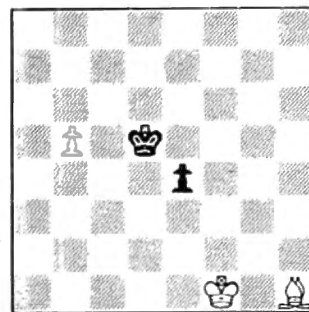
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Tidbit #1

To move texts from Model I Scripsit tape to Newscrip disk, use the zaps provided with NEWDOS80 to patch Model I SCRIPSIT/LC for use on the Model III. I modified SCRIPSIT/LC to use the Model III ROM for cassette I/O. Use SCRIPSIT/LC, load the text from tape, and save it to disk with the A option which makes it compatible with Newscrip.

Make these changes (applied to a back-up disk) to use the Model III ROM routines for tape I/O:

SCRIPSIT/LC,17,C9	change:	F7	18	2E	D9	0E	08	CD	8C	63
	to:	F7	18	2E	C3	35	02	CD	8C	63
SCRIPSIT/LC,17,F7	change:	10	17	C9	D9	F5	0E	08	57	CD
	to:	10	17	C9	C3	64	02	08	57	CD
SCRIPSIT/LC,18,13	change:	FE	18	F4	CD	F0	63	06	FF	AF
	to:	FE	18	F4	C3	87	02	06	FF	AF
SCRIPSIT/LC,18,22	change:	A5	18	D5	CD	F0	63	D9	AF	CD
	to:	A5	18	D5	C3	96	02	D9	AF	CD
SCRIPSIT/LC,18,41	change:	64	E1	C9	E5	21	00	FB	18	F5
	to:	64	E1	C9	C3	F8	01	FB	18	F5

To make SCRIPSIT end go to DOS Ready instead of rebooting:

SCRIPSIT/LC,19,E5	change:	C2	76	6F	C3	00	00	CD	68	65
	to:	C2	76	6F	C3	2D	40	CD	68	65

Clifford Kent, Motville, NY

Listing continued

```
1065 REM IF NOT SYNCHRONIZED THEN OPEN GRID BREAKER
1066 REM
1070 IFSY$="H"THENAL$="O"
1074 REM
1075 REM CALCULATIONS FOR % REACTOR POWER
1076 REM
1080 D(41)=D(14)/HG-HV:IPD(41)<@THEND(41)=0
1090 IPFB=0THENGOTO1110
1094 REM
1095 REM CALCULATIONS FOR STARTUP RATE
1096 REM
1100 D(43)={(D(14)-BB)/BB}*JA
1104 REM
1105 REM CALCULATIONS FOR SCORE
1106 REM
1110 BB=D(14):PZ=PZ+D(28)*GO:IFAS$="T"THENPZ=0
1120 IPPZ<@THENPZ=0
1124 REM
1125 REM PRINTOUT OF CALCULATED VALUES
1126 REM
1130 PRINT@142,D(14);@206,D(41);@867,D(40);@931,D(33);@270,D(43)
;@313,D(27);CHRS(30);@398,AO;@185,D(31);CHRS(30);@526,D(15);@569
,D(29);CHRS(30);@590,D(16);@441,D(28);CHRS(30);@718,D(11);@697,D
(30);CHRS(30);@782,D(12);@510,WC;@356,D(37)
;
1140 PRINT@420,D(38);@484,D(39);@612,D(22);@676,D(23);@740,D(24)
;@226,D(25);@162,D(26);@995,WG;@953,PZ;CHRS(30);@1017,KA;CHRS(31)
;
1141 REM
1142 REM ***** ANNUNCIATOR SECTION *****
1143 REM
1144 REM
1145 REM LOW PRIMARY TEMPERATURE
1146 REM
1150 IPD(15)<JJTHENZA=1ELSEZA=0
1154 REM
1155 REM REACTOR TRIP ON LOW-LOW PRIMARY TEMPERATURE
1156 REM
1160 IPD(15)<JIANDTI$="R"THENAH$="T"
1164 REM
1165 REM LOW STEAM GENERATOR LEVEL
1166 REM
1170 IPD(22)<HUORD(23)<HUORD(24)<HUTHENZB=2ELSEZB=0
1174 REM
1175 REM GENERATOR OVERPOWER
1176 REM
1180 IPD(27)<JNTHENZC=4ELSEZC=0
1184 REM
1185 REM AUX FEED PUMP START
1186 REM
1190 IFAP>@ORAG>@THENZD=8ELSEZD=0
1194 REM
1195 REM HI STEAM GENERATOR LEVEL
1196 REM
1200 IPD(22)>HXORD(23)>HXORD(24)>HXTHENZE=16ELSEZE=0
1204 REM
1205 REM PRIMARY PORV OPEN
1206 REM
1210 IPAK>@THENZP=32ELSEZP=0
1214 REM
1215 REM FEED PUMP TRIP
1216 REM
1220 IPAD=0ORAE=0THENZG=64ELSEZG=0
1224 REM
1225 REM HI PRIMARY PRESSURE
1230 IPD(15)>JKTHENZH=120ELSEZH=0
1234 REM
1235 REM TURBINE TRIP
1236 REM
1240 LA=ZA+ZB+ZC+ZD+ZE+ZF+ZG+ZH:OUTB,LA:IFAI$="T"THENZI=1ELSEZI=
0
1244 REM
1245 REM SAFETY INJECTION START
1246 REM
1250 IFAJ$="S"THENZJ=2ELSEZJ=0
1254 REM
1255 REM HI SECONDARY TEMPERATURE
1256 REM
1260 IPD(25)>JRTHENZK=4ELSEZK=0
1264 REM
1265 REM HI STARTUP RATE
1266 REM
```

```
1270 IPD(43)>JATHENZL=8ELSEZL=0
1274 REM
1275 REM LOW PRIMARY FLOWRATE
1276 REM
1280 IPD(11)<HZTHENZM=16ELSEZM=0
1284 REM
1285 REM HI PRIMARY PRESSURE
1286 REM
1290 IPD(16)>JUTHENZN=32ELSEZN=0
1294 REM
1295 REM STEAM/PRED MIS-MATCH
1296 REM
1300 A=D(42)+D(20)+D(21):B=GM*A:C=GN*A:IPD(17)>BORD(17)<CTHENZO=
64ELSEZO=0
1304 REM
1305 REM LOW SECONDARY TEMPERATURE
1306 REM
1310 IPD(25)<JPTHENZP=128ELSEZP=0
1314 REM
1315 REM STEAM DUMP OPEN
1316 REM
1320 LB=Z I+ZJ+ZK+ZL+ZM+ZN+ZO+ZP:OUTL,LC:IFAN$="O"THENZQ=1ELSEZQ=
0
1324 REM
1325 REM LOW PRIMARY PRESSURE
1326 REM
1330 IPD(16)<JTTHENZS=4ELSEZS=0
1334 REM
1335 REM TRIP REACTOR ON LOW-LOW PRIMARY PRESSURE
1336 REM
1340 IPD(16)<JSANDAI$="R"THENAH$="T"
1344 REM
1345 REM TRIP TURBINE ON LOW-LOW SECONDARY TEMPERATURE AND/OR
LOW-LOW SECONDARY PRESSURE
1346 REM
1347 REM
1350 IPD(25)<JJOORD(26)<JOTHENAI$="T"
1354 REM
1355 REM REACTOR COOLANT PUMP TRIP
1356 REM
1360 IPAA=0ORAB=0ORAC=0THENZR=2ELSEZR=0
1364 REM
1365 REM LOW SECONDARY PRESSURE
1366 REM
1370 IPD(26)<JPTHENZU=16ELSEZU=0
1374 REM
1375 REM HI SECONDARY TEMPERATURE
1376 REM
1380 IPD(26)>JQTHENZV=32ELSEZV=0
1384 REM
1385 REM SECONDARY PORV OPEN
1386 REM
1390 IFAM>@THENZW=64ELSEZW=0
1394 REM
1395 REM REACTOR OVERPOWER
1396 REM
1400 IPD(41)>JATHENZX=120ELSEZX=0
1404 REM
1405 REM TRIP REACTOR ON:
LOW-LOW STEAM GENERATOR LEVEL
HI STARTUP RATE
HI-HI PRIMARY TEMPERATURE
HI-HI PRIMARY PRESSURE
1406 REM
1407 REM REACTOR STATUS = TRIP
1408 REM
1410 IPD(16)<JPORD(15)<JHTHENAN$="C"
1420 IPD(22)<HRORD(23)<HRORD(24)<HRORD(43)>JAORD(41)>JBORD(15)>J
LORD(16)>JVVORAH$="T"THENZT=8ELSEZT=0
1424 REM
1425 REM TRIP TURBINE ON HI-HI STEAM GENERATOR LEVEL
1426 REM
1430 IPD(22)>HYORD(23)>HYORD(24)>HYTHENAI$="T"
1434 REM
1435 REM CHECK FOR NEW OR CLEARED ALARMS
1436 REM
1440 LC=2Q+2R+2S+2T+2U+2V+2W+2X:OUT2,LC:IF LA<LDORLB<LEORLC<LFTE
EN1470
1450 IFLA>LDORLB>LEORLC>LFTHEN1460 ELSE1480
1454 REM
1455 REM NEW ALARM PULSE
1456 REM
1460 OUT13,16:GOTO 1480
```

```
1464 REM
1465 REM CLEARED ALARM PULSE
1466 REM
1470 OUT13,32
1480 LD=LA:LE=LB:LF=LC
1484 REM
1485 REM BRANCH FOR HI STEAM GENERATOR LEVEL
1486 REM
1490 IFZE=16THENGOSUB1540
1494 REM
1495 REM BRANCH FOR LOW STEAM GENERATOR LEVEL
1496 REM
1500 IFZB=2THENGOSUB1550
1504 REM
1505 REM BRANCH FOR REACTOR TRIP
1506 REM
1510 IFZT=8THEN1530
1520 GOTO340
1530 AB$="T":AI$="T":AL$="O":GOTO340
1531 REM
1532 REM HI STEAM GENERATOR LEVEL:
TRIP FEED PUMPS
TRIP AUX FEED PUMPS
1533 REM
1534 REM
1535 REM
1540 AD=0:AE=0:AF=0:AG=0:RETURN
1541 REM
1542 REM LOW STEAM GENERATOR LEVEL:
START FEED PUMPS
START AUX FEED PUMPS
1543 REM
1544 REM
1545 REM
1550 AF=200:AG=200:AE=375:AD=375:RETURN
1554 REM
1555 REM ZERO GENERATOR LOAD WHEN GRID BREAKER OPENS
1556 REM
1560 D(29)=0:D(27)=0:D(38)=0:D(28)=0:RETURN
1564 REM
1565 REM SCREEN FORMAT
1566 REM
1570 CLS:PRINT@128,"RX POWER MWTH";@192,"RX POWER %";@256,"START
UP RATE";@304,"CONTROL RODS";@512,"TEMPERATURE";@576,"PRESSURE
";@704,"FLOWRATE %";@768,"MASS %";@896,"SI %";@960,"PRIMARY";@2,
"SECONDARY";@47,"ELECTRICAL";@342,"FEED VALVE 1 %";
1580 PRINT@406,"FEED VALVE 2 %";@478,"FEED VALVE 3 %";@598,"S/G
LEVEL 1 %";@662,"S/G LEVEL 2 %";@726,"S/G LEVEL 3 %";@214,"TEMPER
ATURE";@150,"PRESSURE";@982,"STEAM DUMP %";@854,"THROTTLE %";@9
18,"TURBINE SPEED";
1590 PRINT@299,"MVA";@171,"VOLTAGE KV";@555,"MVAR";@427,"MW";@68
3,"CURRENT";@939,"MWHR";@1003,"TIME";:FORI=@TO127:SET(I,4):NEXT:
FORY=@TO47:SET(40,Y):SET(41,Y):SET(82,Y):SET(83,Y):NEXT:RETURN
1591 REM
1592 REM REACTOR TRIP:
REACTOR STATUS = TRIP
CONTROL RODS POSITION = 0
GRID BREAKER = OPEN
TURBINE = TRIP
1593 REM
1594 REM
1595 REM
1596 REM
1597 REM
1600 AH$="T":AO=0:AL$="O":AI$="T":RETURN
1604 REM
1605 REM HOLDING LOOP WHEN OUT OF REACTOR OPERATION TIME
1606 REM
1610 AS=INKEY$:IFAS=""THEN1620 ELSE10
1620 OUT13,32:FORI=1TO200:NEXT:OUT13,0:FORI=1TO200:NEXT:GOTO1610
1624 REM
1625 REM ***** EVENTS SECTION *****
1626 REM
1630 ONRND(35)GOSUB1640,1650,1660,1670,1680,1690,1700,171
0,1720,1730,1740,1750,1760,1770,1780,1790,1800,1810,1
820,1830,1840,1850,1860,1870,1880,1890,1900,1910,1920
,1930,1940,1950,1960,1970,1980:GO=GO*GM:RETURN
1634 REM
1635 REM REACTOR COOLANT PUMP #1
1636 REM
1640 AA=RND(34):RETURN
1644 REM
1645 REM REACTOR COOLANT PUMP #2
1646 REM
1650 AB=RND(34):RETURN
1654 REM
1655 REM REACTOR COOLANT PUMP #3
1656 REM
```

Listing continued

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DEALER INQUIRIES INVITED

Tidbit #2

These two patches are for TRSDOS 1.3. The first lets you bypass the date question, and the second gives long error messages.

PATCH *0 (ADD = 4EB5, FIND = CD1B02, CHG = B72846)

PATCH *4 (ADD = 4E28, FIND = 20, CHG = 18)

The following patches do the same as those above but for TRSDOS 1.2.

PATCH *0 (ADD = 4EB7, FIND = CD1B02, CHG = B72846)

PATCH *4 (ADD = 4E29, FIND = 20, CHG = 18)

These patches alter the stepping speed of TRSDOS 1.3 from 6 milliseconds to 10 milliseconds. Use OF and IF for 20 milliseconds.

These patches alter TRSDOS 1.3 from 40 to 80 tracks.

PATCH *0 (ADD = 42BE, FIND = 0C, CHG = 0E)

PATCH *0 (ADD = 42BE, FIND = 0C, CHG = 0E)

PATCH *0 (ADD = 4516, FIND = 0C, CHG = 0E)

PATCH *0 (ADD = 4544, FIND = 1C, CHG = 1E)

PATCH *0 (ADD = 4EF1, FIND = 0C, CHG = 0E)

PATCH *0 (ADD = 4926, FIND = 28, CHG = 50)

PATCH *0 (ADD = 499B, FIND = 28, CHG = 0D)

PATCH *0 (ADD = 4B29, FIND = 29, CHG = 51)

PATCH *2 (ADD = 4461, FIND = 28, CHG = 50)

PATCH *6 (ADD = 5C06, FIND = 28, CHG = 50)

PATCH *6 (ADD = 5D53, FIND = 28, CHG = 50)

PATCH *7 (ADD = 5203, FIND = 28, CHG = 50)

PATCH *7 (ADD = 53FF, FIND = 28, CHG = 50)

PATCH *7 (ADD = 5504, FIND = 28, CHG = 50)

PATCH *7 (ADD = 5C4F, FIND = 29, CHG = 50)

PATCH *7 (ADD = 5CD4, FIND = 28, CHG = 50)

PATCH *7 (ADD = 0000, FIND = 00, CHG = 00)

Listing continued

```
1660 AC=RND(34):RETURN
1664 REM
1665 REM FEED PUMP #1
1666 REM
1670 AD=RND(375):RETURN
1674 REM
1675 REM FEED PUMP #2
1676 REM
1680 AE=RND(375):RETURN
1684 REM
1685 REM AUX FEED PUMP #1
1686 REM
1690 AF=RND(200):RETURN
1694 REM
1695 REM AUX FEED PUMP #2
1696 REM
1700 AG=RND(200):RETURN
1704 REM
1705 REM START INJECTION START
1706 REM
1710 AJ$="S":RETURN
1714 REM
1715 REM PRIMARY PORV OPEN
1716 REM
1720 AK=RND(5):RETURN
1724 REM
1725 REM GRID BREAKER OPEN
1726 REM
1730 AL$="O":RETURN
1734 REM
1735 REM SECONDARY PORV OPEN
1736 REM
1740 AM=RND(100):RETURN
1744 REM
1745 REM CONTROL ROD WITHDRAWAL/DROP
1746 REM
1750 AO=AO+RND(10)-5:RETURN
1754 REM
1755 REM CONTROL ROD DROP TO HOT STANDBY POSITION
1756 REM
1760 AP=23:RETURN
1764 REM
1765 REM STEAM DUMP OPEN
1766 REM
1770 AN$="O":RETURN
1774 REM
1775 REM PRIMARY LINE BREAK
1776 REM
1780 LB(1)=RND(25):RETURN
1784 REM
1785 REM SECONDARY LINE BREAK
1786 REM
1790 LB(2)=RND(200):RETURN
1794 REM
1795 REM REACTOR COOLANT PUMP #1
1796 REM FEED PUMP #2
1797 REM
1800 AA=RND(34):AE=RND(375):RETURN
1804 REM
1805 REM REACTOR COOLANT PUMP #2
1806 REM REACTOR COOLANT PUMP #3
1807 REM
1810 AB=RND(34):AC=RND(34):RETURN
1814 REM
1815 REM PRIMARY PORV
1816 REM CONTROL ROD WITHDRAWAL/DROP
1817 REM
1820 AR=RND(5):AO=AO+RND(10)-5:RETURN
1824 REM
1825 REM OPEN STEAM DUMP
1826 REM FEED PUMP #2
1827 REM
1830 AN$="O":AE=RND(375):RETURN
1834 REM
1835 REM PRIMARY PORV OPEN
1836 REM PRIMARY LINE BREAK
1837 REM
1840 AK=RND(5):LB(1)=RND(25):RETURN
1844 REM
1845 REM SECONDARY LINE BREAK
1846 REM PRIMARY LINE BREAK
1847 REM
1850 LB(2)=RND(200):LB(1)=RND(25):RETURN
```

```
1854 REM REACTOR COOLANT PUMP #1
1855 REM SECONDARY PORV OPEN
1856 REM
1857 REM
1860 AA=RND(34):AM=RND(100):RETURN
1864 REM
1865 REM SAFETY INJECTION START
1866 REM PRIMARY LINE BREAK
1867 REM
1870 AJ$="S":LB(1)=RND(25):RETURN
1874 REM
1875 REM GRID BREAKER OPENS
1876 REM CONTROL ROD WITHDRAWAL/DROP
1877 REM
1880 AL$="O":AO=AO+RND(10)-5:RETURN
1884 REM
1885 REM GRID BREAKER OPENS
1886 REM CONTROL RODS TO HOT STANDBY POSITION
1887 REM
1890 AL$="O":AO=23:RETURN
1894 REM
1895 REM SECONDARY PORV
1896 REM GRID BREAKER OPENS
1897 REM
1900 AM=RND(100):AL$="O":RETURN
1901 REM
1902 REM FEED PUMP #1
1903 REM FEED PUMP #2
1904 REM AUX FEED PUMP #1
1905 REM AUX FEED PUMP #2
1906 REM
1910 AD=RND(375):AE=RND(375):AF=RND(200):AG=RND(200):RETURN
1914 REM
1915 REM REACTOR COOLANT PUMP #1 TRIP
1916 REM STEAM DUMP OPEN
1917 REM
1920 AA=0:AN$="O":RETURN
1924 REM
1925 REM REACTOR COOLANT PUMP #2 TRIP
1926 REM PRIMARY LINE BREAK
1927 REM
1930 AB=0:LB(1)=RND(25):RETURN
1934 REM
1935 REM PRIMARY PORV
1936 REM FEED PUMP #2
1937 REM
1940 AK=RND(5):AE=RND(200):RETURN
1944 REM
1945 REM FEED PUMP #1
1946 REM FEED PUMP #2
1947 REM AUX FEED PUMP #1
1948 REM AUX FEED PUMP #2
1949 REM
1950 AD=1:AE=1:AF=1:AG=1:RETURN
1953 REM
1954 REM PRIMARY LINE BREAK
1955 REM SECONDARY LINE BREAK
1956 REM PRIMARY PORV
1957 REM SECONDARY PORV
1958 REM
1960 LB(1)=RND(25):LB(2)=RND(200):AK=RND(5):AM=RND(100):RETURN
1964 REM
1965 REM FEED PUMP #1
1966 REM FEED PUMP #2
1967 REM AUX FEED PUMP #1
1968 REM
1970 AD=RND(375):AE=RND(375):AF=RND(200):RETURN
1974 REM
1975 REM REACTOR COOLANT PUMP #1
1976 REM REACTOR COOLANT PUMP #2
1977 REM REACTOR COOLANT PUMP #3
1978 REM
1980 AA=RND(34):AB=RND(34):AC=RND(34):RETURN
1984 REM
1985 REM INITIAL CONDITIONS FOR HOT STANDBY
1986 REM
1990 AA=34:D(1)=32:AB=34:D(2)=32:AC=34:D(3)=32:AD=375:D(4)=375:AE=375:D(5)=375:AF=0:AG=0:AP=102:D(11)=102:MP=100:D(12)=100:DP=36
4:D(14)=364:TP=567:D(15)=567:PP=2224:D(16)=2224:DS=0:D(17)=0:PE=
1400:D(19)=1400:F1=0:D(42)=0:F2=0:D(20)=0:F3=0
2000:D(21)=0:S1=1830:D(22)=60:S2=1830:D(23)=60:S3=1830:D(24)=60:
ST=1131:D(25)=1131:SP=1108:D(26)=1108:AO=25:AN$="R":AI$="T":AJ$=
"R":AL$="O":AN$="C":GO=4/100:RETURN
```


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Getting Loaded

Build an interface board that quickly and automatically loads a 2K program into your cassette-based Model III.

If necessity is the mother of invention, call me Mom.

Almost every time I turned on my cassette-based Model III, I had to load a printer driver and/or Radio Shack's Debug program from my cassette recorder. This soon became an inconvenience. Disk drives would have solved my problem, but I had already spent the grocery money on Debug. I needed a less expensive option.

I arrived at the solution while disassembling my computer's ROM routines. After initialization, the Model III CPU (central processing unit) checks to see if you have disk drives connected. I built an economical auto-load board that takes advantage of this Model III feature.

On boot-up, the board, directed by the Model III's ROM circuitry, automatically loads my utility programs into memory from a RAM chip on the auto-load board. You can display opening

credits, provide direct access to machine language, or any other application that fits into the board's 2K memory.

I'll show you how to build an auto-load board, program the board's RAM chip, and add enhancements to it.

Auto-Load Theory

Radio Shack's disk interface is port-mapped with the port decoding already programmed into the CPU. Address location 0F0 hex tests the floppy disk controller's (FDC) status, while 0F3 hex transfers data to and from the CPU (see Table 1). A nonmaskable interrupt (NMI) indicates to the CPU the end of data transfer, with program flow jumping to 4300 hex and running what's on the disk, or in this case, the board's RAM chip.

Building the Board

Figure 1 is a schematic diagram of the auto-load board. IC2 is a 4040B CMOS

12-stage binary counter that increments on the falling edge of the applied clock's pulse. The auto-load board uses 11 of the 12 outputs as address lines to IC3, a 6116 150-nanosecond CMOS 2K static RAM chip. Q1, a 2N3904 NPN transistor, inverts the remaining input, with an open collector to the CPU's NMI line.

The IC1A's NAND gate inverts the Write NMI register (WRNMIREG) at port 0E4 hex and applies it to the reset at pin 11 of IC2. When the computer attempts to read the FDC, the Disk In pin (ports 0F0-0F3 hex) goes low (logic zero). Disk In low puts a logic zero on the Output Enable (OE), taking the RAM data buffers out of their high impedance state and placing the data on the CPU data bus.

IC1B's NAND gate performs the Or function because both inputs are active low (see Fig. 2). When the Disk In pin goes to logic zero, the 4040B's clock input goes to logic 1. Disk In returns high approximately 1½ milliseconds later, OE floats the data lines, and the clock is incremented on the high-to-low transition. The address supplied to the 6116 counts up one location every time the CPU reads.

Similarly, when you write to the auto-load board with the Disk Out pin low and A0 high (ports 0F1 hex and 0F3 hex), the Write Enable (WE) lets the computer store data and increment the address when it completes the

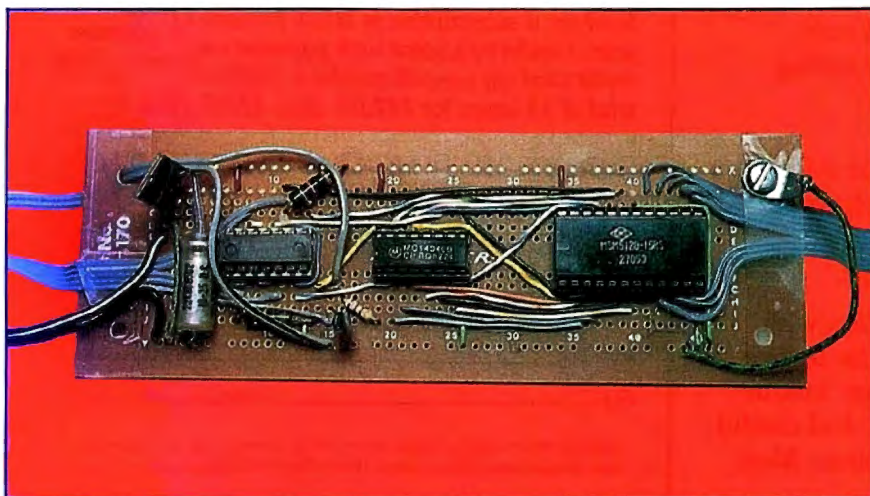


Photo 1. Control and data lines entering and exiting the auto-load board.

The Key Box

**Model III
16K RAM Cassette Basic
Debug or an Editor/Assembler
Hardware Project**

write. Pull-up resistors R1 and R2 hold Disk In and Disk Out at logic 1 when the computer is off.

When you switch on the Model III, the Z80 starts at location 0000 hex of the ROM and follows the program stored there. The computer does an output to ensure no NMI occurs, bringing WRNMIREG low. As this happens, IC1A places a logic one on the address counter's Reset, setting A0-A11 to zero.

The computer then tests Disk In. The CPU assumes no disk drive is connected if it reads 0FF hex. This means the auto-load board's memory location cannot be 0FF hex if the CPU is to continue loading.

The computer makes other tests to check the FDC status register; the first 7 bytes in the 6116 account for them (see Table 2). These conditions must be filled, and all four ports (0F0-0F3 hex) are available for read operations.

The Z80 writes commands to the FDC through ports 0F0 hex and 0F2 hex. The computer must not store these commands, so you can use only 0F1 hex or 0F2 hex for writing. Before the ROM executes a block input, WRNMIREG resets the counter and the computer makes an FDC status check (at 0F0 hex).

After NMI, WRNMIREG goes low, clearing the counter and the NMI. The CPU now starts running the program it loads at 4300 hex. Fortunately, the circuit is easier to build than understand.

Construction

A circuit containing only three chips is ideal for building on a plated grid board. Radio Shack's Experimenter's printed circuit board (part number 267-170) makes layout and wiring simple, and results in a professional-looking product.

Placing the ICs 47LS00, 4040B, and 6116 from left to right seems to give the neatest wiring layout; control lines enter one end of the board and data lines exit the other (see Photo 1). You should use sockets for the two CMOS chips (at least) because of possible static and/or soldering damage. The chip pinouts and the wiring guide let you wire the board in an adult version of connect-the-dots (see Fig. 3).

Solder the IC power pins, Vcc and ground, to their respective rails above and below the main grid pattern. Use 30- to 24-gauge insulated wire for all jumpers. Next, solder in short runs, such as adjacent pins, with address lines and the remaining chip-to-chip lines following.

To keep layout simple, place tran-

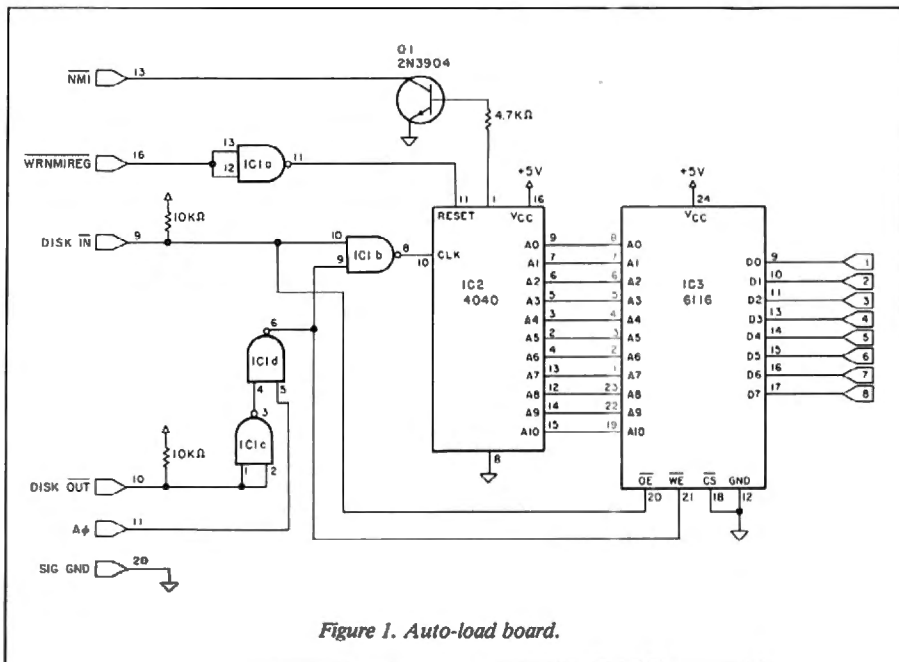


Figure 1. Auto-load board.

sistor Q1 between IC1 and IC2, with the emitter on the ground rail and the 4.7k base resistor connected directly to A11. Solder in the 18-inch control lines, Disk In, Disk Out, A0, and WRNMIREG to IC1, and NMI to the Q1 collector.

Once you've soldered the two pull-up resistors on IC1 and the eight data lines to IC3, you can install the power source. Mount the 7805 regulator above and to the left of IC1 with its pin 3 on the 5-volt rail. A calculator-type wall transformer capable of at least 100 milliamperes (mA) at a direct current (dc) voltage between 7.5 and 35 volts supplies power.

If you can't find a 20-pin in-line plug, cutting a 16-pin DIP header in half gives you two 8-pin in-line plugs. Referring to Fig. 4 for the FDC con-

ductor pin order, wire the eight data lines to the first eight pins and the five control lines to their respective locations. You'll also have to connect a lead from the auto-load board's negative rail to the computer chassis or to pin 20 for a signal ground.

You should carefully inspect the completed board for mistakes or shorts. Pay special attention to the data and control lines; an error here

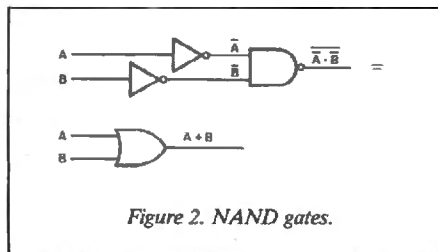


Figure 2. NAND gates.

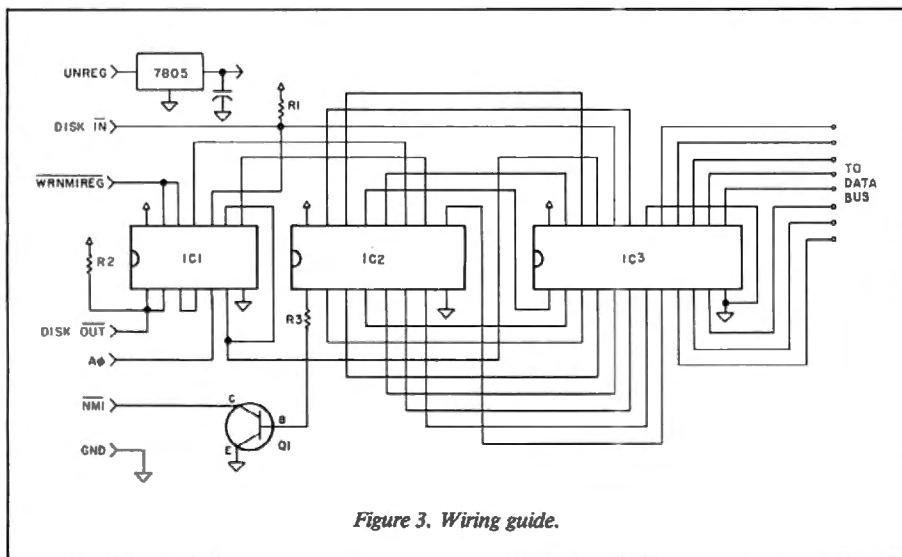


Figure 3. Wiring guide.

Port	Function
0F0 hex	Status/Command register
0F1 hex	Track register
0F2 hex	Sector register
0F3 hex	Data register

Table 1. FDC ports.

Location

000 hex-03 hex (03)
001 hex-0B7 hex (183)
002 hex-0B7 hex (183)
003 hex-0B7 hex (183)
004 hex-0B7 hex (183)
005 hex-0B7 hex (183)
006 hex-0B7 hex (183)

Table 2. FDC status reads.

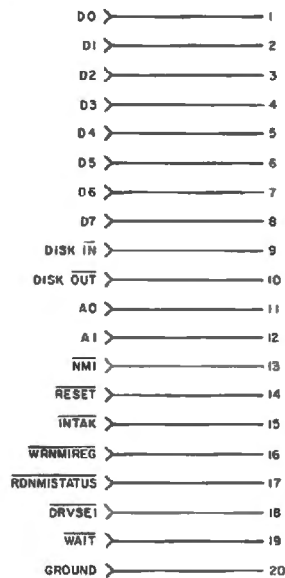


Figure 4. FDC connector pin order.

Part	Description
IC1	74LS00 Quad 2-input NAND gate
IC2	4040B 12-stage CMOS binary counter
IC3	6116 150 nanosecond CMOS 2K x 8 static RAM
Q1	2N2904 NPN transistor (or any general purpose NPN)
REG1	7805 5-volt 3-terminal register
P7	20-pin SIP connector or 16-pin header
R1-2	10k ohm 1/4 watt resistors
R3	4.7k ohm 1/4 watt resistor
PC1	Radio Shack PC board No. 276-170
T1	Wall transformer RS No. 273-1455
C1	25 µF 25 volt filter capacitor
Miscellaneous IC sockets, ribbon cable, 24 to 30 gauge wire	

Table 3. Parts list.

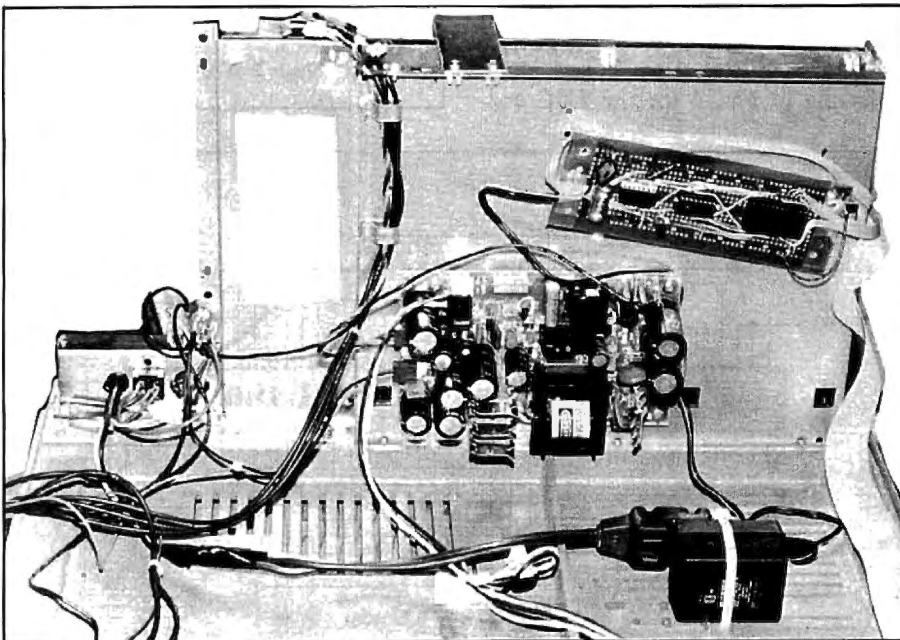


Photo 2. Installation of the auto-load board.

causes problems on the main CPU board. If all looks well, you can begin installing the auto-load board.

Installation

Installing the auto-load board voids Radio Shack's warranty. If you remain undaunted, tip your Model III upside down on a soft pad. Remove the 10 screws on the bottom—one is under the warranty seal—and the single screw on the computer's back.

Set the computer upright while holding the two halves together. Lift the upper section and tip it to the left to protect the video cable. Some models have a chassis shield covering the CPU board that you'll have to remove.

In the mass of chips before you, the FDC connector, named J7, is in the upper left corner.

Model IIIs equipped with an RS-232C or FDC interface have an 8-pin jumper from JP1A, above the Z80 CPU (U77), to JP1B, under the RS-232C connector (J7).

If you're using two 8-pin headers, plug them into J7 with a jumper installed from JP1A to JP1B. Since JP1A and B bring the data bus to J7 and 8, the board's data line can plug directly into JP1A.

Bolt the auto-load board, with spacers, to the keyboard side of the CPU's metal support (see Photo 2). Double-check your handiwork; errors can be costly. Since power is constantly on, you should splice a small receptacle into the alternating current (ac) power cord before the on/off switch. This receptacle mates with the transformer to supply the installed board with dc power.

Plug in the computer while it's still apart, the upper half lying on its side with the video cable connected. Using a voltmeter, measure the voltage from positive to negative rails, making sure it's within 10 percent of 5 volts.

Disconnect the ac power and install the chips into their respective sockets. Inspect the board carefully for proper orientation of pin 1 and bent pins before you plug in the computer again.

Hold the break key down while turning on the computer to bypass the ROM's attempt to read the auto-load board. Should strange things happen on the screen, turn off the computer; something's wrong with the installed board. If all is normal, the board is ready for testing.

Testing

Reassemble the computer and type in Program Listing 1 to see whether the

board reads and writes properly. If the numbers match several times, you've tested every line but NMI. Run Program Listing 2; when the loop has cycled 2,048 times, the NMI will invoke a restart to 0000 hex.

Now you can load the memory, using any program under 2K. Although programs begin at 4300 hex, you can store a block move for moving the remaining memory to any desired location.

Program Listing 3 is a Basic method for loading the board's chip with your own credits displayed. Turn on the computer while holding down the break key and type in Listing 3. If no errors occur in the data statement, run the program.

Enter a message, such as your name, at the question mark prompt. Press the enter key and the auto-load board is ready to use. Switch the computer off, wait a few seconds for the CPU to reset, then switch it back on. The screen should display your message.

Then hold down the break key and press the reset button. Load Radio Shack's Debug from cassette and enter Program Listing 4 at 5000 hex. This provides direct entry to machine language rather than Basic when you turn on your Model III.

Since Debug starts at 4332 hex and ends at 493F hex, it's ideal for automatic loading. DEFB's 7-byte string satisfies the FDC status reads, followed by the CASS? prompt and a jump to Debug. Press the J key and type in 5000 to run Listing 4. Reset the computer and the CASS? prompt will appear. Set the cassette rate as you would for Basic and Debug will fill the screen.

Any software you write for the auto-load board must allow for the FDC checks and the 4300 hex starting location. Since my forte is hardware, the programs presented here probably don't do the interface justice.

Enhancements

After a little use, I felt the board needed a few improvements. Battery back-up is both desirable and easy to add. You could have the chip-select pin (CS) on the 6116 chip switched high when not in use, reducing its draw from 30mA to about 2mA.

You can also replace the 74LS00 with a 74C00 or a 4011 (not pin-compatible), and the 6116 with a 6116L, the low-power version. This retains memory at only 2.2 volts.

Since the 6116 is pin-compatible with the single-supply 2716 EPROM, the computer doesn't need power to maintain memory, provided you con-

nect pin 21 to Vcc. Programs stored on EPROMs would then allow set-up similar to a ROM cartridge.

You can add memory by cascading A11 to another 4040B or 74LS93, creating additional address lines. You could use the present 2K as a memory circuit operating system connected to the Model III's input/output bus. Use two ports as address and control lines, and a third for data.

If you pull Q1's collector low, a non-maskable interrupt occurs. A normally open push-button, wired between

ground and Q1, forces a jump to 4049 hex when in Basic, and to 45ED hex after you use the auto-load board. This lets you create a user-defined key that has priority over other keys.

I'd like to hear of any further enhancements, unusual uses, comments, or questions concerning the auto-load board. ■

Contact John W. Snider at 35 Kirkland Ave., Swastika, Ontario, P0K 1T0, Canada.

```

10 INPUT X           'Test byte
20 OUT 228,0         'Reset address counter (E4H)
30 OUT 243,X         'Load 000H with X (Disk OUT-F3H)
40 OUT 228,0         'Reset address counter
50 PRINT INP(243);   'Read 000H (Disk IN-F3H)
60 GOTO 10           'Do again

```

Program Listing 1. Test for read and write functions.

```

10 X=0
20 OUT 228,0         'Reset address counter
30 OUT 243,255       'Disk OUT with 1's (PFH)
40 X=X+1: PRINT X;   'Watch while you wait
50 GOTO 30           'Do until NMI

```

Program Listing 2. Test for NMI restart.

```

10 OUT 228,0         'Reset address counter
20 'FDC status reads, call $VDLINE, and jump to Basic
30 DATA 3,183,183,183,183,183,183,33,15,67,205,27,2,195,175,55
40 FOR X=1 TO 16     '16 data bytes
50 READ A: OUT 243,A 'Read and load data
60 NEXT X           'Do 16 bytes
70 INPUT M$         'Get start-up message
80 FOR Y=1 TO LEN(M$) 'Do each character in message
90 OUT 243,ASC(MID$(M$,Y,1)) 'Output ASCII value
100 NEXT Y          'Repeat for all characters
110 OUT 243,13      'Carriage return for $VDLINE
120 PRINT "Auto Load ready - Press RESET to test"

```

Program Listing 3. Credit display.

```

5000                00100      ORG      5000H
5000 D3E4           00110      OUT      (0E4H),A ;RESET COUNTER
5002 211750        00120      LD        HL,5017H ;POINTER
5005 01F30D        00130      LD        BC,0DF3H ;# BYTES+PORT
5008 EDB3          00140      OTIR     ;5017H-5023H
500A 1607          00150      LD        D,07H ;7*256 BYTES
500C 210C43        00160      LD        HL,430CH ;PAD DEBUG
500F EDB3          00170      OTIR     ;OUT 1 BLOCK
5011 15            00180      DEC        D ;1 LESS BLOCK
5012 20FB          00190      JR        NZ,LOOP ;DO 7 BLOCKS
5014 C30949        00200      JP        4909H ;BACK TO DEBUG
5017 03            00210      DEFB     03H ;FDC READS
5018 B7            00220      DEFB     0B7H
5019 B7            00230      DEFB     0B7H
501A B7            00240      DEFB     0B7H
501B B7            00250      DEFB     0B7H
501C B7            00260      DEFB     0B7H
501D B7            00270      DEFB     0B7H
501E CD4230        00280      CALL     3042H ;CALL CASS?
5021 C30949        00290      JP        4909H ;JUMP TO DEBUG
5000                00300      END      5000H
00000 Total Errors

```

Program Listing 4. Entry to machine language.

Fast Backwards

by Ray Cadmus

CALC (Program Listing 1) provides an easy-to-use four-function calculator that incorporates a form of reverse Polish notation like that found in Hewlett-Packard calculators.

Reverse Polish notation is a way of writing mathematical equations that takes advantage of the way computers store and manipulate numbers to streamline the calculating process. Unlike algebraic equations, where mathematical operators appear in the conventional computational sequence, equations that use reverse Polish notation have the numbers before the operator. For instance, adding five and seven algebraically appears as $5 + 7$; in reverse Polish notation, this same operation is $5 7 +$.

The Program

In addition to the four basic math functions, CALC provides two special-function command keys. Function key 6 (labeled Dec on the display) lets you specify the number of decimal positions displayed in the result. Function key 5 (labeled \$ on the display) automatically formats the display to read out values in units of dollars and cents. When you press the \$ key, you toggle this function on and off.

To perform a mathematical calculation, key in a number

(two numbers for an initial calculation) followed by the desired function. As you enter the number, it appears on the left side of the screen. When you press the operation key, the entry clears and the result appears on the right side of the display. See Table 1 for additional active keys. The Figure depicts a series of possible entries and their results.

Note that the \$ function is engaged in the course of the calculation. Be careful in this mode. The program divides all entries by 100, so 1.00 followed by $20 \times$ results in .20—not the 20.00 you may expect.

The enter key acts like the + key and is an easier target to hit. Pressing any other key clears only the current entry; the total remains undisturbed.

You can expand the program to include your favorite functions: assign a key, test for it in the 50-series of program lines, and set up a routine to handle it as the 4000-series routines do.

The 3000-series of instructions define and activate function keys F1-F8. The screen statement in the third line in the program turns on the label display for the function keys. The Menu routine in line 4080 runs BSET (Program Listing 2), restoring the standard basic functions.

The 5000-series lines convert the current entry to a usable form and divide the value by 100 if you've turned on the \$ function.

The 6000-series lines display the total, after first clearing the screen. The decimal function in lines 4060 and 4062 modifies

Program Listing 1. CALC.

```

2 CLS
3 SCREEN0,1
5 GOSUB3000
6 MBASE$="###,###,###"
7 M$=MBASE$
8 LINE(10,6)-(73,17),1,B
9 LINE(126,6)-(239,17),1,B
10 PRINT@125,"Entry";
11 PRINT@145,"Result";
20 PRINT@42,STRING$(9," ");
25 V$=""
30 C$=INKEY$:IFC$=""THEN30
40 IFC$>"0"ANDC$<"9"ORC$="."THENV$=V$+
C$:PRINT@42,V$;:GOTO30
50 IFC$="+"ORC$="-"ORC$="CHR$(13)
THENGOSUB4010
51 IF C$="-"THEN GOSUB 4020
52 IFC$=";"THEN GOSUB 4030
53 IF C$="/"THEN GOSUB 4040
60 PRINT@62,USINGM$;T;
70 GOTO 20
3000 'SET KEYS
3001 KEY1,"+"
3002 KEY2,"-"
3003 KEY3,"X"
3004 KEY4,"/"
3005 KEY5,"$off":D%=0
3006 KEY6,"Dec"
3007 KEY7,"Clr"
3008 KEY8,"Menu"
3010 KEY ON
3020 ON KEY GOSUB
4010,4020,4030,4040,4050,4060,4070,4080
3030 RETURN
4010 GOSUB 5000:T=T+V:GOSUB 6000:RETURN
4020 GOSUB 5000:T=T-V:GOSUB 6000:RETURN
4030 GOSUB 5000:T=T*V:GOSUB 6000:RETURN
4040 GOSUB 5000:IF V<>0 THEN T=T/V:
GOSUB 6000:RETURN ELSE BEEP:RETURN
4050 IF D%THEN D%=0:KEY5,"$off"ELSE
V$="2": GOSUB 4060:KEY5,"$on":D%=1
4055 RETURN
4060 GOSUB 5000:IF V>6 THEN V=6
4062 M$=MBASE$+"."+STRING$(V,"#"):
GOSUB6000:RETURN
4070 T=0:PRINT@62,USINGM$;T;:RETURN
4080 RUN"bset"
5000 V=VAL(V$):V$="":PRINT@42,STRING$(
9," ")
5010 IF D%THENV=V/100
5020 RETURN
6000 PRINT@62,STRING$(20," ")
6010 PRINT@62,USINGM$;T;:RETURN

```

End

M\$, the print-using mask, as necessary. I've restricted the number of decimal places to no more than six in order to prevent line wrap. ■

Contact Ray Cadmus at 600 W. Lee, Moberly, MO 65270.

Thanks for the Memory

by Bradford N. Dixon
80 Micro Technical Editor

By now Model 100 owners are used to the machine's limited memory for storing text and programs. You can usually overcome this limitation, but a better solution is to find an inexpensive way to add memory to your machine.

Holmes Engineering (5175 Green Pine Drive, Salt Lake City, UT 84107; 801-261-5652) has the answer: their \$75 IM-100 8K RAM module is just what the doctor ordered for Model 100 users tired of out-of-memory errors (see Photo 1).

Each 8K memory module comprises a piggy-back unit of two printed circuit boards, one mounted atop the other, and plugs directly into the memory upgrade sockets inside the 100. Installing an IM-100 is so easy you can do it in the time it takes to read this article.

Getting It Together

First, collect the materials required for the installation: a Phillips-head screwdriver, a flat surface twice the size of the Model 100, and a soft towel to serve as a pad to protect the computer when you turn it over.

Then save all resident programs to tape because you'll switch off the RAM memory before removing the bottom of the computer.

Spread the soft cloth over the flat surface and turn the 100 over onto it. Turn off the RAM memory power switch and

remove the Model 100's four corner screws. Carefully turn the computer face up, letting the screws fall onto your work surface. Put the screws aside; you'll need them when the installation is complete.

Turn the computer face down again. If you try to separate the two halves of the computer at this point, you'll notice they're still locked together. You must first disengage locking tabs on each side and the top of the unit. When you separate the two halves of the computer, you'll see the RAM module sockets on the lower left corner of the CPU board (see Photo 2). If you have an 8K Model 100 you'll notice three empty sockets labeled M8, M7, and M6 from right to left. In a 24K unit, the M8 and M7 sockets are filled with 8K chips.

Installing the Modules

You install the IM-100 modules from right to left, so put your first IM-100 over the M8 socket. Make sure that the small notch at the end of the chip faces you. The IM-100 notch faces

The Key Box

The programs in "Fast Backwards," "Wipe Out," and "A New Pair of Shoes" run in 8K RAM. The program in "Account for Yourself" requires 24K RAM; a printer is optional.

Entry	Result
12+	12
12+	24
2;	48
3/	16
2dec	16.00
0dec	16.
clr	0.0
\$(off)	0.00
123+	1.23

Key	Function
+ =	Adds the current entry to the total or enter
-	Subtracts the current entry
/	Divides by the current entry
;	Multiplies by the current entry

Table 1 (above). CALC's active keys.

Figure (left). A series of calculations done in reverse Polish notation.

```

10 KEY1, "Files" +CHR$(13)
20 KEY2, "Load" +CHR$(34)
30 KEY3, "Save" +CHR$(34)
40 KEY4, "Run" +CHR$(13)
50 KEY5, "List" +CHR$(13)
60 KEY6, "?tre(0)" +CHR$(13)
70 KEY7, "Edit"
80 KEY8, "Menu" +CHR$(13)
90 MENU
    
```

Program Listing 2. BSET.

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- Bad News!** Model III disk BASIC programs only run at half speed on the Model 4.
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Other options enable your programs to run even faster - remove REM's, comments, down arrows, and unnecessary spaces.

Or, format your programs and make them easier to read and debug - insert down arrows and indent between multiple instructions, IF, THEN, and ELSE statements.

I agree. It's foolish to run my Model III disk BASIC programs at half speed on the Model 4. Send me "CONV3TO4" today! Enclosed is my check/money order for \$49.95 plus \$2.00 for shipping/handling (NJ res. add 6% sales tax).

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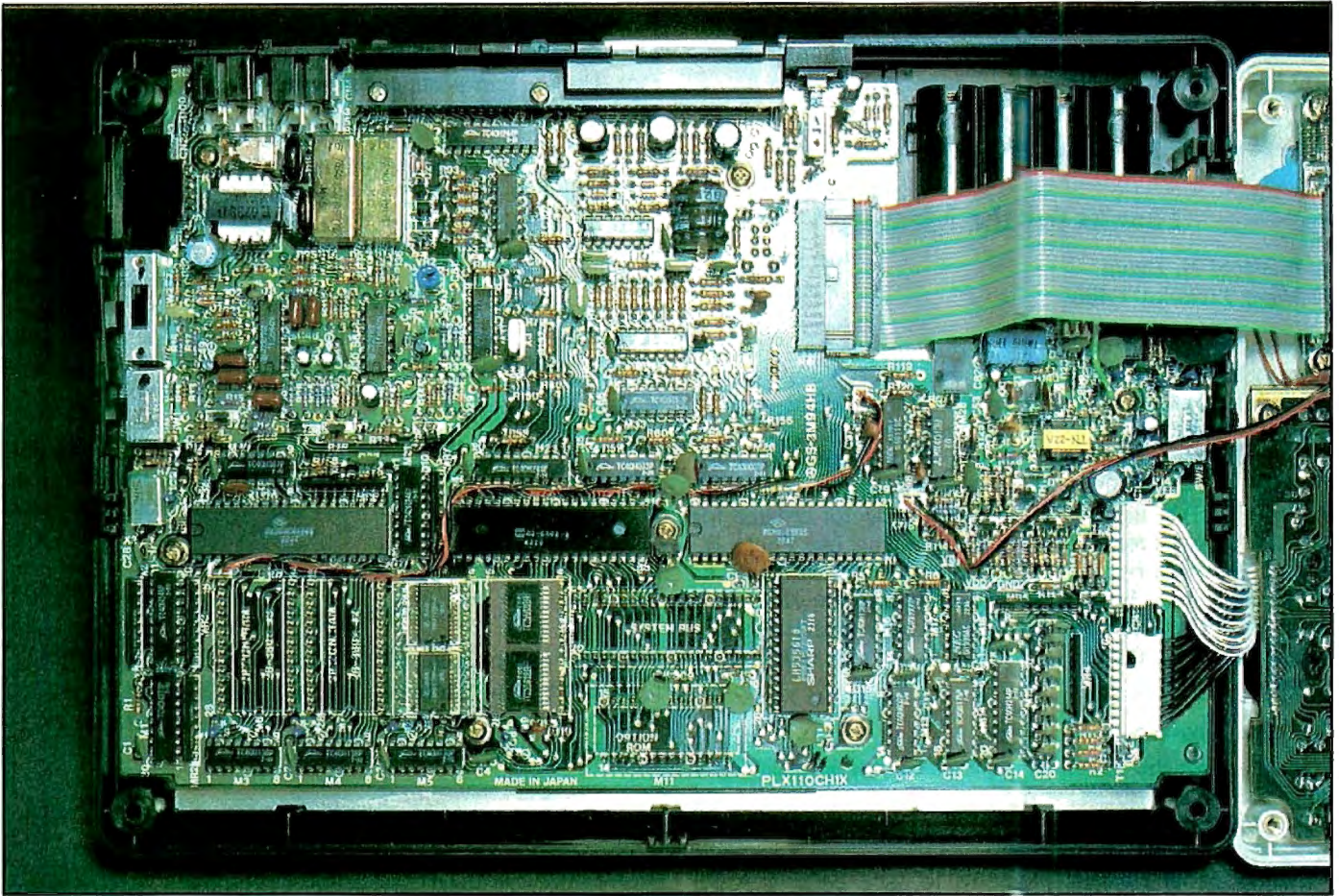


Photo 2. CPU board with RAM expansion sockets in lower left corner.

in the same direction as the notch in the 8K module already installed in the M9 socket (see Photo 3).

Be sure to align the pins on the IM-100 with the socket holes. Gently push the module into the socket until it's firmly in place. If you're installing more than one IM-100, repeat this procedure.

After you've installed all the modules, put the bottom of the Model 100 on top of the inverted keyboard and make sure that the side and top tabs lock.

Before you put the corner screws back in, push the RAM memory switch back on and look at the display. At the bottom of the display on an 8K machine, the total number of free bytes should now read 13,638. An upgrade to 24K reads 21,638, and a 32K total reads 29,638 bytes free. These amounts are lower than the upgrade itself because the operating system uses approximately 2,362 bytes of the RAM memory. If the RAM total is correct, turn the computer over once again and replace the four corner screws.

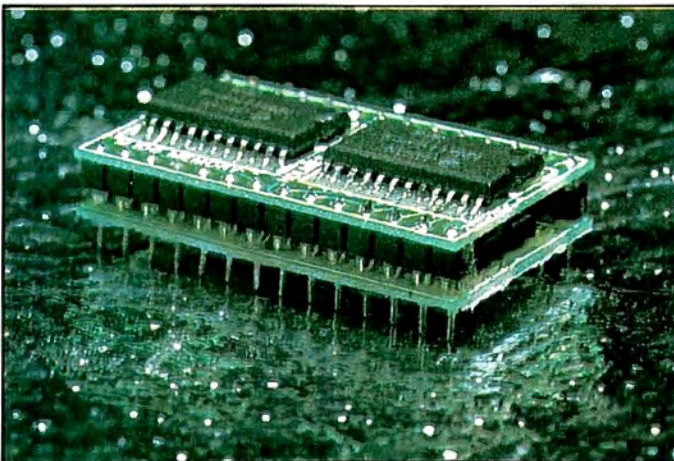


Photo 1. IM-100 8K RAM module.

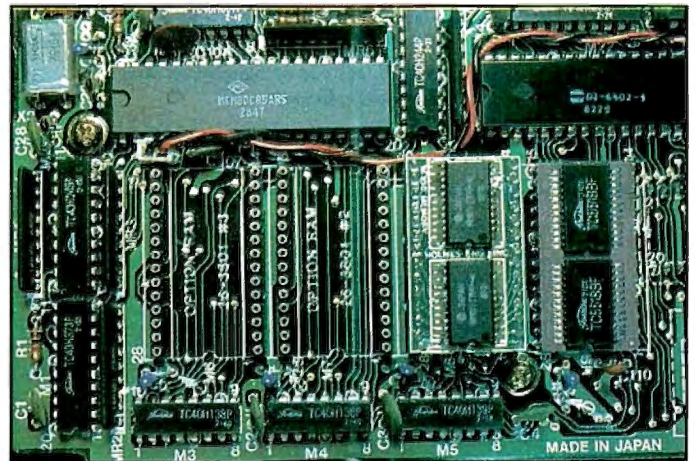


Photo 3. 8K module installed in M8 socket.

Solving Problems

I encountered only two problems in upgrading my 8K Model 100. First, the rows of pins on my IM-100 were too close together to slide neatly into the M8 socket. I had to bend one row out slightly to make the module fit.

The second problem appeared when I looked at the display after installing the module: I had only 13,254 bytes free. The new RAM module seemed to work fine otherwise. I downloaded the memory check program available free from Holmes's BBS (801-263-1103) and found that the original RAM and the IM-100 worked perfectly.

According to Walt Bascom, marketing director at Holmes, different models of the 100 allocate RAM differently for the operating system. As long as the upgrade is close to that noted in the instructions, everything is working properly. ■

Account for Yourself

by Mark Hickenbottom

Draw up a business expense report on the road or keep family budgets in order with Data Manager (see Program Listing 3). Data Manager maintains a spreadsheet and prints a columnar summary report.

The Program

On boot-up, Data Manager first asks if your printer has graphics capability. If so, answer yes. It then asks for the printer width, or the number of columns the printer can print. Enter the width or press the enter key if it is 80 columns wide.

Next, Data Manager displays the current file along with the six main menu options (create a new file, manage a file, add data to a file, print a report, display account balances, or quit the program) and repeats them in abbreviated form at the bottom of the screen near the Model 100 function keys (see Table 2). To select a particular option, press the function key aligned with that option.

Creating a File

Select this option to create a new data file. Data Manager first asks you to name the new data file and then specify a number of fields per record (the default is one).

For each field, the program asks a series of questions. When it asks for the field name, enter a name of no more than six characters. It then asks whether the field is numeric. If it is, answer yes. The program first prompts you for the width of the integer, then for the fractional portion of the field.

If the field isn't numeric, Data Manager asks for the field's width. In either case, if this isn't the last field, the program

asks whether you want the next field printed on the same line.

Data Manager then prompts you for the name of the amount field, the numeric field used to calculate account balances as well as the total when printing reports. Enter the name of the amount field you set up earlier, or press the enter key if you didn't include an amount field. The program then asks for the number of accounts (savings, checking, and so on). Enter the desired number of accounts or press the enter key to continue.

For each account, Data Manager asks a series of questions. It first asks for the account name, which must be fewer than 16 characters long, then the names of the check field and the check string. In the first check field case, a record only affects an account if the check field contains the check string. For example, a savings account is affected only when the category field contains Savings. If this is so, enter the names of the check field (Category) and the check string (Savings).

For the second check field case, a record only affects an account if the check field is not empty. For example, a checking account is affected only when there is some data in the check number field. If this is the case, enter the name of the check field and press the enter key to continue to the check string question. In either case, Data Manager then prompts you to enter the current account balance.

Managing a File

Select this option to add to, print a report of, or display account balances for a particular data file. When Data Manager prompts you, enter the name of the file you want managed.

Option	Description
new	Create a new file
man	Manage a file
add	Add data to a file
rep	Print a report
accs	Display account balances
end	Quit the program

Table 2. Data Manager's main menu options.

"Worksheet 100" — A Spreadsheet Program for the TRS-80™ * Model 100 Portable Computer

The "Worksheet 100" works with spreadsheets of up to 16 columns by 40 rows with 24K of RAM or up to 16 columns by 60 rows with 32K. Eight main functions using the programmable function keys plus three entry modes provide large spreadsheet convenience. The "Goto" function, doubling as a "search function", will speedily move the marker to any cell given coordinates, column and row labels or cell contents. Full arithmetic operators plus summation, averaging, maximum and minimum functions are provided.

Worksheets can be saved or loaded using RAM or cassette. A very useful group of worksheet templates (with formulas) is provided ready to load. These are "Expense Report", "Sales Report", "Service Report", "Weekly Schedule", "Personal Tax Worksheet", and "Personal Finances I and II".

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* TRS-80 is a trademark of Tandy Corporation

Adding Data to a File

Choose this option to add records to the end of the file. Data Manager displays brief instructions about the function keys. Once you've read the display, press any key. For each field name Data Manager displays, enter the necessary data. If you make a mistake, press the F1 key and then the enter key before pressing the enter key on the last field. Data Manager displays the field names again, letting you reenter the record. When you're done entering data, press the F2 key, then the enter key after pressing the enter key on the last field.

Printing a Report

Choose this option to print a columnar report of the data


file. The program displays a menu that lets you print all or selected records and a total of the amount field. To print only records that have a certain field containing a certain string, select one of the record-selection options. For a total of the amount field printed, select one of the print total options. Data Manager then asks you for the names of the check field and the check string.

The program asks for the header, which it prints at the top of every page. Once you've entered the header, Data Manager prints the report.

Displaying Account Balances


When you select this option, Data Manager displays all the account balances.

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188 • 80 Micro, March 1984

Expense Log Example

First determine how to set up the data file. An expense log requires the following information: month, day, category, name, description, check number, and amount. For this example, assume you want all the fields printed on the same line. The log also needs a checking account.

Run Data Manager and select the Creation option from the main menu. Type in EXPLOG.DO for the file name and 7 for the number of fields.

The month field allows a maximum width of two numbers. In this example, enter Month for the field name, no to the numeric question, 2 for the width, and yes for the same line question. The maximum width for the day field is two, so respond to the prompts in this field with Day, no, 2, and yes in sequence.

Expenses (for example, savings and food) belong in the category field, whose maximum width is eight characters. Enter Cat, no, 8, and yes in this field. The name field, with a maximum width of 18 characters, contains vendors' names—Radio Shack, for example. Enter Name, no, 18, and yes in this field.

Descriptions of merchandise delivered or services rendered ("Installed 8K RAM," for example) comprise the 20-character-wide description field. Enter Desc, no, 20, and yes to the prompts. The check number field has a maximum width of three characters (for a maximum of 999). Enter Check, no, 3, and yes. The amount field contains the amount of the transaction; its maximum integer width is five (for -9999.99), while its maximum fractional width is two characters. Enter Amount, yes, 5, and 2.

For this example, enter Amount for the name of the

amount field. Enter a 1 for the number of accounts and Checking for the account name. Records affect the checking account whenever the check number field is not empty. Enter Check for the name of the check field and press the enter key for the check string. Enter 200.00 for the balance.

Now select the Manage option by pressing the F1 key. Enter EXPLOG.DO as the file name.

Press the F2 key to select the Addition option. If you make a mistake entering any of the records, press the F1 key, the enter key, and then reenter the record. For the first record, enter 02 for the month, 12 for the day, xfer for the category, First Interstate for the name, deposit for the description, 000 for the check number, and 1000 for the amount. For the next record, enter 02, 12, food, Safeway, groceries, 237, and -23.89. For the next record, enter 02, 13, trans, Shell, gas, press the enter key, and then enter -12. At this point, the program displays the name of the first field of the next record. Press F2 and then the enter key.

Select the Report option and then the All-Records-With-Total option. After you enter Expense Log for the header, the program prints the report.

Now select the Accounts option. Data Manager displays the checking account balance, 1176.11. Press any key when you're ready to go back to the main menu.

Choose the End option to end the program and return to the Model 100 menu. ■

Contact Mark Hickenbottom at 28 Wrangler Court, Chico, CA 95926.

Program Listing 3. Data Manager.

```

0 CLEAR 1000:ON KEY GOSUB
1,2,3,4,5,6,7,8:KEY ON:GOTO 100
1 K=1:RETURN
2 K=2:RETURN
3 K=3:RETURN
4 K=4:RETURN
5 K=5:RETURN
6 K=6:RETURN
7 K=7:RETURN
8 K=8:RETURN
100 DIM FN$(30),FW(30),FF$(30),FSS$(30)
,RC$(30)
110 MS$="Configuring":GOSUB 10000
120 QU$="Can your printer print
graphics":GOSUB 11000
130 IF NO THEN 160
140 P1$=CHR$(188):P2$=CHR$(172):P3$=CHR$(
204):P4$=CHR$(181)
150 P5$=CHR$(202):P6$=CHR$(173):P7$=CHR$(
174):GOTO 170
160
P1$="":P2$="":P3$="":P4$="":P5$="":
P6$="":P7$="":
170 PW=80:INPUT "Printer width";PW
180 IF FL$="" THEN MS$="Data manager"
ELSE MS$="Managing "+FL$
190 GOSUB 10000:K=0
200 PRINT "man   Manage a file"
210 PRINT "add   Add data to file"
220 PRINT "rep   Print report"

```

```

230 PRINT "accs  Display account
balances"
240 PRINT "new   Create a new file"
250 PRINT "end   End data manager"
260 PRINT "man   add rep accs new
end";
270 IF K=6 THEN MENU ELSE IF K=0 OR K>5
THEN 270
280 ON K GOSUB
1000,2000,3000,4000,5000:GOTO 180
1000 AB=0:RL=0
1010 MS$="File selection":GOSUB 10000
1020 INPUT "File to manage";FL$
1030 OPEN FL$ FOR INPUT AS 1
1040 INPUT #1,FQ
1050 FOR F=0 TO FQ-1
1060   INPUT #1,FN$(F):INPUT #1,FW(F)
:INPUT #1,FF$(F):INPUT #1,FSS$
1070   IF FSS$="yes" THEN FF$(F)=FF$(F)+
":GOTO 1090
1080   FF$(F)=FF$(F)+CHR$(13)+CHR$(10)
:RL=RL+1
1090   NEXT
1100 INPUT #1,AF:INPUT #1,AQ:IF AQ=0
THEN 1140
1110 FOR A=0 TO AQ-1
1120   INPUT #1,AN$(A):INPUT #1,AF(A)
:INPUT #1,AC$(A)
1130   INPUT #1,OB(A):AB(A)=OB(A):NEXT
1140 INPUT #1,TH$:CLOSE:RETURN
2000 IF FL$="" THEN 2180
2010 MS$="Data addition":GOSUB 10000

```

Listing 3 continued

Listing 3 continued

```

2020 PRINT "During data addition,"
2030 PRINT "use the following function
keys:"
2040 PRINT "F1: Re-enter record."
2050 PRINT "F2: End adding data."
2060 GOSUB 12000
2070 OPEN FL$ FOR APPEND AS 1
2080 GOSUB 10000
2090 FOR F=0 TO FQ-1:K=0
2100   PRINT FN$(F);TAB(6);": ";
2110   LINE INPUT RC$(F)
2120   IF K=1 THEN 2080
2130   IF K=2 THEN 2190
2140   IF LEN(RC$(F))>FW(F) THEN 2100
2150   NEXT
2160 FOR F=0 TO FQ-1
2170   PRINT #1,RC$(F):NEXT
2180 GOTO 2080
2190 CLOSE:AB=0
2200 RETURN
3000 IF FL$="" THEN 3180
3010 AT=0:K=0:MS$="Report
generation":GOSUB 10000
3020 PRINT "all   Print all records"
3030 PRINT "allt  Print all records with
total"
3040 PRINT "sel   Print selected
records"
3050 PRINT "selt  Print selected records
with total"
3060 PRINT:PRINT
3070 PRINT "all allt sel selt";
3080 IF K=0 OR K>4 THEN 3080 ELSE IF (
K=2 OR K=4) AND AF=-1 THEN 3080
3090 CLS:IF K<3 THEN 3130
3100 INPUT "Field to check";FD$:GOSUB
13000
3110 IF FF=-1 THEN 3100
3120 INPUT "String to check for";FC$
3130 LINE INPUT "Header? ";HD$
3140 IF AB THEN 3170
3150 FOR A=0 TO AQ-1
3160   AB(A)=OB(A):NEXT
3170 PR=-1:GOSUB 14000
3180 RETURN
4000 IF FL$="" OR AQ=0 THEN 4080
4010 IF AB THEN 4040
4020 CLS:PR=0:FOR A=0 TO AQ-1
4030   AB(A)=OB(A):NEXT:GOSUB 14000
4040 MS$="Account balances":GOSUB 10000
4050 FOR A=0 TO AQ-1
4060   PRINT AN$(A);TAB(15);": ";AB(A)
:NEXT
4070 GOSUB 12000
4080 RETURN
5000 MS$="File creation":GOSUB 10000
5010 INPUT "File to create";FL$
5020 CLS:INPUT "Number of fields";FQ
5030 FOR F=0 TO FQ-1
5040   CLS:PRINT "Field";F

```

Listing 3 continued

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Listing 3 continued

```

5050 INPUT "Name";FN$(F)
5060 IF LEN(FN$(F))>6 THEN 5050
5070 QU$="Is field numeric":GOSUB
11000
5080 IF YES THEN 5120
5090 INPUT "Width of field";FW(F)
5100 IF FW(F)=1 THEN FF$(F)="!":GOTO
5160
5110 FF$(F)="\ "+SPACE$(FW(F)-2)+
"\":GOTO 5160
5120 INPUT "Width of integer
portion";WI
5130 INPUT "Width of fractional
portion";WF
5140 FW(F)=WI:FF$(F)=STRING$(WI,"#")
5150 IF WF>0 THEN FW(F)=FW(F)+1+WF:FF$
(F)=FF$(F)+". "+STRING$(WF,"#")
5160 IF F=FQ-1 THEN YES=0:GOTO 5180
5170 QU$="Is the next field on the
same line":GOSUB 11000
5180 IF YES THEN FS$(F)="yes" ELSE FS$
(F)="no"
5190 NEXT
5200 CLS:INPUT "Name of amount
field";FD$
5210 GOSUB 13000:AF=FF
5220 CLS:AQ=0:INPUT "Number of
accounts";AQ
5230 IF AQ=0 THEN 5330
5240 FOR A=0 TO AQ-1

```

```

5250 CLS:PRINT "Account";A
5260 INPUT "Name of account";AN$(A)
5270 IF LEN(AN$(A))>15 THEN 5260
5280 INPUT "Name of check
field";FD$:GOSUB 13000:AF(A)=FF
5290 IF AF(A)=-1 THEN 5280
5300 LINE INPUT "Check string? ";AC$(A
)
5310 INPUT "Account balance";AB(A)
5320 NEXT
5330 OPEN FL$ FOR OUTPUT AS 1
5340 PRINT #1,FQ:FOR F=0 TO FQ-1
5350 PRINT #1,FN$(F):PRINT #1,FW(F)
:PRINT #1,FF$(F):PRINT #1,FS$(F):NEXT
5360 PRINT #1,AF:PRINT #1,AQ:IF AQ=0
THEN 5390
5370 FOR A=0 TO AQ-1
5380 PRINT #1,AN$(A):PRINT #1,AF(A)
:PRINT #1,AC$(A):PRINT #1,AB(A):NEXT
5390 PRINT #1,"":CLOSE
5400 FL$="":RETURN
10000 CLS:ZL=INT((40-LEN(MS$))/2):ZR=40-
LEN(MS$)-ZL
10010 PRINT CHR$(27);"p";SPACE$(ZL)
;MS$;SPACE$(ZR);CHR$(27);"q";
10020 RETURN
11000 AN$="":PRINT QU$;:INPUT
AN$:AN$=LEFT$(AN$,1)
11010 IF AN$<>"y" AND AN$<>"Y" AND AN$<>
"n" AND AN$<>"N" THEN 11000

```

Listing 3 continued

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Wipe Out

by Thomas Robb

The conventional way to kill a file on the Model 100 is to load Basic and type in KILL followed by the file name and extension. I wrote a program that simplifies this process; Delete lets you erase unwanted directory files and programs with a single keystroke (see Program Listing 4).

I also wrote a related program, DIRTBL, that PEEKs into the Model 100's file directory to examine the directory table (see Program Listing 5).

Deleting Files

In the Delete program (see Listing 4), line 200 and the sub-routine in lines 1100-1125 clear the screen and display active RAM files through the Files command, with a delete prompt at the bottom of the screen. Line 220 forms the For...Next loop to examine the directory table entries.

Variable F% in line 1205 picks up each entry's directory flag. The program bypasses the file (that is, it doesn't display it with the delete prompt) if it isn't a valid entry (bit 7 doesn't equal 1), if it's one of the five ROM based programs (bit 4 equals 1), or if it's an "invisible" entry (bit 3 equals 1).

For all remaining files, line 1215 builds the ASCII file name in string variable FN\$ from this entry's directory table in bytes 4-11. Line 1217 bypasses Delete, then displays the file name beside the delete prompt. Typing an upper- or lowercase Y kills the file; any other response leaves the file intact.

The Directory Table

The directory table is located at RAM address F962 hexadecimal (63842 decimal), regardless of your unit's memory size. To see the table, in Basic type PRINT PEEK(63842). You should get back 176. An 11-byte directory entry manages each potential file in the system. There are 27 possible file entries in the directory table, 24 of which you can display on the menu and three "invisible" entries (i.e., they don't appear on the menu). The first byte, byte 1 of the 11-byte file entry, or the directory flag, contains the information listed in Table 3.

The directory flag for Basic reads B0 hexadecimal (260 octal) because bits 7, 5, and 4 are set. The flag is located at the first byte of the directory table, F962 hexadecimal (hex). The directory flags for the other four ROM-based programs (Text, TELCOM, ADDRSS, and SCHEDL) are the same; you'll

Listing 3 continued

```

11020 IF AN$="y" OR AN$="Y" THEN YES=-
1:NO=0
11030 IF AN$="n" OR AN$="N" THEN
YES=0:NO=-1
11040 RETURN
12000 IF INKEY$="" THEN 12000 ELSE
RETURN
13000 FOR F=0 TO FQ-1
13010 IF FN$(F)=FD$ THEN FF=F:GOTO
13030
13020 NEXT:FF=-1
13030 RETURN
14000 CLS:OPEN FL$ FOR INPUT AS 1
14010 FOR F=1 TO 4+4*FQ+4*AQ:LINE INPUT
#1,TH$:NEXT
14020 IF PR THEN GOSUB 15000
14030 IF EOF(1) THEN 14210
14040 FOR F=0 TO FQ-1:LINE INPUT #1,RC$(
F):NEXT
14050 IF AB OR AQ=0 THEN 14120
14060 FOR A=0 TO AQ-1
14070 IF AC$(A)="" THEN 14090
14080 IF RC$(AF(A))<>AC$(A) THEN 14110
ELSE 14100
14090 IF RC$(AF(A))="" THEN 14110
14100 AB(A)=AB(A)+VAL(RC$(AF))
14110 NEXT
14120 IF NOT PR THEN 14030
14130 IF K<3 THEN 14170
14140 IF FC$="" THEN 14160
14150 IF RC$(FF)<>FC$ THEN 14030 ELSE
14170
14160 IF RC$(FF)="" THEN 14030
14170 IF LS>=58 THEN GOSUB 16000:GOSUB
15000
14180 IF K=2 OR K=4 THEN AT=AT+VAL(RC$(
AF))
14190 FOR F=0 TO FQ-1
14200 FD$=RC$(F):GOSUB
17000:NEXT:LS=LS+RL:GOTO 14030
14210 IF NOT PR THEN 14300
14220 IF K=1 OR K=3 THEN 14290
14230 FOR F=0 TO FQ-1
14240 FD$=STRING$(FW(F),"-"):GOSUB
17000:NEXT:LS=LS+RL
14250 FOR F=0 TO FQ-1
14260 IF F=AF THEN FD$=STR$(AT):GOSUB
17000:GOTO 14280
14270 FD$=SPACE$(FW(F)):GOSUB 17000
14280 NEXT:LS=LS+RL
14290 GOSUB 16000
14300 CLOSE:AB=-1:RETURN
15000 FOR ZZ=1 TO 6:LPRINT "":NEXT
15010 LPRINT P1$;STRING$(PW-2,P2$);P3$
15020 ZL=INT((PW-2-LEN(HD$))/2):ZR=PW-2-
LEN(HD$)-ZL
15030 LPRINT P4$;SPACE$(ZL);HD$;SPACE$(
ZR);P5$
15040 LPRINT P6$;STRING$(PW-2,P2$);P7$
15050 LPRINT "":LS=10:RETURN
16000 LPRINT CHR$(12);:LS=0:RETURN
17000 IF INSTR(FF$(F),"#")=0 THEN LPRINT
USING FF$(F);FD$;:GOTO 17030
17010 IF VAL(FD$)<>0 OR FD$="" 0" THEN
LPRINT USING FF$(F);VAL(FD$);:GOTO 17030

17020 LPRINT SPACE$(FW(F)-LEN(FD$))
;FD$;RIGHT$(FF$(F),2);
17030 RETURN
    
```

End

Directory flag bits

Description

Bit 7*	1 = valid entry
Bit 6	1 = ASCII text file (extension is .DO)
Bit 5	1 = machine-language file (implied extension of .CO)
Bit 4	1 = ROM file
Bit 3	1 = "invisible" file
Bit 2	reserved
Bit 1	reserved
Bit 0†	internal use only

*MSB (most significant bit)
 †LSB (least significant bit)

Table 3. The first byte of the directory file entry.

find them at F96D hex, F978 hex, F983 hex, and F98E hex, respectively. The directory flag for an ASCII file, for example, is CO hex (300 octal) because bits 7 (valid entry) and 6 (ASCII file) are set.

Bytes 2-3 of each valid entry in the directory table give the first, or starting, address for that file. Byte 2 is the low-order byte; byte 3 is the high-order byte. (This may seem backward but it's consistent with the Model 100's 80C85 chip addressing scheme.) For Basic, this starting address works out to be 6C49 hex (27721 decimal). Bytes 4-11 of each valid entry contain the 8-byte ASCII file name.

Assuming a maximum of 24 files in the Model 100, I was surprised to find 27 entries in my directory table. As I'd expected, the first five entries are the ROM-based programs. The

```

190 DIRTBL=63842
200 FOR J%=1 TO 27
210 F%=PEEK(DIRTBL+(J%-1)*11)
220 HB%=PEEK(DIRTBL+(J%-1)*11+2)
225 LB%=PEEK(DIRTBL+(J%-1)*11+1)
230 PRINT "File" J% " " F% HB%*256+LB%;

240 FOR I%=3 TO 10
250 PRINT CHR$(PEEK(DIRTBL+(J%-1)*11+I%));
260 NEXT I%
265 PRINT
270 NEXT J%
    
```

Program Listing 5. DIRTBL.

```

100 ' Model 100 DIRECTORY file delete
      with QUERY
110 ' (C) 1983 by Thomas L. Robb,
      WBL, MN
120 '
200 CLS: FILES: GOSUB 1100: ' Display
      directory and prompt screen
210 DIR=63842 ' RAM Location of
      directory table (F962h)
220 FOR J%=1 TO 27: GOSUB 1200: NEXT '
      Consider all directory entries
230 CLS: MENU ' Exit
1100 '
1101 ' Display prompt screen
1102 XY%=282 ' PRINT @ position
1103 X1%=57: Y1%=53 ' Pixel coordinates
      for FILENAME hilite
1105 PRINT @XY%,"Delete";
1110 LINE (X1%,Y1%)-(X1%,Y1%+10): LINE
      (X1%,Y1%)-(X1%+58,Y1%): LINE (X1%+58,Y1%
      )-(X1%+58,Y1%+10) ' Hilite FILENAME
1115 PRINT @XY%+14," ";
1120 PRINT @XY%+19,"(Y/N)?" ;
    
```

Program Listing 4. Delete.

```

1125 RETURN
1200 '
1205 F%=PEEK(DIR+(J%-1)*11) ' Pickup
      FILE Directory flag
1210 IF (F%<128) OR ((F% AND 16)>0) OR
      ((F% AND 8)>0) THEN RETURN ' Bypass this
      FILE if NOT VALID entry, a ROM entry, or
      an INVISIBLE entry
1215 FN$="": FOR I%=3 TO 10: FN$=FN$+
      CHR$(PEEK(DIR+(J%-1)*11+I%)): NEXT '
      Build this entry's FILENAME
1217 IF FN$="DELETEBA" THEN RETURN ' DO
      NOT allow this program to be deleted
1220 PRINT @XY%+8,LEFT$(FN$,6);: PRINT
      @XY%+15,RIGHT$(FN$,2); ' Display this
      FILENAME
1225 PRINT @XY%+26," ";: PRINT
      @XY%+26,;: K$=INPUT$(1) ' Wait for user
      response
1230 IF K$="Y" OR K$="y" THEN PRINT @XY%
      +26,"Deleted";: KILL FN$ ELSE PRINT @XY%
      +26,"No";
1235 RETURN
    
```

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Program Listing 6. SHOOTR.

```

0 ' SHOOTR.BA CRAPS ON THE 100
5 ' BY RON BALONIS 11/24/3
10 CLEAR 200: DIM KUR(12), ODDS(12)
15 RVID$=CHR$(27)+"p": NVID$=CHR$(27)+"q"

20 ODD$=RVID$+"##"+NVID$
25 '---RANDOMIZE
30 T=VAL(RIGHT$(TIMES,2))
32 FOR I=1 TO T*3+7
34 X=RND(1)
36 NEXT I
38 FOR I=1 TO 12: '--- POINT CURSOR
40 READ KUR(I)
42 NEXT I
44 FOR I=1 TO 12: '--- POINT ODDS
46 READ ODD$(I)
48 NEXT I
50 CLS: '---MAKE THE GAME SCREEN
52 PRINT@203, "***** CASINO CRAPS
SIMUATION *****";
54 PRINT@289, "=== PRESS E TO EXIT ===";
56 PRINT@41, "CRAPS POINT WIN";
58 PRINT@67, "POINT CRAPS";
60 PRINT@81, " 2 3 4 5 6 7 11";
62 PRINT@106, " 8 9 10 12";
65 LINE(2,3)-(236,27),1,B
70 FOR X=2 TO 74 STEP 18
72 FOR Y=16 TO 26
74 PSET(X,Y): PSET(X+144,Y)
76 NEXT Y
78 NEXT X
80 FOR Y=4 TO 26
82 PSET(38,Y): PSET(92,Y): PSET(98,Y)
84 PSET(140,Y): PSET(146,Y): PSET(200,Y)
86 NEXT Y
95 '---COME OUT ROLL
100 PRINT@200, "CHANCES ARE: 22.2%";

105 PRINT " 67.7% 11.1%";
110 PRINT@286, "== PRESS SPACEBAR TO ROLL
==";
120 GOSUB 400: '---GET A ROLL
130 P0INT=DT0T: DT$=STR$(DT0T)
140 DT$=RIGHT$(DT$, LEN(DT$)-1)
150 IF INSTR("4568910", DT$) <> 0 THEN 200
160 IF DT0T=7 OR DT0T=11 THEN 360
170 PRINT@286, "*** CRAPS! SHOOTER
LOSES ***";
175 RUN
180 '
190 '---POINT ESTABLISHED
200 PRINT@41, "ROLL ";: PRINT@74, "ROLL ";
210 PRINT@58, "LOSE";: PRINT@98, " 7 ";
220 PRINT@114, "11";
230 PRINT@KUR(DT0T), USING ODD$: DT0T;
240 PRINT@280, " % CHANCE";
250 PRINT " <PRESS SPACEBAR TO ROLL>";
260 PRINT@280, USING "##.#": ODD$(P0INT);
290 '
300 GOSUB 400: '---GET A ROLL
320 IF P0INT=DT0T THEN 360
330 IF DT0T <> 7 THEN 300
340 PRINT@280, SPACE$(39);
350 PRINT@286, "***** SHOOTER LOSES! ***
**";
355 RUN
360 PRINT@280, SPACE$(39);
365 PRINT@286, "***** SHOOTER WINS! ***
**";

```

sixth entry is an "invisible" file (directory flag is 88 hex) located at C602 hex in my machine with a file name of Suzuki. The seventh entry, also an invisible ASCII file, is named Hayashki. The eighth entry is always an invalid entry, but the only one with a directory flag of 00 hex. Files 9-27 are valid files.

ASCII file Hayashki is an empty file (that is, its first byte is the end-of-file sentinel, control-Z). The Suzuki file contains two 00 hex bytes. Obviously, these are not user files—perhaps they represent the "fingerprint" of someone associated with the design of the machine. David Sumner's memory map (*80 Micro*, December 1983, pp. 232 and ff.) shows Suzuki to be any Basic program not yet saved to RAM and Hayashki to be the end address of documents.

To display the directory in your machine, run the short program in Listing 5. You'll see the directory flag, starting address, and name of every file in the DIRTBL. ■

You can reach Thomas Robb at 2632 Sumac Ridge, White Bear, MN 55110.

A New Pair of Shoes

by Ronald F. Balonis

SHOOTR simulates a casino craps game with a success probability readout at each roll to help you develop a gambler's most important skill—knowing when to quit (see Program Listing 6). Although the program doesn't let you make bets, it'll give you an idea of the odds you're up against in craps.

The Game

The outcome of craps depends on the throw of the dice. There are 36 ways a pair of dice can make number totals of from 2 to 12; the odds range from 1 in 36 for a 2 or a 12, to 1 in 6 for a 7. In casino craps when your first, or come-out, roll results in a 7 or an 11, you win immediately. A roll of 2, 3, or 12 is an immediate loss (craps), while a roll of 4, 5, 6, 8, 9, or 10 means you have established a point and can roll again. Your point value appears on the display in inverse video.

From then on, you continue to roll the dice until you either

```

370 RUN
390 '---ROLL THE DICE
400 POKE 65450,0: '---CLEAR KEYBOARD QUEUE
410 X=RND(1): KB$=INKEY$
420 IF KB$="E" THEN MENU
430 IF KB$<>" " THEN 410
450 '
490 '
500 PRINT@160, SPACE$(120);
510 D1=INT(RND(1)*6+1)
520 D2=INT(RND(1)*6+1)
530 X=65: Y=31: DIE!=D1: GOSUB 1000
540 X=150: Y=31: DIE!=D2: GOSUB 1000
550 DT0T=D1+D2: RETURN
900 '
1000 '---DIE GRAPHICS
1010 LINE (X+1,Y+1)-(X+21,Y+21),1,B
1020 ON DIE! GOSUB

```

Listing 6 continued

lose with a roll of 7, or win when you roll the point value you set in your first roll. All other number combinations represent points or rolls, which let you continue shooting the dice. Success in this game is determined by the betting strategy at each throw of the dice.

The Program

SHOOTR's algorithm is almost a direct coding of the game's rules and play sequence. To roll the dice, press the space bar. To exit the game, press the E key instead of the space bar.

The lines of code before line 100 define the come-out roll screen and initialize variables. The program processes the first roll between lines 100 and 200. It then displays an immediate win or loss, and, after a short delay, the first screen appears.

Then the program continues at lines 200-400; you roll until you get a 7 to lose or your point to win.

Lines 400-550 form the dice-rolling routine and lines 1000-1700, the dice graphics routine. The program uses the Model 100's pseudorandom function to roll the dice, and to make them natural, randomizes them in lines 30-36 and 400.

Lines 100 and 260 display the odds of making a number at each roll.

With practice, you'll become a hot shooter who knows when to bet big. ■

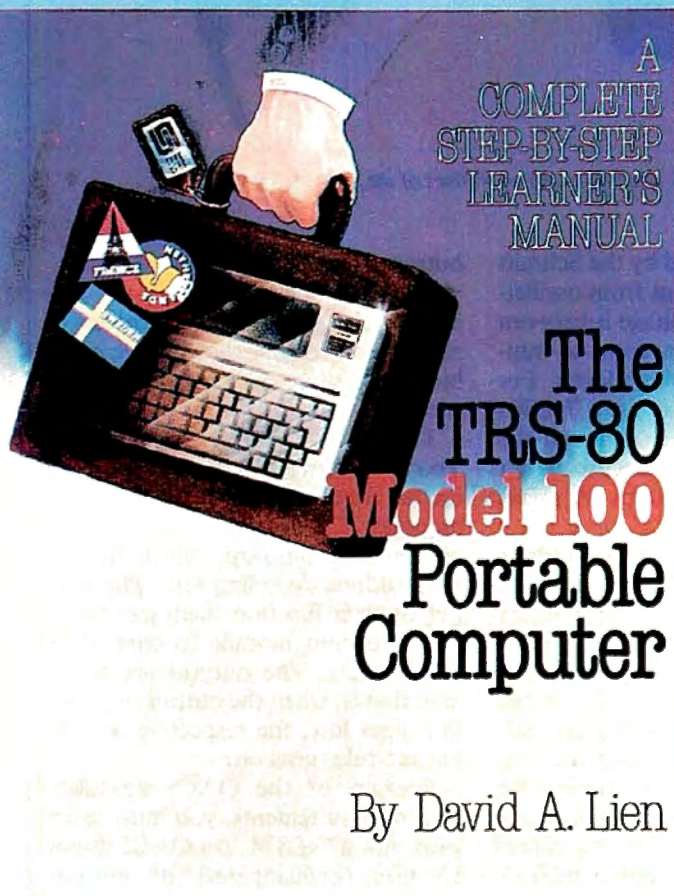
You can reach Ronald F. Balonis at 118 Rice St., Trucksville, PA 18708.

Listing 6 continued

```

1100,1200,1300,1400,1500,1600
1030 RETURN
1090 '---ONE DOT
1100 LINE(X+10,Y+10)-(X+12,Y+12),1,BF
1120 RETURN
1190 '---TWO DOTS
1200 LINE(X+4,Y+4)-(X+6,Y+6),1,BF
1220 LINE(X+16,Y+16)-(X+18,Y+18),1,BF
1230 RETURN
1290 '---THREE DOTS ONE + TWO
1300 GOSUB 1100:GOTO 1200
1390 '---FOUR DOTS TWO + TWO
1400 LINE(X+4,Y+16)-(X+6,Y+18),1,BF
1450 LINE(X+16,Y+4)-(X+18,Y+6),1,BF
1480 GOTO 1200
1490 '---FIVE DOTS FOUR + ONE
1500 GOSUB 1400:GOTO 1100
1590 '---SIX DOTS TWO + FOUR
1600 LINE(X+4,Y+10)-(X+6,Y+12),1,BF
1650 LINE(X+16,Y+10)-(X+18,Y+12),1,BF
1700 GOTO 1400
4900 '
5000 '---POINT CURSOR TABLE
5010 DATA 0, 81, 84, 87, 90, 93
5020 DATA 0,105,108,111,114,117
5030 '---CHANCE OF MAKING POINT TABLE
5040 DATA 0.0, 0.0, 0.0,33.3,40.0,45.4
5050 DATA 0.0,45.5,40.0,33.3, 0.0, 0.0
6000 '-----END OF PROGRAM

```



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The board is as simple to operate as it is to build—you control it with a short Basic program (see the Program Listing).

The Output Module

Opto 22's OAC5 ac output module (see Fig. 1 for a simplified functional diagram) is the primary component of this month's project. There are four pins on the module, two for dc control and two for ac output. The OAC5 uses an internal opto-isolator to isolate the ac and dc sections.

When current passes through the internal light-emitting diode (LED), the phototransistor switches on the triac, turning on the ac device. The OAC5 operates in the range of 12–140 volts (V) ac and handles a load of up to 3 amperes (A), or 360 watts (W) at 120 V.

Constructing the AC Control Board

The schematic for the TRS-80 ac control board shows pin numbers in parentheses for the Model III (see Fig. 2). I use an on-board terminal strip (see the Photo) and keep the ac wiring separate. You need only four integrated circuits (ICs) for this board: a 74LS138, 74LS32, 74LS14, and a 7474 (see Table 1 for a parts list). The 74LS14 is a hex inverter Schmitt trigger.

Since one of the inverters has a resistor-capacitor (R-C) network at its input, the hysteresis (a reluctance to

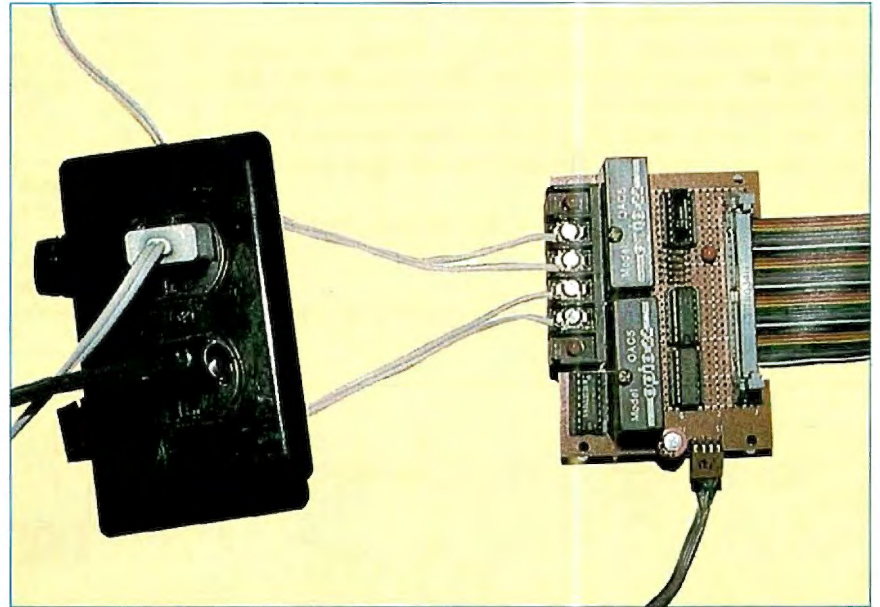


Photo. Electronics and ac portions of the finished project.

switch states) provided by the Schmitt trigger keeps the output from oscillating when the input voltage is between the defined TTL (transistor-to-transistor logic) low and high levels. For this application you can use a 74LS04 hex inverter in a pinch (though it's poor design practice), since it won't matter if the 7474 flip-flops are preset repeatedly.

The 74LS138 provides the address decoding for the 7474 flip-flops. As in last month's project, I give you the choice of an address range in case you have another device using a conflicting address. The dotted lines in the schematic (Fig. 2) indicate the address I used in my own construction and in later examples. See Table 2 for addresses that various combinations provide. (The slash in the table represents the respective inverted address

output from the inverter.)

I've specifically designed the addresses in this and in other projects in my column so that they can be combined and share common address decoding.

The 7474 is a dual D-type flip-flop. You use the two flip-flops to latch the on/off condition of the two ac output modules. The computer switches and selects each flip-flop, which has its own address decoding line. The output of each flip-flop then goes to an OAC5 output module to control its on/off state. The outputs are active low; that is, when the output of a flip-flop goes low, the respective ac output module turns on.

Because of the OAC5 module's current requirements, you must use a 7474, not a 74LS74. An OAC5 draws 12 mA (milliamperes) of current

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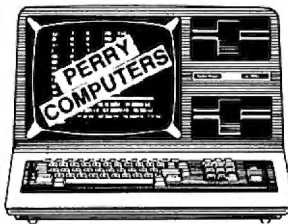
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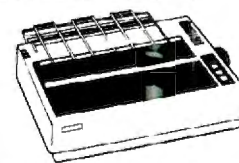
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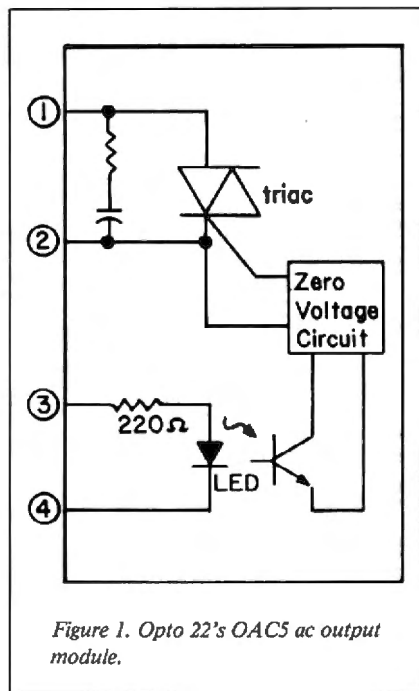


Figure 1. Opto 22's OAC5 ac output module.

when turned on. The maximum low-level output current (I_{OL}) specification for the 7474 is 16 mA, well within the 12 mA requirement of the OAC5. The 74LS74, however, has a maximum I_{OL} specification of only 8 mA, lower than necessary.

The OAC5 ac output modules are normally open; that is, the connected ac device is kept off until the computer tells the OAC5 to turn it on. So even if the OAC5 circuitry receives no power, the ac device remains off. You must know and control the on/off state of the device at all times, regardless of the power state of the controlling electronics.

It's also important that the controlling digital circuitry power-up to a known and proper condition. This usually means that the digital control lines to the OAC5s must be high and remain high immediately after power-up, until altered by the computer. The schematic indicates how to implement this feature (see Fig. 2).

The input to one of the 74LS14 inverters (pin 13) has an R-C network connected to it, as I've mentioned. This network and the attached inverter keep the 7474 preset pins active (low) for approximately 33 milliseconds after you turn on the computer. This presets the flip-flops to the high output state, keeping the OAC5s in the off state. You preset the flip-flops

Quantity	Description	Manufacturer	Part Number	Price
1	74LS138	DIGI-KEY		\$0.66
1	74LS14	DIGI-KEY		0.64
1	74LS32	DIGI-KEY		0.43
1	7474	DIGI-KEY		0.46
5	3.3K resistors	DIGI-KEY		0.50
1	100 µf capacitor	Radio Shack	272-1028	0.79
1	10 µf capacitor	Radio Shack	272-1025	0.59
2	red LEDs	Radio Shack	276-041	0.79
2	OAC5 ac modules	Washtenaw Digital Systems		10.50
1	ac outlet			
1	outlet box			
1	outlet plate			
1	ac plug			
-	ac line cord			
2	fuse holders	Radio Shack	270-364	0.89
2	fuses			
1	4-pin power connector			
1	8-inch piece of 40-conductor ribbon cable*	DIGI-KEY		
1	8-inch piece of 50-conductor ribbon cable†	DIGI-KEY		
1	40-pin edge connector*	Radio Shack	276-1558	4.95
1	50-pin edge connector†	Radio Shack	276-1566	4.95
1	40-pin cable header*	3M	3432-4205	
1	50-pin cable header†	3M	3433-5205	
1	40-pin socket connector*	3M	3417-6000	
1	50-pin socket connector†	3M	3425-6000	

*Model I
†Model III

The OAC5 AC modules are available from the author c/o Washtenaw Digital Systems, P.O. Box 2014, Ann Arbor, MI 48106. Please include \$1 per order for shipping and handling. Michigan residents should add 4 percent sales tax. DIGI-KEY Corp. is located at Highway 32 S., P.O. Box 677, Thief River Falls, MN 56701.

Table 1. Parts list and ordering information.

any time you reset the computer, either by turning it on or by depressing the reset button.

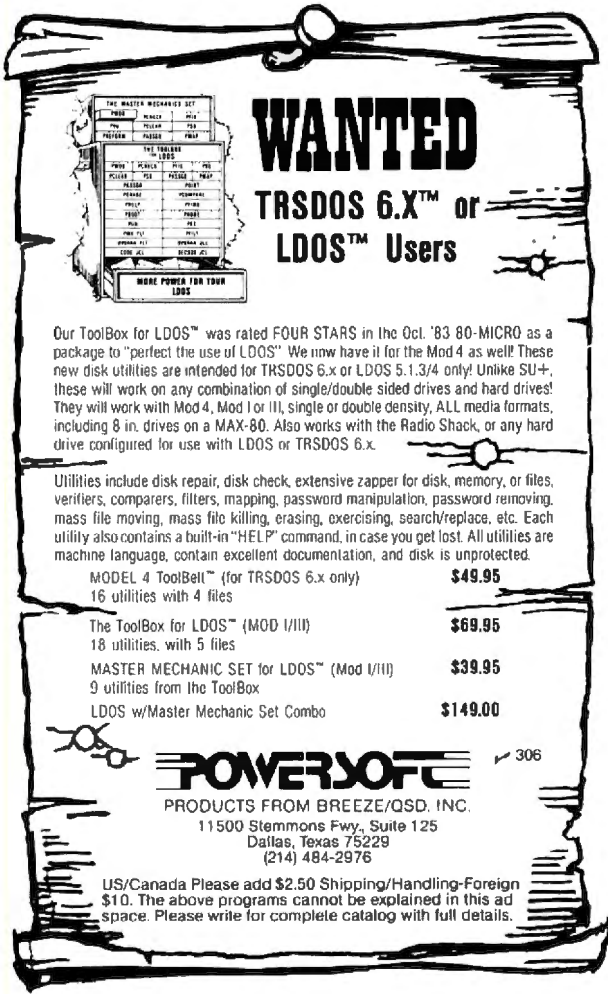
Two external red LEDs on the board (labeled LED1 and LED2 in Fig. 2) indicate when the respective OAC5 module is on. They turn on each time the respective flip-flop output goes low, regardless of the state of the attached ac device, and even if no device is attached.

Components for the Project

I used parts available at any hardware store—an ac wall outlet, an outlet box, and a cover plate—for my in-

terface to the ac devices (see the Photo). You can place the fuses for each ac module on the electronics board, if room permits (see Fig. 2). I put my fuse holders in the ac outlet box (see the Photo). You must use fuses so as not to destroy the electronics through some ac fault—a short, for example. The maximum fuse rating is 3A, but you can use a smaller one, depending upon the requirements of the ac device you want to control.

Figure 2 shows the wiring for the ac portion of the project. The outlet has two three-prong ac sockets, the ground connection of which is not



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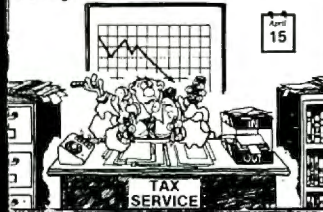
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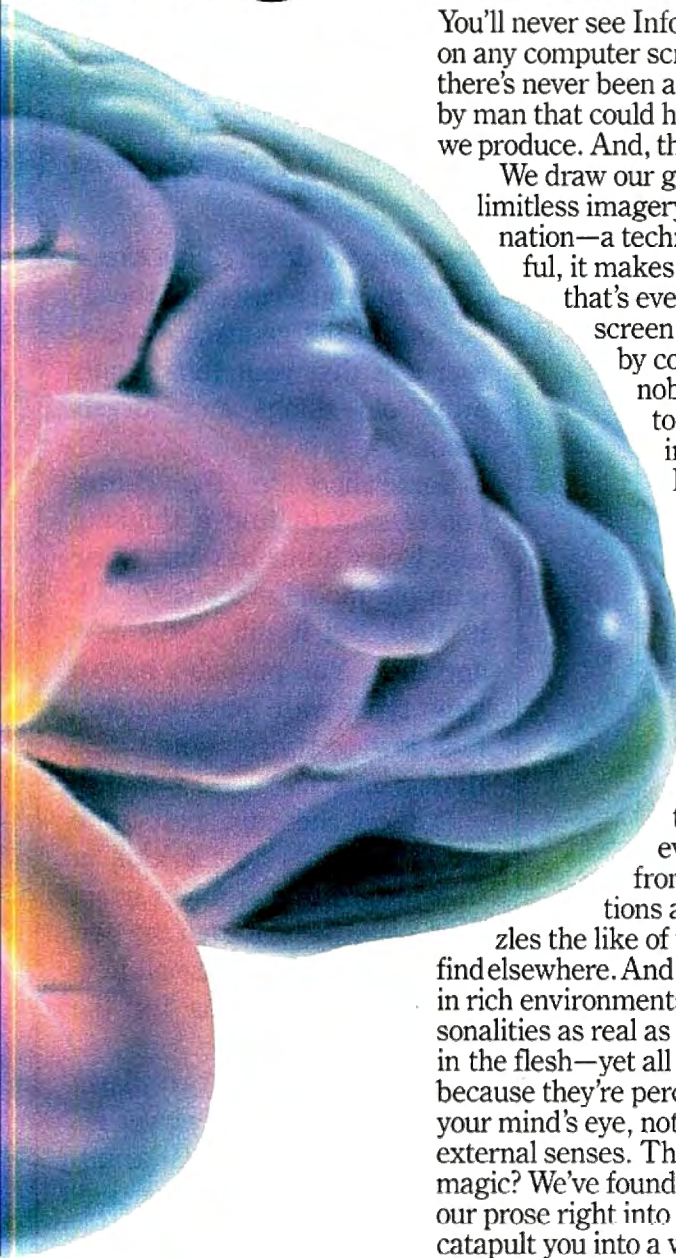
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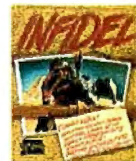
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Thinking Cap

by Richard Ramella

```

100 REM * BOXWORDS * TRS-80 LEVEL II BASIC *
110 REM * FUN HOUSE * MARCH '84 * RICHARD RAMELLA
120 DATA A,E,I,O,U,B,C,D,F,G,H,J,K,L,M,N,P,Q,R,S,T,V,W,X,Y,Z
130 CLEAR 250
140 DIM D$(26)
150 DEFSTR F
160 P=15360
170 G$=CHR$(32)
180 CLS
190 FOR A=1 TO 26
200 READ D$(A)
210 NEXT A
220 C$=CHR$(191)
230 INPUT "FIRST PLAYER'S NAME";A$
240 CLS
250 INPUT "SECOND PLAYER'S NAME";B$
260 H=85
270 CLS
280 FOR X=0 TO 40
290 IF X=0 OR X=20 OR X=40 THEN FOR Y=X+64 TO X+384 STEP 64: PRI
NT @ Y,C$;: NEXT
300 PRINT @ X,C$;
310 PRINT @ X+384,C$
320 NEXT X
330 Y=28
340 FOR X=0 TO 80
350 SET(X,Y)
360 NEXT X
370 PRINT @ 513,A$;
380 PRINT @ 534,B$;
390 FOR N=1 TO 20
400 A=RND(2)
410 IF A=1 THEN E$=D$(RND(5)) ELSE E$=D$(RND(20)+5)
420 G=65
430 H=85
440 PRINT @ G,E$;
450 PRINT @ H,E$;
460 FOR M=109 TO 10 STEP -1
470 F=INKEY$
480 J=G
490 K=H
500 IF F="W" AND PEEK(P+G-64)=32 THEN G=G-64
510 IF F="P" AND PEEK(P+H-64)=32 THEN H=H-64
520 IF F="A" AND PEEK(P+G-1)=32 THEN G=G-1
530 IF F="L" AND PEEK(P+H-1)=32 THEN H=H-1
540 IF F="S" AND PEEK(P+G+1)=32 THEN G=G+1
550 IF F=";" AND PEEK(P+H+1)=32 THEN H=H+1
560 IF F="Z" AND PEEK(P+G+64)=32 THEN G=G+64
570 IF F="." AND PEEK(P+H+64)=32 THEN H=H+64
580 PRINT @ J,G$;
590 PRINT @ K,G$;
600 PRINT @ G,E$;
610 PRINT @ H,E$;
620 PRINT @ 640,"TIME:";INT(M/10);G$;
630 NEXT M,N
640 PRINT @ 728,"GAME ENDS. SCORE POINTS.";
650 END

```

Boxwords.

Before we do anything else, I want you to go up in the attic, out in the garage, or wherever it is that your family puts away old things and forgets them.

Somewhere in the clutter you're sure to find a thinking cap. Every home has one. Mine is an old model made way back in 1940, but it still works now and then. You probably have a new type with push-buttons, high-low settings, and dual thinker-mods.

Put on the cap, pull up a chair, and let's take a look at four programs that might strain the ultrasettings of even the best thinking cap. These are all Level II Basic programs for the Models I and III.

Boxwords is a two-player game in which each player attempts to spell words across and down from the same pool

The Key Box

Models I and III

4K RAM

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of randomly provided letters.

Nulló is a number puzzle that arranges itself in a logical way. You can always untangle it, but the answer isn't always evident.

Before and After is a quick-paced alphabetizing puzzle game.

Last, let me introduce a guest star who has traveled all the way from Michigan to visit the Fun House this month. Jerry Neidenbach teaches computer programming in Drayton Plains, MI. He sent a thinking cap program called Petals Around the Rose that's so good I'm saving it for last.

Let's start the thought process.

Boxwords

You can play this game alone but it's more fun with two people. When you type RUN and tap the enter key, the program asks each player in turn to type his name and tap the enter key.

Then the program draws two boxes. Player 1 has the left box and should sit to the left. Player 2 has the right box. If you forget, look for your name beneath your box.

Beneath the names is a line and a timer that starts at 10 and goes to zero. When the timer starts, each player sees the same letter appear in the top left corner of his box.

The aim is to maneuver your letter anywhere in the box so you can use later letters to form words across and down. You might use Scrabble rules to keep things straight.

Each player uses a different set of keys to move the letter. Player 1 on the left uses W for north, A for west, Z for south,

and S for east. Player 2 on the right uses P for north, L for west, the period for south, and the semicolon for east.

You have until the timer gets to zero to put your letter where you want it. It freezes in position when time is up for the round.

Each player has the same 20 letters with which to form words in 20 rounds. How differently each uses these letters can be surprising.

Legality of words and scoring are up to the players. I suggest counting one point for each letter in completed words. I also suggest a penalty of 10 points if any two or more touching letters running across or down don't form an acceptable word.

Nulló

Nearly every time you run this puzzle, it will be different and possible to win. The puzzle builds itself in the reverse of the

```
100 REM * NULLO * TRS-80 LEVEL II BASIC *
110 REM * FUN HOUSE * MARCH 1984 * RICHARD RAMELLA
120 CLS
130 CLEAR 500
140 DEFSTR A
150 PRINT CHR$(23)
160 N$=CHR$(191)+STRING$(3,128)+CHR$(191)
170 A="0000000"
180 FOR X=1 TO 10
190 RANDOM
200 B=INT(RND(8)*LEN(A))
210 IF B<3 OR B+4>LEN(A) THEN 200
220 C=RND(9)
230 V$=RIGHT$(STR$(C),1)
240 IF B=3 THEN A=V$+LEFT$(A,3)+V$+MID$(A,B+1,LEN(A)-B): GOTO 27
250 R$=RIGHT$(A,LEN(A)-(B+3))
260 A=LEFT$(A,B)+V$+MID$(A,B+1,3)+V$+R$
270 PRINT @ 64,A;
280 NEXT
290 Z=126
300 X=1
310 Z$=STRING$(1,128)+CHR$(191)+STRING$(1,128)
320 PRINT @ Z,Z$;
330 PRINT @ 160,Y$;
340 M$=INKEY$
350 IF M$="," AND Z>126 THEN Z=Z-2: X=X-1
360 Q=124+(2*LEN(A))
370 IF M$="." AND Z<Q THEN Z=Z+2: X=X+1
380 IF M$="R" AND X>4 AND MID$(A,X,1)<>"0" THEN GOSUB 440
390 PRINT @ Z,Z$;
400 IF A="0000000" THEN 620
410 PRINT @ 300,"SCORE:"INT(LEN(A)/2)-3;
420 PRINT @ 64,A;STRING$(2,128);
430 GOTO 340
440 IF MID$(A,X,1)=MID$(A,X-4,1) THEN 540
450 FOR H=1 TO 10
460 PRINT @ Z-6,N$;
470 FOR T=1 TO 10
480 NEXT T
490 PRINT @ 128,STRING$(32,128);
500 FOR T=1 TO 10
510 NEXT T
520 NEXT
530 RETURN
540 IF X=5 THEN A=MID$(A,2,3)+RIGHT$(A,LEN(A)-X): GOTO 560
550 A=LEFT$(A,X-5)+MID$(A,X-3,3)+RIGHT$(A,LEN(A)-X)
560 PRINT @ Z+1,STRING$(1,128);
570 X=1
580 Z=126
590 PRINT @ 128,STRING$(32,128);
600 PRINT @ 64,A;STRING$(2,128);
610 RETURN
620 PRINT @ 290,"W-I-N-N-E-R 1";
630 GOSUB 670
640 PRINT @ 290,STRING$(13,128)
650 GOSUB 670
660 GOTO 620
670 FOR T=1 TO 50
680 NEXT T
690 RETURN
700 END
```

Nulló.

way you must solve it, so if the program had only one puzzle, you'd get tired of it quickly.

When you type RUN and tap the enter key, a string of large numbers builds itself on the screen. Below the puzzle line is a white cursor that shows your position. The action you take in this game is from this position.

To make the cursor move, tap the left-arrow key to go left and the right-arrow key to go right. Don't press the enter key after any move in the game.

You score points and shorten the puzzle string by eliminating two identical numbers at a time. However, these two identical numbers must be separated by

three other numbers, and the cursor must be below the number on the right that you want to remove.

For example, part of the puzzle string reads 34563. You position the cursor beneath the number 3 on the right. Then you tap the R key for remove. The two 3's disappear, and your score is reduced by one.

A perfect score is zero, and at that point the string only has seven zeros in it. If you reach that stage the program names you the winner. You will recognize losing situations because you won't have any good moves left.

Also, it won't work if you try to eliminate zeros from the string.

Before and After

This is an alphabetizing game for fast thinkers.

At the start you see a modest animation that indicates that the game begins when Blip hits Blop. In each round of the game, you must make your decision before Blip and Blop meet. At first Blip drops toward Blop slowly. Then the game gets faster—and faster.

In each round, a row of four letters appears. Beneath it appears one letter. Beneath this one letter appears either the word BEFORE or AFTER. The object is to type one of the top row's letters that alphabetically follows the rule of before or after.

Here's an example:

```
B C P Z
  C
  AFTER
```

All you have to do is type a top-

```
100 REM * BEFORE AND AFTER * TRS-80 LEVEL II BASIC
110 REM * FUN HOUSE * MARCH 1984 * RICHARD RAMELLA *
120 CLS
130 P=101
140 PRINT @ 64,STRINGS(16,"-");
150 PRINT @ 120,"BEFORE AND AFTER"STRINGS(7,32)"STARTS WHEN BLIP
  HITS BLOP."
160 PRINT @ 192,STRINGS(16,"-");
170 GOSUB 460
180 PRINT @ 256,"AFTER THAT. MAKE DECISIONS BEFORE BLIP MEETS BL
  OP."
190 GOSUB 460
200 GOSUB 460
210 CLS
220 PRINT @ 54,"BLIP -"CHR$(94);
230 SET(125,0)
240 GOSUB 460
250 PRINT @ 1014,"BLOP -"CHR$(94);
260 SET(125,45)
270 GOSUB 460
280 GOSUB 490
290 CLS
300 R=5
310 PRINT @ 960,"SCORE";SC;
320 FOR A=270 TO 279 STEP 3
330 RANDOM
340 H$=CHR$(64+RND(26))
350 K$=K$+H$
360 PRINT @ A,H$;
370 NEXT
380 L$=CHR$(64+RND(26))
390 PRINT @ 402,L$
400 N=RND(2)
410 IF N=1 THEN M$="BEFORE" ELSE M$="AFTER"
420 PRINT @ 526,M$;
430 GOSUB 490
440 K$=""
450 GOTO 310
460 FOR T=1 TO 1000
470 NEXT T
480 RETURN
490 X=125
500 SET(125,45)
510 FOR Y=0 TO 44
520 Q$=INKEY$
530 IF R=5 AND Q$<>" " THEN GOSUB 600: RETURN
540 SET(X,Y)
550 FOR T=1 TO P
560 NEXT
570 RESET(X,Y)
580 NEXT Y
590 IF R=0 THEN RETURN ELSE 730
600 IF P>2 THEN P=P-2
610 FOR A=1 TO 4
620 J$(A)=MID$(K$,A,1)
630 IF J$(A)=Q$ AND N=1 THEN GOSUB 690: RETURN
640 IF J$(A)=Q$ AND N=2 THEN GOSUB 710: RETURN
650 NEXT
660 IF Q$=CHR$(32) AND N=2 AND L$>J$(1) AND L$>J$(2) AND L$>J$(3)
  AND L$>J$(4) THEN SC=SC+45-Y: CLS: RETURN
670 IF Q$=CHR$(32) AND N=1 AND L$<J$(1) AND L$<J$(2) AND L$<J$(3)
  AND L$<J$(4) THEN SC=SC+45-Y: CLS: RETURN
680 GOTO 730
690 IF Q$=<J$(A) THEN CLS: SC=SC+45-Y: RETURN
700 GOTO 730
710 IF Q$=>J$(A) THEN CLS: SC=SC+45-Y: RETURN
720 GOTO 730
730 PRINT @ 480,"GAME OVER"
740 END
```

Before and After.



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row letter that comes after C in the alphabet. The P and the Z are winners. However, the C in the top row is also a winner. A match is a winner whether you're seeking before or after.

If no letter in the top row is a winner, tap the space bar and you win because you recognize that fact.

Your score increases according to how much space is left between Blip and Blop when you type the right answer.

You play until either Blip meets Blop before you make a decision or you make a wrong decision. The pressure will be on because the game speeds up after a few plays. A good player can run up a pretty high score at this game.

Petals Around the Rose

The old Fun House keeper offers sincere thanks to Jerry Neidenbach, who sent this interesting and well-written program with the request that I offer it to all who visit the Fun House.

This is a most mysterious situation. If you can figure out what it does, the program will name you a potentate and reward you with a beautiful rose. If you can't figure out the secret of the puzzle, I'm afraid that's that. You'll just have to keep trying for as long as it takes.

However, I leave no Fun House visitor out in the cold for long. Anyone who wants the answer to Petals Around the Rose can send me a stamped, self-addressed envelope with a note that says at least Petal on it. Say more if you wish. My address is below.

All the instructions for this

Petals Around the Rose.

```

100 REM * PETALS AROUND THE ROSE * TRS-80 LEVEL II BASIC
105 REM * FUN HOUSE MARCH '84
110 REM * BY JERRY NEIDENBACH 3057 SHAWNEE LN DRAYTON PLAINS, MI
40020
120 CLEAR 500
130 CLS
140 RANDOM
150 PRINT "1. THE NAME OF THIS GAME IS 'PETALS AROUND THE ROSE.'
    THAT NAME IS IMPORTANT."
160 PRINT "2. THE ANSWER TO ANY ROLL IS ALWAYS AN EVEN NUMBER."
170 PRINT "3. YOU WILL ALSO BE TOLD THE ANSWER FOR ANY ROLL OF T
    HE DICE."
180 A$=CHR$(188)+STRING$(7,140)+CHR$(188)
190 B$=CHR$(191)+CHR$(128)+CHR$(179)+STRING$(3,128)+CHR$(179)+CH
    R$(128)+CHR$(191)
200 C$=CHR$(191)+CHR$(128)+CHR$(140)+STRING$(3,128)+CHR$(140)+CH
    R$(128)+CHR$(191)
210 T$=A$+CHR$(128)+A$+CHR$(128)+A$+CHR$(128)+A$+CHR$(128)+A$
220 BT$=STRING$(9,131)+CHR$(128)
230 D$=CHR$(191)+STRING$(3,128)+CHR$(176)+STRING$(3,128)+CHR$(19
    1)
240 E$=CHR$(191)+STRING$(7,128)+CHR$(191)
250 F$=CHR$(191)+STRING$(5,128)+CHR$(140)+CHR$(128)+CHR$(191)
260 G$=CHR$(191)+CHR$(128)+CHR$(131)+STRING$(5,128)+CHR$(191)
270 H$=CHR$(191)+CHR$(128)+CHR$(131)+CHR$(128)+CHR$(176)+STRING$
    (3,128)+CHR$(191)
280 I$=CHR$(191)+CHR$(128)+CHR$(131)+STRING$(3,128)+CHR$(131)+CH
    R$(128)+CHR$(191)
290 J$=CHR$(191)+CHR$(128)+CHR$(131)+CHR$(128)+CHR$(176)+CHR$(12
    8)+CHR$(131)+CHR$(128)+CHR$(191)
300 A$(1)=D$
310 A$(2)=G$
320 A$(3)=H$
330 A$(4)=I$
340 A$(5)=J$
350 A$(6)=B$
360 B$(1)=E$
370 B$(2)=F$
380 B$(3)=F$
390 B$(4)=C$
400 B$(5)=C$
410 B$(6)=C$
420 PRINT T$
430 FOR J=1 TO 10
440 X=8
450 T=0
460 S=320
470 FOR I=1 TO 5
480 X(I)=RND(6)
490 PRINT @ S,A$(X(I));
500 IF POINT(X,14) THEN G=X(I)-1: T1=T1+G
510 S=S+10
520 NEXT I
530 S=384
540 FOR I=1 TO 5
550 PRINT @ S,B$(X(I));
560 IF POINT(X,17) THEN G=X(I)-1: T=T+G
570 S=S+10
580 X=X+20
590 NEXT I
600 PRINT @ 440,BT$+BT$+BT$+BT$+BT$
610 PRINT "THE ANSWER IS" T+T1
620 PRINT
630 INPUT "PRESS <ENTER> FOR THE NEXT ROLL":COS
640 NEXT J
650 PRINT @ 512,"NOW WE SHALL SEE IF YOU HAVE DISCOVERED THE SEC
    RET."
660 PRINT
670 PRINT
680 PRINT "PRESS <ENTER> TO CONTINUE."
690 IF INKEY$="" THEN 690
700 FOR J=1 TO 10
710 X=8
720 T=0
730 S=320
740 FOR I=1 TO 5
750 X(I)=RND(6)
760 PRINT @ S,A$(X(I));
770 IF POINT(X,14) THEN G=X(I)-1: T1=T1+G
780 S=S+10
790 NEXT I
800 S=384
810 FOR I=1 TO 5
820 PRINT @ S,B$(X(I));
830 IF POINT(X,17) THEN G=X(I)-1: T=T+G
840 S=S+10
850 X=X+20
860 NEXT I
870 PRINT @ 440,BT$+BT$+BT$+BT$+BT$
880 PRINT
890 PRINT

```

Listing continued

program will appear on the screen after you type RUN and tap the enter key.

Last, I will help anyone who has trouble making a Fun House program work. You must include a self-addressed, stamped envelope. Send a listing of the program as it is in

your machine.

Describe the problem—lines where you get error messages, what they say, and so on. Write me: Richard Ramella, 1493 Mt. View Ave., Chico, CA 95926.

Next month we will look at some programs for keeping secrets. ■

Listing continued

```

900 INPUT "WHAT IS THE ANSWER";AN
910 IF AN<>T+T1 THEN PRINT "SORRY, YOU DO NOT KNOW THE SECRET":
END
920 NEXT J
930 CLS
940 FOR Z=0 TO 6.28 STEP .01
950 R=SIN(4*Z)
960 X=R*COS(Z)
970 Y=R*SIN(Z)
980 X1=45*X
990 Y1=20*Y
1000 SET(X1+64,Z3-Y1)
1010 NEXT Z
1020 PRINT @ 980,"YOU ARE NOW A POTENTATE.";
1030 GOTO 1030
1040 END

```

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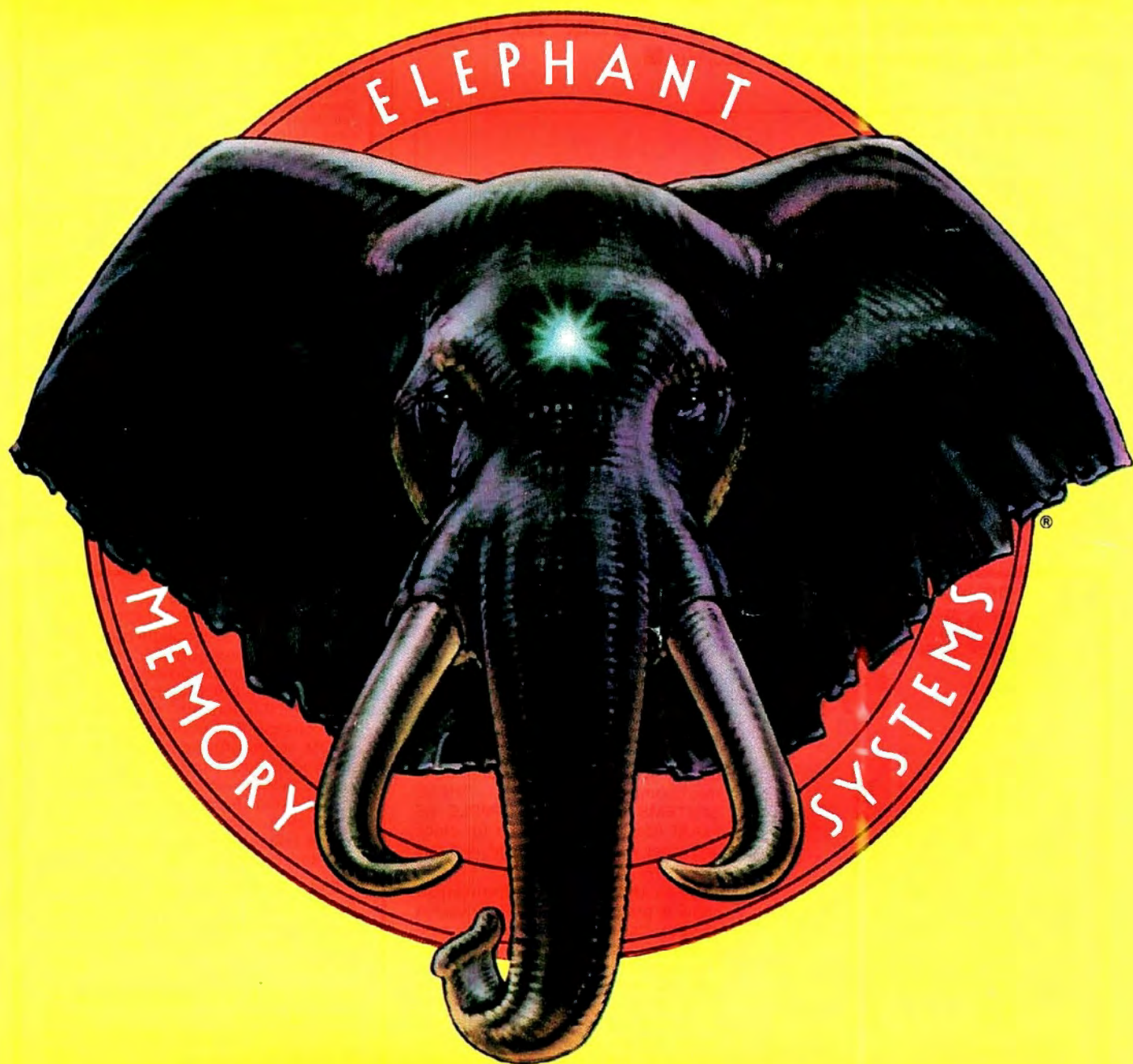
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Logic Functions in Basic and Assembly

I don't know if it's coincidence or the phases of the moon, but recently I've had a spate of questions and comments from readers on a single theme: logic operations in both Basic and Assembly language.

One letter was from a reader announcing that Model 4 Basic includes four undocumented functions: XOR, EQV, IMP, and MOD. I considered possible uses for those functions and how to include them in my programs.

The first three "hidden" Model 4 Basic commands led me to review logic operations in general, and the uses of logic functions in Basic.

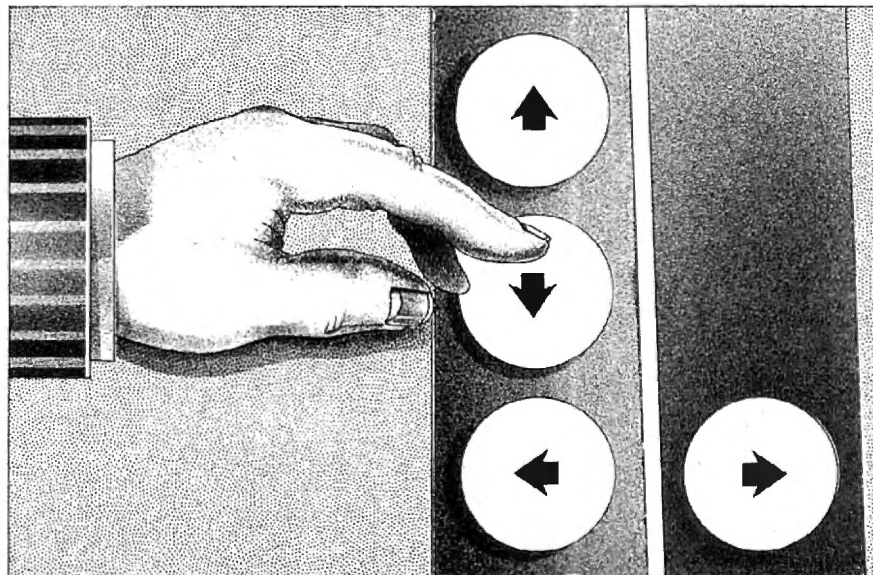
I'll discuss the oddball MOD command at the end of the column.

Quick Definitions

The only real difference between logic functions in machine language and those in Basic is the length of bit strings on which each operates. In machine language, all logic functions involve 8-bit operands, one of which must be in the A register. The result is always stored back in the A register. The Z80 instruction set supports four logic functions: AND, OR, XOR, and CPL (which is really a NOT instruction).

In Model I/III Basic, you can use three logic functions: AND, OR, and NOT. Model 4 Basic includes those three and adds XOR, EQV, and IMP. All Basic logic functions operate on 16-bit integer values.

Logic functions in machine language and Basic operate on a single bit position at a time. Unlike arithmetic functions, in which carrying and borrowing affect neighboring bits, logic functions are blind to bits in columns next to the bit tested and changed. Except for NOT, each logic function requires two operand bits to produce a single-bit result. Except for IMP, the order of the operands never affects the



result. Table 1 shows the truth table for the six logic functions mentioned above.

Since logic functions test only one bit at a time, you must think in terms of bits strings instead of general value. In other words, to use these functions intelligently in your programs, you'll need to do some conversions in and out of binary notation. For example,

$$5 = 13 \text{ AND } 7$$

makes little sense until you make the following conversions:

$$\begin{array}{r} 13 = 0000\ 1101 \\ \text{AND } 7 = 0000\ 0111 \\ \hline 0000\ 0101 = 5 \end{array}$$

Logic in Assembly Language

AND is most often used as a bit mask, deleting (resetting) unwanted bits and preserving those in a specified part of a byte. Suppose you are concerned with the last 4 bits (bits zero to 3) of a byte. You need merely AND

the byte with 0F hexadecimal (hex) (0000 1111 binary) to erase any bits in the first four positions. In Assembly language, the operation would look like this:

```
LD  A,byte
AND 0FH
```

Your only other alternative in Assembly language is to perform four separate RES operations to eliminate the first 4 bits.

OR, on the other hand, is most often used to set a group of bits at once. If you need to insure that bits zero to 3 are set, you could OR 0F hex instead of performing four SET operations.

You can use OR and AND together to force a value into the appropriate range. For example, graphics routines often need to insure that the current value in HL is a legitimate screen address. Since the screen is memory mapped from 3C00 hex to 3FFF hex, if the value in H is between 3C hex and 3F hex (0011 1100 to 0011 1111), HL must be pointing at the screen. To



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THE NEXT STEP

force H into that range, while maintaining its current value if it already is in correct range, many programmers would use:

```
LD  A,H ;Put value in A
AND 3FH ;Eliminate bits 7 & 8
OR  3CH ;Set bits 2-5
LD  H,A ;HL ==> screen memory
```

XOR is most often used in machine language to clear the A register, since any value XORed with itself is zero. Whenever you see the instruction XOR A in a listing, the programmer is setting A to zero, the zero flag to Z, and the carry flag to NC. That's a lot of work for a single, fast instruction to perform.

However, you can use XOR for another purpose, based on one of its quirks. Any number XORed by the same value twice remains unchanged. That is ((J XOR K) XOR K) always produces the original value, J. If you need to save data in a coded form, so another computerist cannot easily read it with a zap utility, consider Program Listings 1 and 2. Use these relocatable programs as a USR routine to code or decode any string. The programs use the XOR command to compare each element of the string with its position in the string, producing a seemingly random group of characters that another person will find difficult to decipher.

Using these programs can present a few problems. First, the coded form of a string can include a 00 hex byte or another end-of-string marker. Therefore, if you are going to store the strings on disk, you should use random files instead of sequential files—otherwise, you might not recover all your data.

Second (this happened to me while I was testing the programs), the coded form of a string could contain control codes that affect your video display when you request a printout of the string; the screen might suddenly display Japanese characters (on a Model III) or shift into 32-character mode. To be safe, don't display the coded forms of strings.

Logic Functions in Basic

Programmers use logic functions in Basic most often to manipulate bit records that are part of a larger data-base system. By using bit records, you

X	Y	X AND Y
1	1	1
1	0	0
0	1	0
0	0	0

(Result is 1 if both bits are 1)

X	Y	X OR Y
1	1	1
1	0	1
0	1	1
0	0	0

(Result is 1 if either bit is 1)

X	Y	X XOR Y
1	1	0
1	0	1
0	1	1
0	0	0

(Result is 1 if one bit is 1)

X	NOT X (CPL X)
1	0
0	1

(Result is 1 if bit is 0)

X	Y	X EQV Y
1	1	1
1	0	0
0	1	0
0	0	1

(Result is 1 if bits are the same)

X	Y	X IMP Y
1	1	1
1	0	0
0	1	1
0	0	0

(Result is 1 if both bits are 1 or if first bit is 0)

Table 1. Truth table for six logic functions.

can shorten your programs, search through your data more easily, and, most important, condense the disk space needed to store your data.

For example, suppose you want to set up a simple mailing list program for a small business in Basic. In addition to the obvious name, address, city, state, and zip code data fields, you might want to maintain some standard information about each entry in the system, which you could later use for searches. For instance, you might record:

- whether each entry represents a business or an individual;
- whether the entry is a supplier or a customer;
- who should receive catalogs;
- who should receive sales fliers;
- who should receive Christmas cards;
- who is allowed to buy on credit; and
- who will allow you to buy on credit.

First, you would allocate each piece of information to a specific bit in a 16-bit integer as follows:

- Bit 0 0 = business, 1 = individual (1)
- Bit 1 0 = customer, 1 = supplier (2)
- Bit 2 0 = no catalog, 1 = catalog (4)
- Bit 3 0 = no flyer, 1 = flyer (8)

The numbers in parentheses are values used to set each bit (i.e., the decimal value of a byte that has only that bit set).

When you set up the arrays to hold information for your data base, add a separate array, R%(), to hold the information byte for each entry. When you want to set a particular bit in a particular byte, OR the byte with the number in parentheses. For example, to indicate that name number 17 belongs to a supplier, use:

```
R%(17) = R%(17) OR 2
```

If you want to reset a particular bit, AND the byte with the complement (NOT value) of the number in parentheses. To take entry number 12 off your catalog list, use:

```
R%(12) = R%(12) AND (NOT 4)
```

Of course, your program performs the logic work, and the person typing in the information won't see it.

To search on a single key, use the AND function. For example, to search for all flier recipients in your file, use:

```
IF R%(X) AND 8 THEN GOSUB...
```

to your display or print routine.

To search on multiple keys, you can still use AND, but you must include a test value equal to the sum of all the search bits. When you want a list of all individuals who receive catalogs, use:

```
IF R%(X) AND 5 = 5 THEN GOSUB...
```


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```

00100 ;*****
00110 ;*
00120 ;*   String Coder/Decoder   ;*
00130 ;*   ;*
00140 ;*****
00150 ;
7F00      00160      ORG      7F00H      ;PROGRAM IS RELOCATABLE
7F00 CD7F0A 00170      CALL     0A7FH      ;GET STRING VARPTR IN HL
7F03 E5      00180      PUSH     HL          ;TRANSFER VARPTR
7F04 DDE1     00190      POP      IX          ; TO IX REGISTER
7F06 DD4600 00200      LD       B,(IX+0)      ;B = STRING LENGTH
7F09 DD6E01 00210      LD       L,(IX+1)      ;GET LSB OF STRING ADDR.
7F0C DD6602 00220      LD       H,(IX+2)      ;HL=> STRING
7F0F 7E      00230      LOOP    LD       A,(HL)      ;GET CHARACTER IN A
7F10 A8      00240      XOR      B          ;XOR BY POSITION
7F11 77      00250      LD       (HL),A      ;PUT IT BACK
7F12 23      00260      INC      HL          ;BUMP POINTER TO NEXT
7F13 10FA    00270      DJNZ    LOOP      ;REPEAT UNTIL DONE
7F15 C9      00280      RET          ;RETURN TO BASIC
0000      00290      END
00000 TOTAL ERRORS
34451 TEXT AREA BYTES LEFT
    
```

Program Listing 1. Relocatable Assembly-language routine that lets you code or decode any string.

```

10 '*****
20 '*
30 '*   String Coder/Decoder   *
40 '*   Demonstration Routine *
50 '*
60 '*****
70 '
80 ' To code or decode a string, T$, use
90 '   X =USR (VARPTR(T$))
100 '
110 CLEAR 1000
120 DIM A%(10)
130 FOR I=0 TO 10
140   READ A%(I)
150 NEXT I
160 DATA 32717, -6902, -7715, 18141, -8960, 366
170 DATA 26333, 32258, 30632, 4131, -13830
180 CLS
190 PRINT @ 0,CHR$(30);
200 INPUT "ENTER STRING TO BE CODED";T$
210 X=0: DEFUSR=VARPTR(A%(0))
220 X=USR(VARPTR(T$))
230 PRINT
240 PRINT "Coded form:  "
250 PRINT T$
260 PRINT
270 X=USR(VARPTR(T$))
280 PRINT "Decoded form:  "
290 PRINT T$
300 PRINT: PRINT
310 GOTO 190
    
```

Program Listing 2. Relocatable Basic routine that lets you code or decode any string.

By selecting the correct values and logic functions, you can pull any subset out of the main file.

Model 4 Basic

Using the AND, OR, and NOT functions available in Model I/III Basic, you can test a bit string for any possible combination of 1's and zeros. However, the program logic of such a test sometimes becomes obscure. The Model 4 enhancements (EQV, IMP, and XOR) make such tests easier.

For instance, suppose you want a list of business customers who were supposed to receive a catalog but no sales fliers. In Model I/III Basic, you could write the test as:

```
IF R%(x) AND 15=4 THEN GOSUB...
```

You could use the same statement in Model 4 Basic, but you could also use:

```
IF R%(x) EQV 4=-1 THEN GOSUB...
```

This line of Basic shows more clearly that you're testing for an exact match of 0000 0000 0000 0100 (-1=1111 1111 1111 1111) and therefore is more self-documenting.

Other Uses of Logic Functions

Once you start using logic functions in either Basic or Assembly language, you may tend to let them take over most of your programming needs. They certainly simplify many programming problems. For example, suppose you need to POKE locations X1 and X2 with the value 32000 (you may be setting the USR pointer in Tape Basic). In Model I/III Basic, you

Tidbit# 3

If you want to eliminate the question mark the computer displays each time you use the Input command in Level II Basic, here is a simple program to do it. I suggest that you set memory size to 32255.

Corey Lindsly
West Chester, PA

```

10 FOR Z=32256 TO 32284
20 READ A
30 POKE Z,A
40 NEXT
50 DATA 62,8,205,51,0,62,8,195,51,0,229,62,195,50,175,65,33,0
60 DATA 126,34,176,65,225,201,229,62,201,24,240
70 POKE 16837-10:POKE 16838,126:POKE 16836,195
80 POKE 16813,24:POKE 16814,126:POKE 16812,195
    
```


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THE NEXT STEP

might write the following:

```
POKE X1, INT(32000/256)
POKE X2, 32000 - INT(32000/256)+256
```

You could do the same thing with the commands:

```
POKE X1, 32000 AND &H00FF
POKE X2, (32000 AND &HFF00)/256
```

or the same thing in Tape Basic:

```
POKE X1, 32000 AND 255
POKE X2, (32000 AND -256)/256
```

In Model 4 Basic you could also write:

```
POKE X1, 32000 MOD 256
POKE X2, (32000 AND -256)/256
```

The second and third methods work whether you use a positive integer (such as 32000) or a negative integer (such as -485) to represent the address you're POKEing into memory. The first (and most common) method requires that you first convert any negative integers into positive single-precision values.

Comparisons in Basic

Any time Basic evaluates an expression involving a comparison (for example, $X < 3$) it replaces the comparison with either a "true" flag of -1 or a "false" flag of zero. You can use comparisons wherever any other expression is valid, not just in If...Then statements.

As a teacher, I have written several grade book and grade-averaging programs. In order to avoid multiple If...Then statements to change a letter grade (in variable GR\$) to its numeric equivalent (in GR!), I use a statement such as:

```
GR! = -4*(GR$="A") - 3*(GR$="B")
      -2*(GR$="C") - (GR$="D")
```

The same principle lets me derive letter grades from their numeric equivalents. Many beginning programmers find it difficult to understand that Basic uses the equals sign (=) as both an assignment operator (LET X=3) and as a comparison function (IF X=3...), especially when they try to put the comparisons into other expressions. The concept would be much simpler if Basic used two different symbols, as do the Pascal or C programming languages.

While comparisons in Basic can become confusing, those in Assembly language often drive programmers up the wall. I've shown the relationship between various comparison tests in Basic and Assembly language in Table 2. None of the comparison tests shown change the data in any register or memory location; if you are willing to alter memory values, several other tests, involving the parity and sign flags, are available. But these comparison tests should be sufficient for most of your programming needs.

At the beginning of this column, I listed four undocumented Model 4 Basic commands, three of which I've already discussed. The fourth command, which has nothing to do with logic operations, is the MOD command.

Coming up with applications for the MOD function was easy, and I was glad to learn that it exists. The result of $X \text{ MOD } Y$ is the remainder after X is divided by Y . For example, $17 \text{ MOD } 3$ returns a value of 2 because 17 divided by three is five, with two left over. I have often used a Basic expression that produces the same result in order to create a repetitive action inside a longer loop. For example, if you wanted to display the contents of a 70-element array in five columns on

the screen, in Model I/III Basic you'd use:

```
100 FOR X=0 TO 69
110 Y=X-INT(X/5)*5
120 IF Y=0 PRINT ELSE
      PRINT TAB(Y*10);
130 PRINT A%(X);
140 NEXT X
```

Now, in Model 4 Basic, you can replace line 110 with:

```
110 Y=X MOD 5
```

which is not only easier to write, but easier to understand when you debug the program. ■

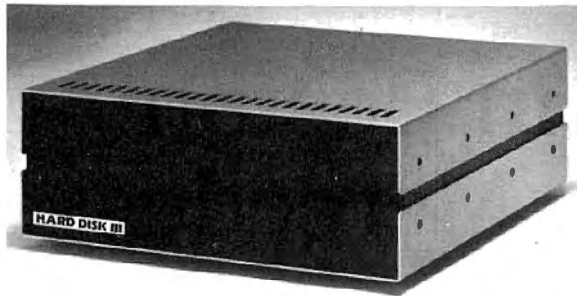
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Basic	Assembly Language
IF A=B THEN GOTO...	CP B: JR Z...
	CP B: JP Z...
IF A<>B THEN GOTO...	CP B: JR NZ...
	CP B: JP NZ...
IF A=>B THEN GOTO...	CP B: JR NC...
	CP B: JP NC...
	CP B: JP P...
IF A<B THEN GOTO...	CP B: JR C...
	CP B: JP C...
	CP B: JP M...
IF A=0 THEN GOTO...	OR A: JR Z...
	OR A: JP Z...
IF A<>0 THEN GOTO...	OR A: JR NZ...
	OR A: JP NZ...
IF A>127 THEN GOTO...	OR A: JP M...
IF A<128 THEN GOTO...	OR A: JP P...

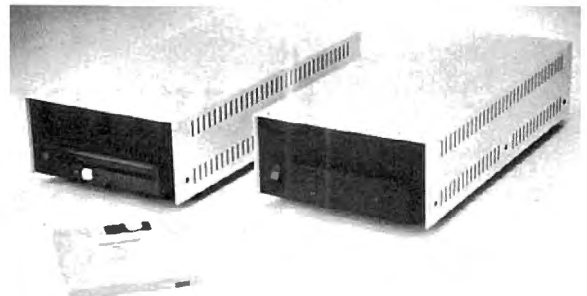
Table 2. The relationship between comparison tests in Basic and Assembly language.

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Burnout in Boston: Goodbye, Mercedes

Dammit!" Mercedes yanked a smoldering disk from the Mach 4 and flung it across the MIT lab, swearing for the first time in over a year with the Gamer's Cafe.

It was our third month in Boston, and things were going badly. Not only was its creator becoming more irritable every day, but the Mercedes Mach 4 had been crashing more violently and often, despite marathon programming efforts. Even halving the clock speed and turning the warp drives to minimum density ("going into PMC mode," Mad Max called it) hadn't fixed the bugs.

Worse, the strain was telling on Mercedes. "What's the matter?" Max asked kindly.

"Oh, nothing." She began swearing more vividly. "It's just that the [syntax error] computer won't work, and who needs a [bad filename] Ph.D. anyhow?"

"Now, now," I put an arm around her shoulders. "You've already earned two. The Nobel committee asked for a copy of the Mach 4 Technical Manual."

"Great." She sighed and pressed her hands to her temples. "But there's something wrong with the, what do you call it, you know, like the disk controller except software."

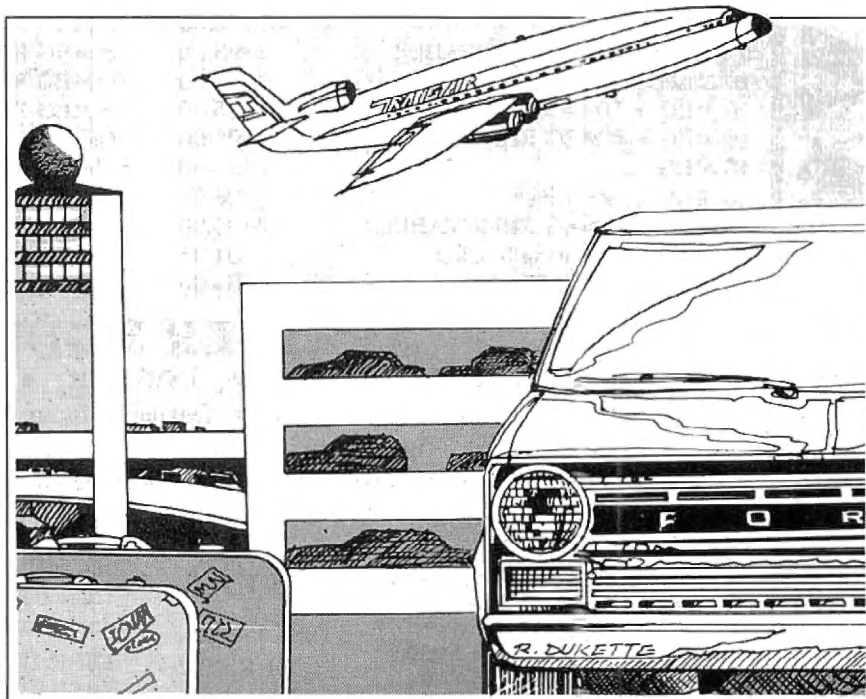
"The DOS?" Max asked.

"DOS, yeah." Mercedes shook her head dazedly. "Geez, I must have been at this too long."

"Nothing to worry about," Max reassured her. "Dictating the operating system and writing the ROM off the top of your head. You should take a break."

"Yeah." Mercedes bent to her notes again, paused, blinked, and muttered, "ROM?"

"It's just burnout," I told Max while we shared coffee and worries. "You said yourself she's been working too hard."



"I hope so," Max fretted. "But you hear about these child prodigies who lose everything when they hit puberty. They stop reading John von Neumann and start reading Judy Blume."

"Not our Mercedes," I said, inwardly wondering what it was she'd snatched up and hidden in her briefcase when I'd come in the day before. "She'll be fine once she finishes this project."

"I suppose." Max sipped his coffee. "We need to get back on the road. I wonder if we'll ever get there again."

I tried to cheer Max up. "At least she isn't like Jay Wallace of Tucson, AZ. Ever since seeing Shawn Roberts' high score in Frogger, he says, 'I've been having fits and nightmares mostly consisting of Shawn being hit by a truck or falling off a log and drowning in a river. Using an entire Sunday I conquered my innermost fears and destroyed Shawn's feeble score.'"

"Now that my duty is done I challenge Shawn to reach within himself and try to beat my score because I

know he no longer possesses the eye of the tiger," Max read. "From frog to tiger. Mixing his animal metaphors."

When Max and I reached the lab the next morning, the atmosphere had changed. Mercedes looked bored, her adviser looked unhappy, and there were two strangers there, one nosing through papers on the table while the other said something about Washington. They had bureaucratic grey eyes to match their suits, and they looked like the type that don't get along with people who live in vans and play games.

"They asked if they could come in and take over running some stuff, and I said sure," Mercedes shrugged. "I don't want to be one of those weird kids who spends 10 hours a day in front of a computer." She giggled. "Although I did see *WarGames* four times. Matthew Broderick's cute."

Max and I gaped. "Come on,

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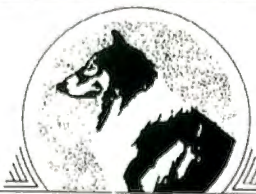
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Rear Guard	195,240	John Hope, Kingston, Ont.
Rescue at Rigel	456	Glenn Butler, Belrose, N.S.W.
Sea Dragon	610,180*	Robert Fitzwilliam, Houston, TX
Sky Sweep	1,000,540	Tommy Seniuk, Vegreville, Alta.
Space Castle	69,750	Rick Sayre, Stockton, CA
Space Intruders	14,030	Ron Johnston, Emporia, KS
Space Rocks	32,600	John Dunkelberg Jr., Winston-Salem, NC
Star Blazer	52,750	Mark Adams, Tampa, FL
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 Apschal	390	Carl Pflanzler, Gillette, NJ
Time Bandit	14,460	Mark Adams, Tampa, FL
Time Runner	162,354	Detlef Sturm, Schauenburg, W. Germany
Voyager I	1,177	Al Ayer, Mechanicsburg, PA
Weerd	61,180	Tommy Seniuk, Vegreville, Alta.
Wild West	47,000	Dave Westfall, N. Olmsted, OH

*Expert mode: 339,080 (David Smith, Kingwood, TX).

THE GAMER'S CAFE

Mercedes," Max finally said. "We're taking you to the doctor."

"I'll make an appointment," I said, picking up the phone and looking at my watch. "Is it 4:15 already?"

"I think it's around 10—" Max checked his own watch—"but mine says 6:50. It always acts up around the Mach 4. Cosmic RFI."

"What's RFI?" Mercedes said.

That distracted me, and I turned too fast and brushed my hand against one of the drives. Then the whole room wavered and I watched Mercedes, blurred, slide up and away as everything shifted.

I was in the same room, but there were different things on the table—some test tubes and Bunsen burners—and there was a woman facing me, wearing a white lab coat over an outdated dress and with a hairdo like Harriet Nelson's. As she opened her mouth to scream in surprise, I glimpsed a calendar on the wall behind her. It said 1955, and I had just started to scream myself when I was back in the Mach 4 lab with the others.

"Where was I? What happened?" I tried to tell them. "Did you see me go? Did I disappear?"

"Couldn't have been for more than a second," Max said, looking worriedly at me. "I must have blinked."

"Oh, come off it," Mercedes snorted. "Time-tripping. Geez, how did I ever get involved with these weirdos in the first place?"

"There's no problem," the doctor said. "She's a perfectly healthy, normal 11-year-old girl."

"Normal?" I grabbed his lapels. "Doctor, this girl is not normal. This is Mercedes Silver. She has a master's from Johns Hopkins and her Ph.D. project has ruined her mind."

"Bulk-erased her," Max added. "Burned her EPROMs."

"Listen," Mercedes said, coming in from the waiting room. "I just called home and my dad said I should come back to Baltimore. Can you give me a lift to the airport?"

Max and I looked at each other. "Okay," Max swallowed.

"And play something besides those Who and Yardbirds tapes on the stereo," Mercedes pouted. "Don't you have any Journey?"

"You know what we have to do," Max told me as we drove to Logan Airport. "We have to go back to MIT and smash the Mach 4."

"Right," I said, glancing at Mercedes in the back seat. "It's done enough damage already. The world's not ready for it."

"And if the government gets its hands on it—" Max shuddered, then broke off as the van stopped and Mercedes got out. We shook her hand and helped her with her suitcase.

"Goodbye," Mercedes said. A smile crossed her face; a memory of rides in the Gamer's Cafe, perhaps. For a minute she looked like herself again—tired, but herself.

"Thanks for the lift," she said. ■

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TRS-80 Basic: A Chameleon Language

Basic isn't just Basic. It can provide various characteristics, depending on how you initialize it. With forethought, you can tailor Basic to meet your specifications.

You can, for instance, protect a certain area of your computer's memory, reserve memory space for files, or simplify loading your cassette loading operations on the Model III.

Although the discussion below relates specifically to TRSDOS, the features outlined apply to all DOSes. Check your DOS manual for the correct syntax.

Protecting Memory

Protecting memory saves a specific amount of random-access memory for machine-language programs or sub-

outines. When you do so, you prevent Basic and certain DOS routines from inhabiting memory locations above an address you specify.

Protected memory space extends from a memory address one above the memory location you specify to the top of memory. In a Model I/III 16K RAM computer, the top of memory is 32,767 (7FFF hexadecimal [hex]); in a 32K RAM machine, it's 49,151 (BFFF hex); for a 48K RAM computer, it's 65,535 (FFFF hex).

The procedures for protecting memory are simple. To do so in one step, use this syntax: BASIC -m:XXXXX (where -m signals the computer to expect a memory-save address and XXXXX represents the address location one unit below the

first address you want protected).

A two-step procedure is to type in BASIC, then indicate the protect-memory address at the TRSDOS "Memory Size?" prompt. Merely pressing the enter key after the prompt doesn't protect memory.

Reserving File Space

Frequently, a program uses information stored in data files on the disk. To use these files, the Basic interpreter must reserve memory space for them. If you answer Basic's initialization question "Files?" by pressing the enter key, Basic reserves room for three files. Potentially, you can reserve from none to 15 files.

You also have to reserve space in memory to use disk files. Your Basic interpreter has to set aside space in memory to use this type of file. Basic lets you do this either automatically or manually. If you answer the files prompt by pressing the enter key, Basic automatically reserves room for three files.

Alternatively, you can manually reserve room for up to 15 files, or for no files.

You determine the number of files you need to open based on the requirements of your program. Be aware that the fewer files you open, the more memory you'll leave available for other operations. Conversely, if you don't open enough files for a program, you'll get an error when you run it.

The greatest number of files your program opens at any one time determines the number of files you need. Opening no files when you initialize Basic leaves more memory for other operations. Not opening enough files results in an error when you run the program.

Article	Page	Cassette File Spec	Disk File Spec	Comments
Side A				
TRS-NUKE	50	A	TITLE/BAS	Basic
Bugs From Outer Space	82	B	NUKE/BAS	Basic
Bugs From Outer Space	82	CEA	MAIN1/SRC	Editor/Assembler
Bugs From Outer Space	82	DEA	TEXT1/SRC	Editor/Assembler
The Return of Hinrichs' Word Processor	100	E	WORD/BAS	Basic
Parallel Driving	126	F	STNDRD/BAS	Basic
A Piece of the Pie	142	G	PIEPLT/BAS	Basic
Side B				
Sneak a PEEK, Invoke a POKE	152	H	UTIL/BAS	Basic
Character Sketching	156	I	FORMGN/BAS	Basic
The Forgotten Interface	166	J	PARIO1/BAS	Basic
The Forgotten Interface	166	K	PARIO2/BAS	Basic
The Forgotten Interface	166	L	PARIO3/BAS	Basic
The Forgotten Interface	166	PARIO4	PARIO4/CMD	System
The Forgotten Interface	166	MEA	PARIO4/SRC	Editor/Assembler

March 1984 Load 80 directory.

RELOAD 80

When you open files, they are set at a logical record length of 256 bytes, so a single data record can be up to 256 bytes long. Since a fixed length record file may not be the most economical use of memory space, another option is the variable length record file. Denote variable length files by adding the suffix "v" to the number of files reserved in Basic.

Again, you can control the number of files reserved in Basic by a single command, BASIC -f:n (where -f prepares the computer to receive an open-files command and n is a number of files, from zero to 15). If you use the command BASIC -f:nv, the files reserved will be variable length.

Or, you can use the two-step method; enter Basic, then respond with your chosen number of files at the prompt, "How many files?"

Cassette Baud Rate on the Model III

On the Model III, you can set the cassette baud rate in two ways. The easiest is to patch your TRSDOS disk with the following command:

PATCH BASIC/CMD (ADD=5202, FIND=00,CHG=FF)

Enter this line from the TRSDOS Ready prompt. Now, when you enter Basic, the computer will prompt you "Cass?" to which you answer either H (for a high baud rate of 1,500 baud) or L (for a low baud rate of 500 baud). You can change the system back to its original state by reversing the values for Find and CHG in the above patch command.

If you don't want to change your DOS, you can control the baud rate by POKEing either a zero (for low baud rate) or 1 (for high baud rate) into memory location 16913. Thus, the Basic command for a low baud rate is POKE 16913,0. The 1,500 baud rate is faster and more reliable when saving information on tapes, but if you want your tapes to be compatible with the Model I, write them at 500 baud.

With the above options at hand, you can easily make Basic fit your needs. A little thought before you press the enter key can make all the difference. ■



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READER EXCHANGE

Continued from p. 40

the basis for the Probability Triangle program.

● The bibliography for John Bell's "Straddle the Market" article (November 1983, p. 242) was inadvertently omitted. The references for this article are as follows:

Black and Scholes *The Pricing of Options and Corporate Liabilities* Journal of Political Economy, May-June 1973, pp. 399-417.

Black and Scholes *Valuation of Option Contracts and a Test of Market Efficiency* Journal of Finance, May 1972.

Fischer *Black Fact and Fancy in the Use of Options* Financial Analysts Journal, July-August 1975.

● An error was made in Harold A. Kime's program listing (Input, August 1983, p. 20). In line 32140, the IF F=3 should be changed to IF F=1. And line 33100 should read:

```
33100 DEFUSR0 = -1200:J = USR0(0):
RETURN.
```

● In our December 1983 issue, we duplicated lines 2940-4440 of Program Listing 3 in David Engelhardt's "Real World Control—Part II," and so omitted lines 4450-5600 of Listing 3 and lines 10-300 of Program Listing 4. The missing lines in Program Listings 1 and 2 are printed below and on the next page. We apologize for this error.—Eds.

Program Listing 1. These lines were missing from Program Listing 3 of "Real World Control—Part II" (December 1983, p. 132). Program Listing 2 contains the lines missing from Program Listing 4.

```
04450     DEFB  4H           ;ZONE 3
04460     DEFB  8H           ;ZONE 4
04470 ;*****
04480 ; RELAY LATCHING TIME DELAY
04490 ;*****
04500 DLY  LD  BC,4FFFH       ;TIME DELAY VALUE
04510     CALL 60H           ;DO TIME DELAY
04520     IN  A,(1H)         ;CHECK FOR RELAYS OFF
04530     CPL                    ;COMPLEMENT VALUE
04540     AND 0FH           ;MASK FOR SPRINKLER RELYS
04550     CP  0             ;ARE THEY OFF?
04560     RET
04570 ;*****
04580 ; SOUND ACKNOWLEDGE ROUTINE
04590 ;*****
04600 SOUND LD  BC,2FFFH       ;SONA ON TIME
04610     CALL BUSON         ;TURN ON INTERNAL BUS
04620     LD  A,2             ;
04630     OUT (4H),A         ;TURN ON SONA OR BUZZER
04640     CALL 60H           ;TIME DELAY
04650     LD  A,2             ;
04660     OUT (4H),A         ;TURN OFF SONA OR BUZZER
04670     CALL BUSOFF       ;TURN ON INTERNAL BUS
04680     RPT
04690 ;*****
04700 ; BUS ENABLE AND DISABLE SUBROUTINES
04710 ;*****
04720 BUSON LD  A,16          ;
04730     OUT (0ECH),A       ;ENABLE INTERNAL BUS
04740     RPT
04750 ;
04760 BUSOFF XOR  A         ;
04770     OUT (0ECH),A       ;DISABLE INTERNAL BUS
04780     RET
04790 ;*****
04800 ; ROUTINE TO GET MANUEL ACT BIT FROM ZONE #
04810 ;*****
04820 PORTKV LD  HL,PORT       ;GET START OF ACT BIT TBL
04830     LD  D,0             ;CLR D RFG
04840     LD  A,(ZHOLD)       ;GET ZONE #
04850     LD  E,A             ;CALCULATE OFFSET TO
04860     ADD HL,DE           ; OBTAIN ZONE ACT BIT
04870     LD  A,(HL)         ; FROM PORT TABLE
04880     RPT
04890 ;*****
04900 ; MESSAGES
04910 ;*****
04920 MESS0 DEFB 'AUTO SEQUENCE ACTIVATED'
04930     DEFB 0D0AH
04940 MESS1 DEFB 'SPRINKLER SYSTEM PROGRAM - DO YOU WANT?'
04950     DEFB 0A0AH
04960     DEFB 'A = AUTOMATIC MODE'
04970     DEFB 0A0AH
04980     DEFB 'M = MANUAL MODE'
04990     DEFB 0A0AH
05000     DEFB 'G = START AUTO MODE SEQUENCE ON DEMAND'
```

Listing 1 continued

READER EXCHANGE

Listing 1 continued

```

05010      DEFW      @A0AH
05020      DEFM      'E = EXIT SPRINKLER PROGRAM'
05030      DEFB      @DH
05040 MESS2  DEFM      'MANUEL SETUP MODE'
05050      DEFW      @D0AH
05060 MESS3  DEFM      'ZONE 1 = WEST SECTION OF BACK YARD'
05070      DEFB      @AH
05080      DEFM      'ZONE 2 = EAST SECTION OF BACK YARD'
05090      DEFB      @AH
05100      DEFM      'ZONE 3 = SIDES OF HOUSE '
05110      DEFB      @AH
05120      DEFM      'ZONE 4 = FRONT YARD'
05130      DEFW      @A0AH
05140      DEFM      'ENTER ZONE # YOU WISH TO TURN ON - '
05150      DEFB      @3H
05160 MESS4  DEFM      'MANUEL MODE IS ACTIVATED'
05170      DEFB      @DH
05180 MESS5  DEFM      'ENTER ZONE ON TIME IN MINUTES '
05190      DEFM      '(FORMAT MUST BE 01--39) = '
05200      DEFB      @3H
05210 MESS6  DEFM      'ILLEGAL ZONE ENTRY--REENTER ZONE #'
05220      DEFW      @D0AH
05230 MESS7  DEFM      'IF YOUR SATISFIED WITH THE ZONE # AND '
05240      DEFM      'TIME, HIT --C-- ELSE TYPE ANY KEY TO '
05250      DEFM      'CONTINUE'
05260      DEFB      @DH
05270 MESS8  DEFB      @AH
05280      DEFM      'ENTRY GREATER THAN 39 MINUTES--REDUE '
05290      DEFW      @D0AH
05300 MESS9  DEFM      'ZONE NOW RUNNING IS ZONE '
05310 ZNUM    DEFB      '1'
05320      DEFM      ' CYCLE = '
05330 ZCYK    DEFB      '1'
05340      DEFB      @AH
05350 MESS9A  DEFM      'DO YOU WANT TO STOP THE SYSTEM? Y/N'
05360      DEFB      @DH
05370 MESS10 DEFM      'SHUT-OFF ERROR FAULT...ZONE STILL ON '
05380      DEFM      'IS ZONE - '
05390 EZONE   DEFB      @DH
05400      DEFB      @DH
05410 MESS11 DEFB      @AH
05420      DEFM      'SYSTEM IS NOW SET FOR AUTOMATIC MODE'
05430      DEFB      @DH
05440 MESS12 DEFB      @AH
05450      DEFM      'THE SPRINKLER SYSTEM IS NOW DEACTIVATED'
05460      DEFB      @DH
05470 MESS13 DEFB      @AH
05480      DEFM      'ZONE OR ZONES ARE ACTIVE - PLEASE CHECK'
05490      DEFB      @AH
05500      DEFM      '**** PROGRAM TERMINATED ****'
05510      DEFB      @DH
05520 MESS14 DEFM      'ZONE '
05530 MZONE   DEFB      @DH
05540      DEFM      ' IS NOW ACTIVE'
05550      DEFB      @DH
05560 MESS15 DEFB      @AH
05570      DEFM      'AUTOMATIC MODE ACTIVATED...SCANNING FOR '
05580      DEFM      'SPRINKLER STARTING TIME'
05590      DEFW      @A0DH
05600      END        SPRINK
    
```

```

00010 ; CMTBL PROGRAM.....THIS PROGRAM WILL PATCH THE
00020 ;          COMMANDS IN *TABLE* OR ANY OTHERS
00030 ;          YOU MAY ADD (TO THE TABLE) UNDER
00040 ;          THE *READY* COMMAND MODE.
00050 ;
00060 ; WRITTEN BY DAVE ENGELHARDT    10/82
00070 ; SAVE MEMORY SIZE OF -29020-
00080 ;
00090 ; EXECUTE WITH A /29024
00100 ;
00110 ;          INITIALIZATION SECTION
00120 ;
00130      ORG        7160H
00140 SETUP    LD        A,@C3H          ;PATCH CMTBL PROGRAM TO
00150          LD        (41B2H),A        ; THE SYSTEM TO GIVE
00160          LD        HI,(BEGIN)      ; NEW CUSTOM COMMANDS
00170          LD        (41B3H),HL      ; UNDER BASIC MODE.
00180          JP        IAL9H          ;JUMP TO BASIC
00190 ;*****
00200 ; START OF CUSTOM COMMAND PROGRAM
00210 ;*****
00220 START    PUSH     HI              ;SAVE ALL REGISTERS
00230          PUSH     DE
00240          PUSH     BC
00250          PUSH     AF
00260          LD        HI,.42E6H      ;INPUT COMMAND BUFFER
00270          LD        BC,255         ;LOAD LOOP COUNTER
00280          LD        A,@0          ;LOAD SEARCH COMPARE BYTR
00290          CPIR          ;LOOK FOR END OF COMMAND
00300          LD        A,C          ;SAVE DECREMENTED CTR
    
```

Program Listing 2. Lines missing from Program Listing 4 of "Real World Control—Part II."

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Continued from p. 20

A: Based on what you say, that the problem disappeared when you changed disk drives, the problem is probably that the drive head track-to-track seek time used by the DOS is too short. Switching to a drive with faster reactions cures the complaint. If you'll examine your DOS manuals, you'll find instructions on increasing the wait time during the track seek.

Until you mentioned that switching drives solved the problem, I was betting on the rewritten program as the source of it. Actually, the program is still the source of the difficulty. What gives it away is that the program worked fine until you altered it, and only that program has the problem. Something you're doing in the program is causing the problem. Two directions give the same solution: Change the program (increase wait times during disk access), or use the DOS to increase the wait during disk access. Good luck.

Q: I own a Model III with no disk drives. I installed a Z80B 6 MHz CPU, 48K of 150-nanosecond RAM, and 200-nanosecond video RAM chips. I'm trying to achieve a clock speed of 4 MHz. Everything works fine at 2.6 MHz or below. But when the speed goes beyond this, the screen fills with different characters that change with the different CPU clock speeds. Pressing the break and reset keys have no effect.

It appears that the video can't respond at these speeds. Should clock and clock/2 be in some ratio to the P (CPU) clock speed? Or is it an address-decoding problem? What's preventing 4 MHz operation? (Joseph Nicolas, Scranton, PA).

A: The problem is that the computer has chips other than memory and the CPU that must be upgraded. For example, the address-decoding chips must be upgraded to operate at the higher switching speeds the clock is demanding. For more technical information on 4 MHz operation, you should really talk with one of the companies that manufactures high-speed upgrade kits, such as Holmes Engineering.

Q: I just recently bought a used Model I with expansion interface, monitor, printer, two disk drives, and an assortment of software disks. My previous computer experience has been with a Honeywell Delta 1000. Wow, have I been impressed and snowed under at the same time! Fortunately one of my coworkers has a Model I and he's really helped me out.

My TRSDOS 2.3 has the programs TEST1/CMD and TEST2/CMD, which I've run. My question is about Floppy Doctor, DDT, and Computronics' System Diagnostic. Are the two programs I have enough, or should I get these other three (or only one)? (Earle W. Deneau, Fairfield, CA).

A: No, the two you have aren't enough. Floppy Doctor is a disk-data diagnostic. It checks your disk drive for several problems and verifies data transfer from the Model I CPU to the disk drive. I use it primarily to check out my disks. Whenever one of them seems to be misbehaving, I dig out Floppy Doctor. Using a known good disk, I run through all the diagnostic routines. If the test disk passes, the problem is with the data disk. If it fails, the problem is probably in the drive. If it appears to be the drive, I use Floppy Doctor to try to pinpoint the problem area (and usually with good success).

DDT checks only the drive's rotational speed. The graphics are much more informative than the simple "Drive too fast" or "Drive too slow" messages from Floppy Doctor. I have and use both diagnostics. I recommend both of them to all Model I owners.

I know nothing about Computronics' System Diagnostic. This is the first time I've heard mention of it. However, I just saw and used a new disk drive diagnostic, which thoroughly checks out all aspects of your disk drive. It tells you things like the accuracy of the drive head alignment, motor speed, index hole alignment and timing, the drive head azimuth, and hysteresis. Using it, you can check out all the technical aspects of a disk drive without using an oscilloscope. Its only fault is that it doesn't check out data transfer, like Floppy Doctor does. So you can't use it to check out disks, on-

ly disk drives. It retails for \$79, from J & M Systems Ltd., 137 Utah N.E., Albuquerque, NM 87108, 505-265-1510, and is called Digital Disk Diagnostic.

Q: The issue of problems between the Model I keyboard and Radio Shack's Expansion Interface has been kicked around quite a bit. In the August 1983 issue, R.M. references three letters (p. 316). He may well be correct in suspecting the cable.

In his case, shortening the cable by an inch solved the problem. In my case, I found an intermittent short on pin 39. A jumper solved the problem. I ordered a new cable and after a few days found the same problem, only on pin 2. Could it be that one supplier has defective positioning equipment? In any case, a jumper fixed the problem. (William Burch, MD, Lake Lure, NC).

A: You may well be right, some of the trouble is intermittent shorts in the cables, perhaps defective from the start.

Q: I have no lowercase modification in my Model I, primarily because I've been at a loss to determine which kit to buy. If you aren't willing or able to perform major surgery on your hardware, and you want to buy a kit that has true descenders, requires no software driver, uses no reverse-case, and is compatible with an LNW Expansion Interface and Percom Doubler, what would you buy? (Jeff Carver, APO NY).

A: The only surgery you'd have to do on your hardware is alter the video RAM, cut a trace, and jumper a few points together. All lowercase kits require these changes, which in itself requires soldering. And all the kits require some type of software driver to enable lowercase typing and display. The driver converts the normal uppercase-only input of the keyboard into lowercase, and the shifted-input from lowercase to uppercase.

If you can't solder and don't know anyone who does, you might as well get the Radio Shack lowercase modification. It has true descenders and is backed by the Radio Shack warranty.

If you can find someone who knows how to solder to do the work, borrow

or buy a copy of Dennis Kitz's IJG book *The Custom TRS-80* (see address at end of column), or Philip Van Praag's "Lower Cost Lowercase" article (April 1981, p. 228). It includes the procedure to convert a standard keyboard to lowercase, with an optional switch to disable the modification whenever you want. The disadvantage to this is that you're taking a chance with your keyboard's character generator. It may or may not have true descenders. If it does, then the total cost to convert your keyboard is under \$20, instead of Radio Shack's \$120, plus labor.

If it turns out that you don't have true descenders, get EC-1 from the Electronic Closet (8187 Blakely Ct. West, Bainbridge Island, WA 98110, 206-842-5790). With a standard character set with true descenders, it costs \$11. With a custom character set in addition to the standard, the cost is \$19.

Q: I have access to a Model II with a NDK 3000 parallel printer that has a lot of nice features, including dot-addressable graphics. To print graphics you send Escape M followed by a 16-bit number indicating the number of dot positions you want printed. Then you send the graphics as 16-bit words, where each bit represents one of the 16 dots on the print-head. Each 16-bit word is actually two 8-bit words in sequence. My problem is that the Model II won't send an ASCII zero to the printer, so I can't send any 16-bit numbers with a value less than 257.

I've tried SVC calls instead of Basic LPRINT, but to no avail. I would try POKEing the values into the appropriate byte if I knew which byte the printer was memory mapped to, but I haven't been able to determine that. (Brian Christensen, Woden, Australia).

A: First, the printer is port mapped on the Model II, not memory mapped. Second, Model II Basic doesn't support the PEEK and POKE commands. Have you tried the transparent mode of the SVC printer call? That looks like it's the only possible way to get a null (00H) sent to the printer.

Has anyone else solved this problem?

Q: I have a cassette-based Model III I bought in 1981. It works perfectly. I read in your column that there're three types of 4116 RAM: 200 ns, 150 ns, and 100 ns. I'm now awaiting a speedup kit, Sprinter II. I was planning on replacing the current memory with a 150 ns type.

Would the 100 ns be better? How many would I need? You also suggested running an all-night memory program—where do I get such a program? (Montserrat Pagan, APO CA).

A: The 100 ns memory is the fastest available, but it's very hard to find. My current suppliers (friends, not commercial companies) are out and don't know when they'll have them in again. Your best bet is to search through electronic parts advertisements.

To replace all 48K of memory you'll need 24 chips, eight per 16K bank. As for the all-night memory test, I/O Ware ([formerly Instant Software] Peterborough, NH 03458, 603-924-9261) used to have such a disk (\$14.95), for the Model I, but I don't have any idea if they have a comparable program for the Model III.

It's simple to write a Basic program that performs memory tests. First, clear out as much of memory as possible. Then use a For...Next loop to set memory above the program (say, everything above 19000 decimal) to zero. Next use two nested For...Next loops; the first POKEs a one into the lowest location, the second then reads all the other locations to make sure they're still zero. Then the first loop resets the lowest memory location to zero, increments to the next, and the cycle repeats. Basic is slow, so a test like this takes hours to run. For a "forever" test, just make the last program line end with the Run command.

Also, make certain that you read and understand the manual's instructions on using PEEK and POKE before doing this, or you'll have problems. And finally, DON'T bother the top 2 bytes (65534 and 65535) or your Basic program will crash.

Q: I had the same problem as J.S.S. of West Chatham, MA (August 1983, p. 312), I can't get Profile to run under TRSDOS 2.7DD. I don't know of a way to make Profile run on this system, but Microfiles

(26-1565) runs fine in double-density. So if that program suits your purposes, you're in business. (Michael Norton, Los Altos, CA).

A: Thanks for the suggestion.

Q: In reading the March 1983 issue of *80 Micro*, I found the answer to the question about exiting from Scripsit with Model I double-density without rebooting (p. 18). Use Debug and change the codes at the following locations:

Old code	New code	Location
00	2D	6595
00	40	6596

This is much better than getting a new DOS. (Jim Ryther, Gentry, OK).

A: It certainly is, and I'm glad you shared your discovery with us. I'm surprised that Radio Shack didn't have that address in the original Scripsit, since it is the standard entry point to return to DOS (402DH). I thought the double-density TRSDOS used a different entry point and that that was causing the problem. ■

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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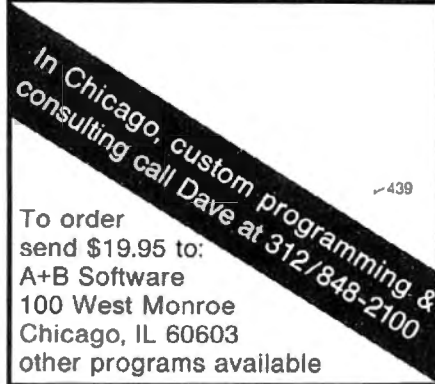
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REVIEWS

Continued from p. 48

system, and other extraterrestrial phenomena.

Other programs you can call from the runtime module include a simple adding and subtracting calculator, mean and standard deviation, simultaneous equations, Bessel functions, number conversions (hex, decimal, and binary), satellite directional calculations for antennas, correlation coefficients, determinant of a matrix, microstrip circuits analysis, and a demonstration program on the principles of space/time physics at the speed of light.

This program has the potential to be very useful to its selected audience. But, with the exception of the integral and differential formulas, many of the formulas are so simple a calculator could handle them better.

The program's value comes from its look-up ability for tables and formulas, and the option to add your own complex formulas for easy retrieval. Easy access to mathematics that you

do not use every day is the key to its usefulness. Virtually any physical constant falls into this category.

Criticism

Unfortunately, the programs lack any error-trapping capability. In the runtime program, error trapping is limited to a displayed message stating that the error is disk input/output (I/O).

In other programs, keying in a value outside the specified range can result in an overflow or division-by-zero error. With this set of programs, errors can result in significant delays because you have to reboot the runtime program before you continue.

No error-trapping procedure checks printer status. Accidentally hitting the printer control keys gives you no indication that the printer is off, but does hang up the program.

Nothing indicates the default and current modes for angle, decimal place, and printer enabled/disabled.

When you search a table for a string value, each comment line with the string appears on the screen and subse-

quent lines scroll up. While scrolling during normal query, you can scroll in reverse, page by page, to look at values displayed previously. When you search for a string, if your search string isn't included in the remarks for a value at the beginning of a page, you

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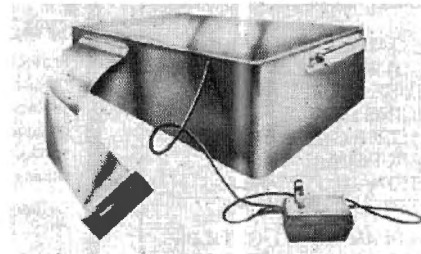
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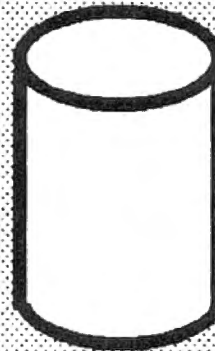
Visicalc^(tn) interface

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	Description	Date	Amount
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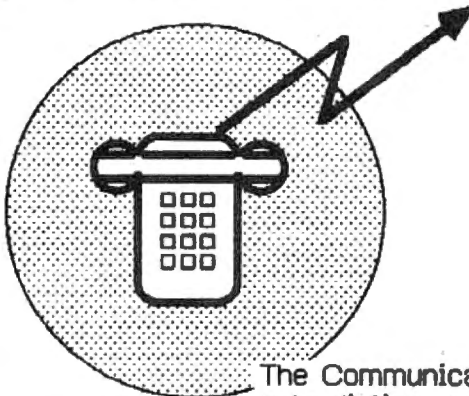


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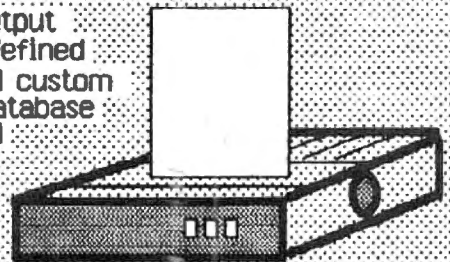
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can't back up to the previous page.

To review the previously displayed value in that case, you have to scroll down and wrap around past the beginning of the file. Some tables have 190 constants, so this takes time.

Likewise, you cannot jump through the table or formula file to a specified area. For example, if you think your table value is between entry numbers 50 and 60, you must scroll up or down from your current location and display each consecutive page until you reach your desired location.

When you specify the file number rather than ask to query or see the general list, the program doesn't display the table value. If you key in the wrong table number, the program can assign the wrong value to your variable.

The option to create your own formulas and table files or add to existing files is inflexible. You can't completely delete an entry you don't need. If you don't have a replacement entry, you must make a notation to ignore it.

No provision exists for inserting

new formulas or tables other than at the end of a file. Tables and formulas are most useful when listed in a particular order for display.

When you save to a file that consists of table entries, designation of, for example, drive 1 is unreliable. If a file by that name is already on the disk in drive zero, the program saves the file to drive zero.

The program could also state some formulas better. One that determines the X and Y values along the circumference for a circle with radius R is written so that X1 is the value R. This formula should make repetitive calculations while R remains constant. Since the value X1 always takes on the value of the answer in these programs, you have to reenter the constant value for R continually.

This brings out another error in the program. The edit mode of Math-Analyzer-Paks is unreliable. When you reverse the order of variables (X1 to X2 and vice versa), the edited formula does not compute correctly from then on. The last term of the equation for the problem described above takes the

square root of the computation.

Starting from scratch and keying in the formula exactly results in the correct answer. I do not advise using the edit mode unless you can easily check your answer to determine the reliability of the resulting equation.

Unfortunately, I could make similar comments about several of the remaining programs supplied with Math-Analyzer-Paks. In many cases, the inaccuracies are significant.

At first, I was excited about the versatility and potential for expansion this program offers. After using the package, however, I feel that its lack of error-checking and user friendliness seriously limits its usefulness. ■

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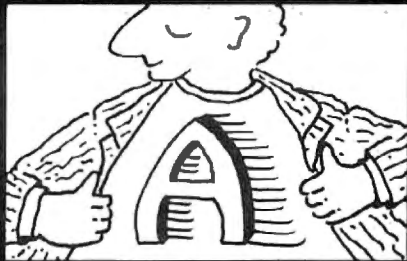
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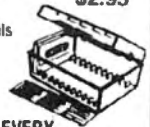
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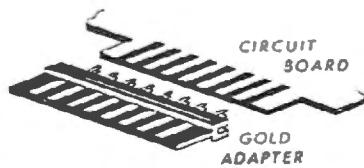
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REVIEWS

run on a 48K Model I with a Line Printer IV. However, you can pass the program through a Convert utility to run on a Model III or Model 4 in the III mode.

Trend Analysis graphs raw data, calculates moving averages of that data, and plots the moving averages.

You select graph scale markers, the time period, and linear or semilogarithmic scales as appropriate.

This program also creates, updates, and saves files. You can combine data from several files into one new file.

Sounds great, doesn't it? It is good, but you have to know what you're do-

IST DATE = 1980

N	DATE	DATA	4-PT AVG	40-PT AVG	DEV%	40-PT WAVE
1	3100	6059	6172	6509	-5.18	6489
2	3110	6133	6121	6503	-5.88	6471
3	3120	6086	6094	6495	-6.19	6450
4	3130	6020	6075	6486	-6.34	6427
5	3140	6007	6062	6477	-6.41	6404
6	3170	5822	5984	6462	-7.40	6372
7	3180	5909	5940	6449	-7.90	6345
8	3190	5931	5917	6437	-8.07	6320
9	3200	5866	5882	6421	-8.39	6292
10	3210	5824	5883	6403	-8.13	6263
11	3240	5647	5817	6381	-8.84	6226
12	3250	5624	5740	6357	-9.69	6189
13	3260	5598	5673	6333	-10.41	6152
14	3270	5530	5600	6306	-11.19	6113
15	3280	5682	5609	6284	-10.74	6082
16	3310	5765	5644	6263	-9.88	6057
17	4010	5783	5690	6243	-8.86	6034
18	4020	5820	5763	6224	-7.41	6013
19	4030	5795	5791	6203	-6.64	5992
20	4070	5683	5770	6178	-6.60	5967
21	4080	5738	5759	6153	-6.40	5945
22	4090	5841	5764	6131	-5.98	5930
23	4100	5905	5792	6110	-5.21	5919
24	4110	5900	5846	6088	-3.97	5909
25	4140	5842	5872	6067	-3.21	5897
26	4150	5828	5869	6047	-2.95	5885
27	4160	5770	5835	6027	-3.19	5872
28	4170	5744	5796	6004	-3.47	5858
29	4180	5721	5766	5982	3.62	5844
30	4210	5673	5727	5960	-3.91	5829
31	4220	5874	5753	5945	-3.22	5825
32	4230	5895	5791	5929	-2.33	5822
33	4240	5938	5845	5917	-1.21	5823
34	4250	5973	5920	5906	0.25	5826
35	4280	6001	5952	5893	0.99	5830
36	4290	6017	5982	5883	1.69	5836
37	4300	6036	6007	5873	2.28	5844
38	5010	5994	6012	5864	2.52	5850
39	5020	6005	6013	5859	2.62	5857
40	5050	6050	6021	5858	2.78	5866
41	5060	6049	6025	5858	0.00	5875
42	5070	6102	6052	5857	0.00	5887
43	5080	6052	6063	5856	0.00	5897
44	5090	5979	6046	5855	0.00	5903
45	5120	5978	6028	5855	0.00	5909
46	5130	6054	6016	5860	0.00	5918
47	5140	6090	6025	5865	0.00	5929
48	5150	6104	6057	5869	0.00	5941
49	5160	6123	6093	5876	0.00	5954
50	5190	6139	6114	5884	0.00	5966

Table 2. NYSE Composite Index.

REVIEWS

ing, in investing and computing, to fully appreciate what this program does and how.

To increase program speed and maximize the number of observations it can handle, Trend Analysis normally performs computations and records data in the integer mode.

Since this mode is limited to handling values between -32,768 and +32,767 and the real world often uses values beyond this range, the program uses a number of data coding methods. You have to adjust to these.

For example, the program follows the convention of dropping the decade number. Thus, it represents March 26 and 27, 1980 as 3260 and 3270 respectively (see Table 2).

In a similar vein, the New York Stock Exchange (NYSE) Composite Index accommodates two significant digits to the right of the decimal point, and you must track both places accu-

rately. The author's approach is to treat the index as a five-digit number with the two decimals becoming the units and tens positions (98.00 becomes 9800). It is up to you to put in the appropriate number of decimal places when you inspect the data.

The program's charting facilities are quite interesting. On my first glance through the documentation, I thought I'd have a problem, since my Line Printer IV doesn't have graphics capabilities. I was pleasantly surprised to find that I didn't need them. The generated charts use dashes, dots, asterisks, and plus signs to display information (see Figs. 1 and 2).

Since the heart of the system is the charting, detailed instructions appear in the manual and as a program segment on the disk for use if the program doesn't produce satisfactory results on your printer. If that's not sufficient, the software author in-

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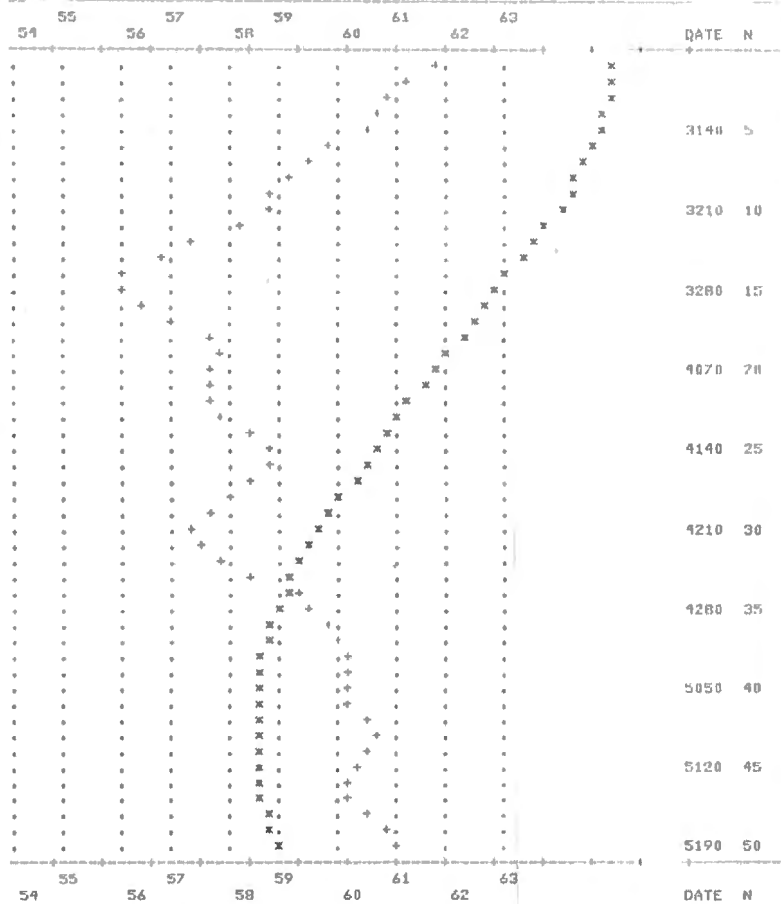


Figure 1. Linear graph of NYSE Composite Index.

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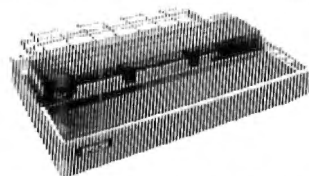
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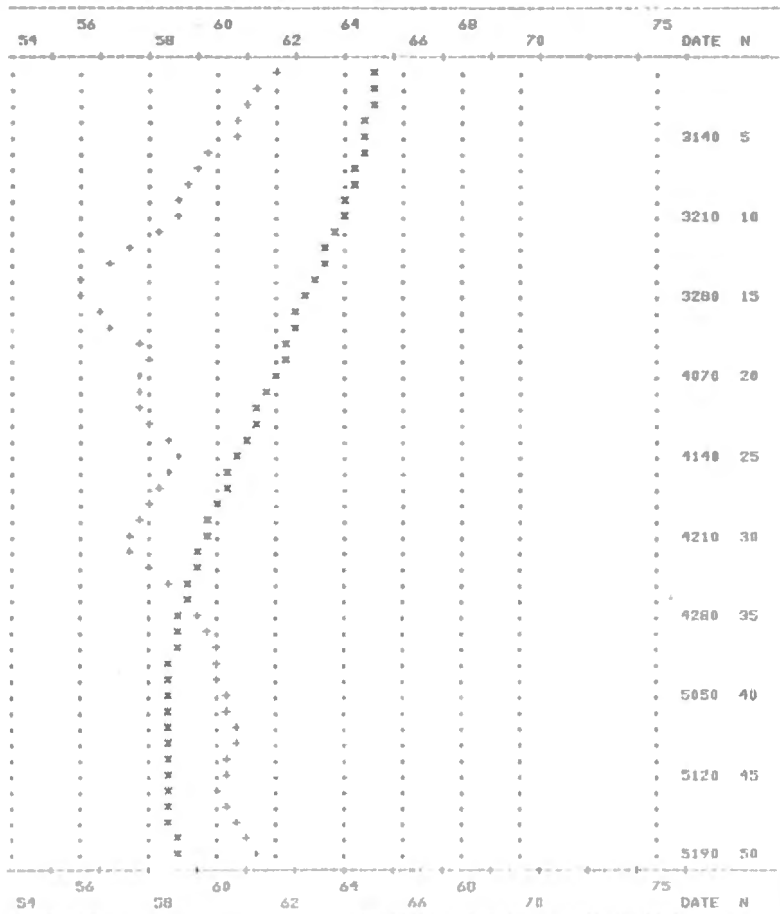


Figure 2. Semilog graph of NYSE Composite Index.

cludes his home phone number so you can call him for help.

Trend Analysis is the primary part of a series of programs. It does the main analysis and plotting. The Dividend Adjustment Program (\$20) revises prices on the files as necessary to reflect cash payments, stock splits, and so on.

The most recent addition to the system, the Advance Decline (A/D) Program (\$37.50), lets you capture A/D data, do preliminary analyses on it, and pass it on to the main Transaction Analysis Program.

Trend Analysis Program



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ZBASIC 2.2 DOES NOT SUPPORT THESE BASIC COMMANDS:

- ATN, EXP, COS, SIN, LOG, TAN, and exponentiation. (However, subroutines are included in the manual for these functions.)
- ERROR, ON ERROR GOTO, ERL, ERR RESUME.
- No direct commands like AUTO, EDIT, LIST, LLIST ETC, although these commands may be used when writing programs.
- Others NOT supported: CDBL, CINT, CSNG, DEFFN, FIX, FRE.
- Normal CASSETTE I/O. (ZBASIC supports it's own SPECIAL CASSETTE I/O statements.)
- SOME BASIC COMMANDS MAY DIFFER IN ZBASIC. For instance, END jumps to DOS READY, STOP jumps to BASIC READY etc.
- MEMORY REQUIREMENTS: to approximate the largest BASIC program that can be compiled in your machine (at one time), enter BASIC and type: PRINT (MEM-6500)/2. Remember, you can merge compiled programs together to fill memory.

ZBASIC 2.2 SPEED COMPARISON DEMO

To help give you an idea how fast compiled programs are, we have included this demo program:

ZBASIC 2.2 DEMO PROGRAM

Time to compile and run complete program	: 0 MIN. 2 SEC.
BASIC Execution speed MOD 1, LEVEL II	: 7 MIN. 34 SEC.
ZBASIC Execution speed MOD 1, LEVEL II	: 0 MIN. 18 SEC.
BASIC Program size (WITHOUT VARIABLES)	: 895 BYTES
ZBASIC Program size (WITHOUT VARIABLES)	: 2733 BYTES

(Remember that the ZBASIC program includes an 1879 byte sub-routine package.) Program shown exactly as compiled and run in BASIC and ZBASIC

```

10 '----- ZBASIC 2.2 EXAMPLE PROGRAM AND TIME TEST-----
20 CLS: CLEAR 100: DEFINT A-X: DEFSTR Z: DIM AA(64, 24), Z(50): RANDOM
30 AA=100: BB=-1000: CC=3: DD=-3: EE=-9999: ST$="START TIME "+TIME#
40 FOR I=1 TO 127 STEP 2 : FOR J=47 TO 1 STEP -3: XX=POINT(I, J): SET(I, J)
50 XX=(I-J)/CC*(7+I+J) : XX=ABS(INT(RND(I+J)-AA)+7) : RESET(I, J)
60 XX=PEEK(I+J) : POKE 15360+I+J, J : OUT 255, J AND (3*J): XX=INP(I)
70 ABS=STR$(I+J) : BA$=LEFT$(ABS, 2) : AA(I/2, J/2)=VAL(BA$)+AA*3
80 BA$=BA$+RIGHT$(BA$, RND(3)) : IX=INSTR(1, BA$, "9") : XX=SQR(I*J)
90 BA$=MID$(BA$, 2, 2) : MID$(BA$, 1, 1)=Z : IF XX THEN 100 ELSE CLS
100 IF LEN(BA$) > 3 OR SGN(XX)=1 AND ASC(BA$)=32 THEN PRINT"++"
110 IF POS(0) < 62 THEN TRON: TROFF: PRINT ELSE XX=NOT(RND(99))+100
120 A$=INKEY$: IF A$="Y" OR A$="y" AND I < 120 THEN PRINT"TRUE.."
130 RESTORE : READ A, C, Z(J), D: GOSUB 170: GOSUB 170: GOSUB 170: GOT0 210
140 NEXT : PRINT "*" : NEXT I: CLS: PRINT 0512, ST$, "STOP TIME ", TIME#
150 STOP: ***** END OF MAIN TEST LOOP *****
160 DATA 12345, -1, "TEST", -9999
170 ON RND(6) GOTO 180, 190, 200, 180, 190, 200
180 RETURN
190 RETURN
200 RETURN
210 ON RND(9) GOSUB 180, 190, 200, 180, 190, 200, 180, 190, 200
220 GOT0 140
    
```

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Conclusion

If your brand of market-watching habits is similar to what the program handles, you will find this system useful. If not, it might still be of some value to you.

For example, if you wish to chart several data values, rather than one and its moving average, you can modify the program to accept multiple values. You would inhibit the moving average computations, and just save and plot the data.

The programs are menu driven and easy to use. They come with extensive documentation, examples, and several years of data to get you started.

As with any investment software, be sure you fully understand the procedures for and ramifications of your actions before committing funds. ■

**The CE-60:
Versatile Printing**

by Colin Alexander

The Brother Compactronic 60 is one of the most affordable and versatile typewriter/printers available for the TRS-80. Convenience and versatility are key words in describing this machine.

At a speed of 13 characters per second, the CE-60 is comparable to other low-cost daisy wheel printers. Although slow by dot matrix standards, its double duty as a typewriter makes

it a nice peripheral for low-volume letter quality printing.

The CE-60 as Typewriter

Even with its acoustic shield open, the CE-60 is surprisingly quiet. It comes with a glare screen that you can adjust to mask out glare from the acoustic shield. Little extras such as these make the CE-60 a bargain.

The sculptured keyboard is in standard QWERTY layout. Despite its excellent tactile characteristics, the keyboard's delay factor annoys some people. So many typists rely on real-time key response for speed, that the CE-60 proves a nuisance in the beginning. I find the delay an asset since I'm less likely to peek at the carriage.

Function Keys

A variety of special function keys provide unique capabilities for a typewriter in this price range. Automatic relocation moves the print head to the next character position whenever you open the cover and then close it. This feature is also key selectable after a correction sequence. Express backspace, line indent, and paragraph indent are all standard features.

Three selector switches are clearly marked for pitch selection, line spacing, and keyboard offset. You can select pitches of 10, 12, or 15 characters per inch (cpi). For line spacing, you can choose single, one and a half, or double line feeds. Keyboard offset adjusts key codes to match the

special characters on the daisy wheel you're using (English, international characters, or symbols).

The Auto key, my favorite feature, lets you type continuously without carriage returns. When the print head approaches the right margin, it enters the hot zone where a space or hyphen produces a carriage return.

CTR and RMF provide automatic centering and flush right features. When you engage CTR, the corresponding key lights up and the print head moves to the center of the page. Every other character that you type advances the print head to the left.

Nothing prints until you press the carriage return key. Then the line of

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REVIEWS

text magically prints in the center of the page. The same sequence occurs for flush right, except the print head moves to the right margin and advances to the left for each character you enter.

When you press the key marked XXX, the key lights up and the printer automatically underlines each character until you cancel the function.

Each special function key has an indicator lamp. You'll always know at a glance which functions are active.

Documentation

Documentation is adequate, but often requires reading between the lines. The precision of English has been lost in translation from the original Japanese.

The procedure for changing daisy wheels needs clarification. I had a hard time properly installing the daisy wheel cassette until I carefully examined the print head mechanism. The instructions don't mention that you must align the direction arrow embossed on the daisy cassette with the tiny metal pin on the wheel itself.

Insert the daisy cassette so that the pin meets the tiny groove in the print head spindle. Don't be afraid to apply a little pressure to properly seat the daisy wheel. Listen for two clicks, not the single click mentioned in the manual.

The CE-60 as Printer

With the optional IF-50 computer interface (\$199), your TRS-80 is min-

```
PATCH CE60/CTL (ADD = BB75, FIND = 00, CHG = 0A)
PATCH CE60/CTL (ADD = BB7E, FIND = CDF0BD0611B7,
  CHG = 0609FE0F2808)
PATCH CE60/CTL (ADD = BB84, FIND = 2808060EFE0C,
  CHG = 060BFE0C2802)
PATCH CE60/CTL (ADD = BB8A, FIND = 2802060F, CHG =
  060D2800)
PATCH CE60/CTL (ADD = BB95, FIND = 78CD04BE, CHG =
  CD04BE00)
PATCH CE60/CTL (ADD = BC69, FIND = 1EDF, CHG = 1E5B)
PATCH CE60/CTL (ADD = BCD1, FIND = 3E1C, CHG = 3E55)
PATCH CE60/CTL (ADD = BCDD, FIND = 3E1E,
  CHG = 3E44)
PATCH CE60/CTL (ADD = BDF8, FIND = B73203BE, CHG =
  FE0F2803)
PATCH CE60/CTL (ADD = BDFC, FIND = 2801AF32, CHG =
  00000C9)
PATCH CE60/CTL (ADD = BE04, FIND = CD9BBBD83E1B,
  CHG = 3E1FCD9BBB78)
PATCH CE60/CTL (ADD = BE0D, FIND = D83E19CD9BBB,
  CHG = 3E1BCD9BBB3E)
PATCH CE60/CTL (ADD = BE13, FIND = D83A03BEB7,
  CHG = 43CD9BBBC9)
```

Program Listing. SuperScripsit printer driver modifications.

utes away from becoming a letter-quality word processing station. The IF-50 contains two membrane-type switches, three LEDs, and a 2K RAM buffer. You can select both Copy and Self-test modes from the interface.

Since the IF-50 is capable of serial or parallel communications (DIP-switch selectable), you can connect your TRS-80's RS-232C port to a dot-matrix printer and the parallel port to the CE-60. By the way, serial interfacing requires modifications to both Su-

perScripsit's serial driver (S/CTL) and the serial cable. According to a Brother Corp. customer service technician, you have to jump several cable wires at the IF-50 end of the cable.

Brother sells a parallel cable for the TRS-80, but my MX-80 ribbon cable works perfectly. Parallel switching devices are also available to permit manual switching between two printers.

I use SuperScripsit with the IF-50, CE-60, and TRS-80 combination. SuperScripsit's Daisy Wheel II (DW2/

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REVIEWS

CTL) printer driver fully supports the remarkable CE-60 with a 44-byte modification (13 simple patches).

All DW2 printer options, including the double-underscore, are available with the optional international daisy wheels. You can't implement double-underscore with the factory-provided daisy wheel, but you can use all other printer codes. Unfortunately, the entire line of daisy wheels is as difficult to find in one place as are the four types of ribbon cartridges.

Begin by using either the TRSDOS Copy utility to copy DW2/CTL into a new file named CE60/CTL or renaming DW2/CTL if you have limited disk space. When TRSDOS Ready appears, type in the patches as shown in the Program Listing.

These modifications correct the forward and reverse half-line feed codes for subscribing, superscripting, strike through, and top-of-form operation, as well as the automatic pitch selection, margin reset, and double-underscore codes.

The advantages of a typewriter/

printer become clear when you've just printed an article and realize that you neglected to underline several words or made a spelling error. Simply reposition the page in the typewriter and make the corrections without reprinting. Pin-feed paper works beautifully in the CE-60.

With its automatic centering, automatic underlining, one-line memory correction, impressive array of daisy wheels, and this modified driver, the Brother Compactronic 60 is a terrific choice for the Model III/4 owner. ■

TRSDUM: A Tape-to-Disk Utility

by Edward Spitzbarth III

TRSDUM is a handy, well-done TRSDOS utility that helps you save a library of cassette programs to disk.

Machine-language programs transferred from tape to disk tend to crash because the program attempts to use memory addresses that TRSDOS al-

ready uses. The only way to run these programs is to load them at a different address.

TRSDUM solves this transition problem by loading a program from tape into its buffer, then letting you

TRSDUM



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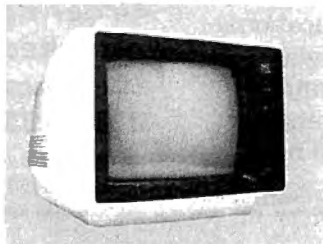
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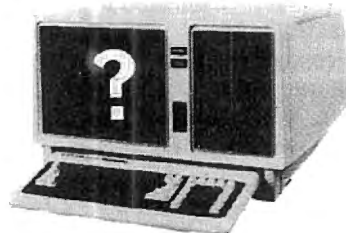
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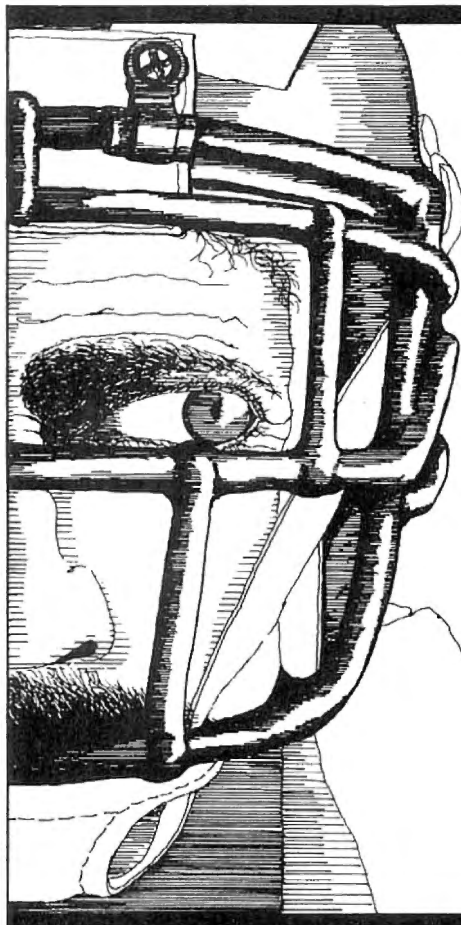
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change the memory address at which the program enters memory. TRSDUM automatically sets the new values or lets you choose your own.

CRB Microtools claims that the automatic memory address works 99 percent of the time, and it has yet to fail me. After you relocate the program, you can save it to disk under your own file name.

TRSDUM makes its own working copy on another disk and is then run like any other machine-language program. This utility is menu-driven and easy to use.

The manual describes each menu selection thoroughly. It's well-written and easy to understand.

I was able to transfer most of my tape programs to disk using TRSDUM. I did have a problem with one program, so I contacted the author of TRSDUM. He explained that this particular tape contains a preloader program that prevents making a disk copy by any means.

TRSDUM has other nice features: It displays program start, end, and execute addresses, and the length of the file. It also makes tape copies of disk programs with a gap between them. Tape versions of this utility, TRSTUM1 and TRSTUM3, are also available.

This is an excellent utility at a reasonable price for anyone upgrading his tape system with a disk drive. ■

Reference Book for CP/M Users

by Alan Neibauer

CP/M Bible is a definitive reference guide that Digital Research should provide with each CP/M package they sell.

The authors begin with a brief overview of operating systems that explains the differences between built-in and transient commands. You load built-in commands with the DOS itself and retain them in memory. They include CP/M's Directory, Rename, Erase, Type, and Save commands.

Transient commands, or utilities, are stored on the disk and temporarily loaded into user memory when you call them. Commonly used transient commands include STAT, PIP, Load, Format, and ED.

CP/M Bible



Mitchell Waite and
John Angermeyer
Howard W. Sams & Co. Inc.
4300 W. 62nd St.
Indianapolis, IN 46268
429 pp.
\$19.95

Well-written? ★★★★★☆
Organized? ★★★★★☆
Thorough? ★★★★★☆
Readable? ★★★★★☆

CP/M Bible details all versions of the system from 1.3 to 3.0. A useful chart in the second chapter compares each version in terms of built-in, transient, and control character commands, disk specifications, and BDOS (Basic disk operating system) functions.

The second chapter also details file specifications, file access procedures, and the use of wildcards in referencing programs.

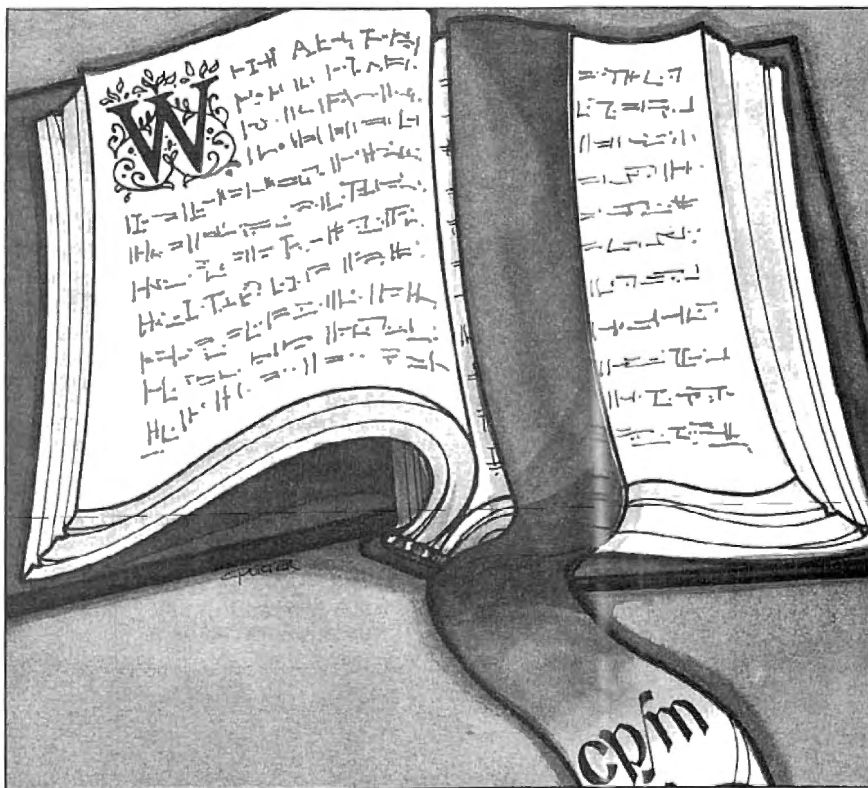
The next 18 chapters explain the most useful built-in and transient commands. This is where CP/M Bible serves as a bible for system users.

Each chapter starts with a short summary explaining the command's basic function and any associated definitions. Then the authors list and explain specific applications of each command. The functions included are those most users perform, as well as those many would like to use.

The authors discuss the simplest built-in functions first: the Directory, Rename, Erase, Type, and User commands. The transient STAT command, which has no real TRSDOS counterpart, takes longer to explain.

Chapter 9 details PIP, a much underrated CP/M transient. While most people use PIP only as they would the Copy command in TRSDOS, CP/M Bible reveals its abilities to copy between all logical devices and use special parameters. The book explains each function concisely yet completely.

The authors treat the remaining transient and built-in functions in the same practical manner. These include the Edit, Format, Save, SYSGEN, MOVCPM, Submit, XSUB, ASM, Load, DDT, and Dump commands.



REVIEWS

Each explanation first summarizes the command, then gives specific applications.

An entire chapter is dedicated to CP/M 3.0 (CP/M Plus) because of its major differences from earlier versions. The authors briefly discuss disk drive chaining, time and date stamping, and new commands.

The book concludes with a number of useful appendices, including optional transient utility programs on the market, a review of CP/M-compatible languages, and related operating systems serving multi-user, 16-bit, and networking functions. A complete bibliography, glossary, ASCII cross-reference guide, command summary, and messages round out the work.

The best feature of *CP/M Bible* is its practical organization. Rather than list features and commands, each chapter discusses a number of specific and useful tasks.

For example, Chapter 10 discusses ED commands according to the function the user would perform, such as "appending lines," "inserting text,"

or "moving the character pointer backward or forward." Organizing the book in this manner lets you scan the table of contents for a complete description of the appropriate function.

Although \$19.95 seems like a lot for a reference manual when Digital Research already supplies one, the *CP/M Bible* is the perfect tool for the new and occasional CP/M user. This book is worth the money. ■

Learn & Teach Programming

by Mary Gasiorowski

Learning & Teaching Programming was written as a crash course in Basic terminology for bright sixth graders. Although it's useful as a resource, this book is incomplete as a teaching text.

You can use it to teach students age seven to adult; younger children need more assistance with the material. Older users might be able to develop

their own programs from the hints this book provides.

The author states in the preface that *Learning & Teaching Programming* is an "introduction to the mechanics" and does not contain many practical applications. It's a quick introduction to all Basic commands and concepts using a Model III cassette-based system. This book does not cover disk systems.

The author groups the material into only three chapters: Beginning Programming, Mechanics of Programming, and Intermediate Programming. Chapter 1 covers introductory concepts, including parts of a microcomputer, the keyboard, and some Basic commands, such as Print, List, Run, and GOTO. Chapter 2 covers the bulk of the Basic commands. Chapter 3 introduces advanced commands: arrays, ASCII codes, graphics, and string functions.

The book begins with a pretest, and each chapter ends with a test that checks the learning process. Eight appendices provide test answers, ASCII

REVIEW DIGEST

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Computer Dictionary for Beginners, Arthur Naiman, Ballantine Books, New York, NY, 150 pp., \$6.95.

"*Computer Dictionary for Beginners* contains some 1100 definitions, most of them for words, expressions, or abbreviations likely to be encountered while shopping for or reading about computers, or trying to understand the manuals that come with them.

"...Naiman has managed to pro-

duce an extremely useful and informative reference work with a strong blend of good-natured humor." *Personal Computing*, January 1984, p. 231.

CP/M 2.2, Montezuma Micro, P.O. Box 32027, Dallas, TX 75232, Model 4, \$199.

"This version of CP/M is more than satisfactory. In our experience it runs, without problem, most CP/M programs not written for a specific microcomputer. The utilities included are excellent as well; they are numerous, useful and function well." *InfoWorld*, Dec. 5, 1983, p. 86.

The Word Machine, Pel-Tek, P.O. Box 1026, Southampton, PA 18966, Models I, III, and 4, \$20.

"...when I was asked to review the new \$20 word processor from Pel-Tek, I was less than enthusiastic....After I had spent only about an hour with The Word Machine, I was pleasantly surprised.

"...Although I cannot recommend this software for the professional writer, law office, or software development house, ...I highly recommend it for the casual writer on a limited budget, or for the individual who wishes to learn some of the basic concepts of word processing." *Basic Computing*, January 1984, p. 20.

How To Do It on the TRS-80, William Barden Jr., IJG Inc., 1953 W. 11th St., Upland, CA 91786, \$29.95.

"*How To Do It on the TRS-80* is a book that covers the TRS-80 Models I, II, III, Color and 100 computers. It is, or soon will be, the premier reference source for these computers.

"...It is for the novice who may need to know how to read the color code on a resistor....It is for the experienced user who may need a quick reference source to find the pin-out on one of the computer's interface connectors." *Basic Computing*, January 1984, p. 32.

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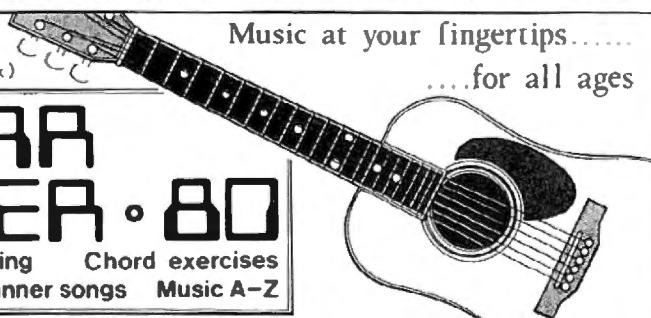
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REVIEWS

codes, a computer glossary, a list of computer publications, general micro-computer information, a chart comparing various microcomputers, general types of software available, and typing help for young children.

This book introduces commands or computer concepts with a little explanation on their purpose and, usually, an example. Unfortunately, the page layout is not convenient for entering the program examples into the computer.

The information that you type into the computer is not highlighted or set off in a separate column—it's in the middle of the explanatory paragraph. In addition, the paragraphs are numbered and you might confuse them

Learning & Teaching Programming



Nancy Lee Olsen
Howard W. Sams & Co. Inc.
4300 W. 62nd St.
Indianapolis, IN 46268
\$10.95

Well-written? ★★★★★
Organized? ★★★★★
Thorough? ★★★★★
Readable? ★★★★★

with the program line numbers.

The teaching value of *Learning & Teaching* is questionable. It doesn't include enough examples or thoughtful exercises. In fact, it doesn't teach—it barely introduces concepts.

A child (and the average adult) is not going to learn programming by himself with this book. He'll need an experienced teacher available to answer questions, provide more examples, and make suggestions to solidify the learning process.

As a resource book, *Learning & Teaching* has some merit. It introduces all the Basic commands and the appendices have a lot of generally useful information. The appendices are at least as valuable as the rest of the text. ■



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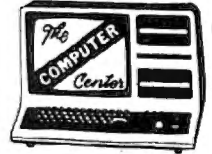
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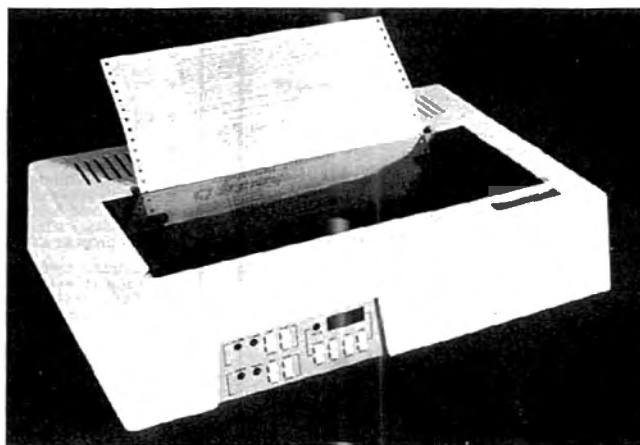
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The DS220 includes both serial and parallel interfaces as standard features, along with a 2,000-character buffer. It costs \$1,995 from DataSouth Computer Corp., 4216 Stuart Andrew Blvd., Charlotte, NC 28210, 704-523-8500.

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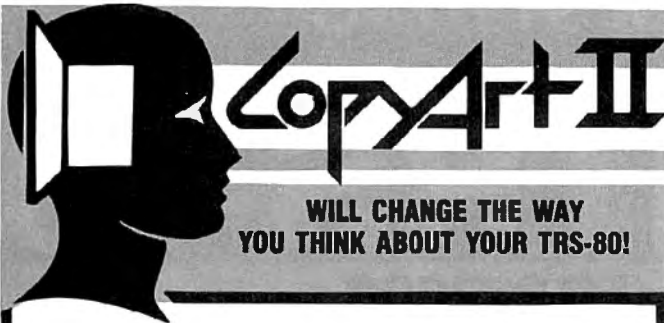
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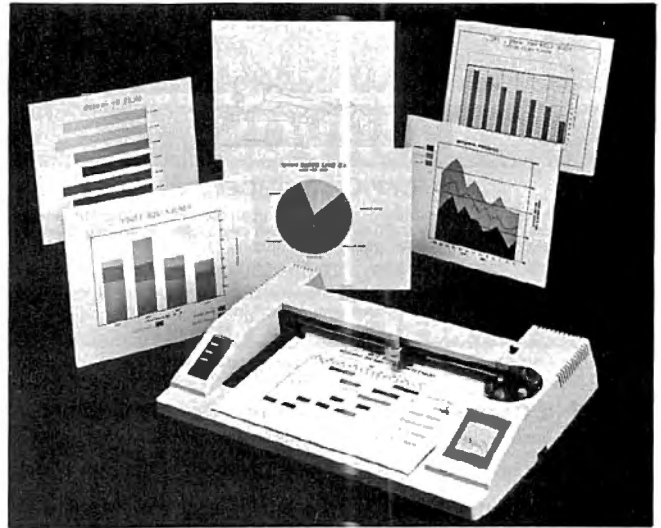


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The Sweet-P Six-Shooter graphics plotter draws charts, graphs, and illustrations in six colors at a speed of 14 inches per second.

Six-Pen Plotter

The Sweet-P Model 600 Six-Shooter is a six-pen plotter/printer that offers a plotting speed of 14 inches per second, mainframe eavesdropping, 19 language character sets, and 2K bytes of buffer memory. It has a rotating carousel that automatically changes and caps the pens during operation according to your instructions.

This plotter can handle both 8½- by 11- and 11- by 17-inch paper, as well as European-equivalent sizes. It comes standard with both RS-232 and parallel interfaces and costs \$1,095 from Enter Computer Inc., 6867 Nancy Ridge Drive, San Diego, CA 92121, 619-450-0601.

Reader Service ✓ 570

PEEKs and POKEs for the Models I, III, and 4.

PEEK and POKE More Powerful Programs documents the pressure points in your computer and tells you how you can use them to improve your programs. This pamphlet costs \$4 from David Lewis, Union College, Box 1927, Schenectady, NY 12308.

Reader Service ✓ 552

Elf Friend

Everyone could use an elf to help them out, right? Here's an elf for your Model 100. The Elf-Writer is a formatting utility for the Text word processor. It features a viewing mode that lets you see how your document will look before it's printed.

You format documents by embedding commands within your text. Elf-Writer supports commands for headers and footers, variable margins, and variable line spacing. You can include Page breaks automatically, forced or handled on a conditional basis. Elf-Writer includes a default file that contains standard

PEEK-A-Boo!

There's nothing more frustrating than looking at someone else's program and not understanding to what all those PEEKs and POKEs refer. Now there's a pamphlet available that defines more than 70 of the most important and useful



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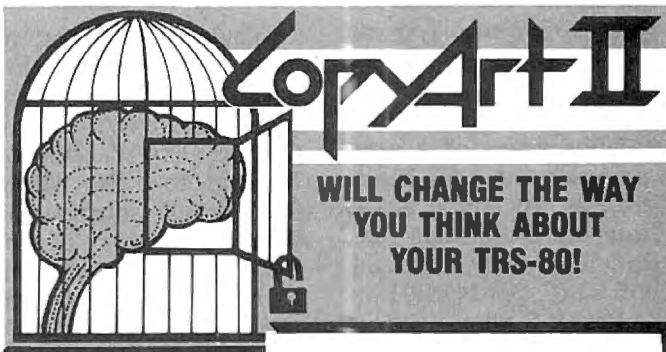
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✓ 161



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15. SUPER EASY TO LEARN editing features. Logical key choices.
16. Hyphenation
17. SPELLING checkers like the 74,000 word Scripsit Dictionary work great with CopyArt II.
18. CHAINING. Chain files together to make books or manuals hundreds of pages long.
19. CENTERING.
20. HEADERS and FOOTERS. You can even put graphics within headers for super page layouts.
21. PAGE NUMBERING. Page numbers can appear at the top or bottom of the page.
22. DOS COMMANDS from within the editor. Kill files, check free space or get directories easily.
23. CUSTOMIZED PRINTER driver. Since your printer has features that other printers don't, CopyArt II will be supplied with the printer driver of your choice below. Each printer driver is custom made to provide you with commands for each of your printer's fine capabilities. If you have more than one printer, order other printer drivers for only \$19.95 each. Printer drivers are available for:
 - Radio Shack LP IV, V, VI, VII, VIII and Daisy Wheel II
 - Epson MX-80, MX-80/FT, MX-100 with or without grafrax.
 - Okidata Microline 80, 82a, 83a and 84
 - NEC 8023
 - Smith Corona Daisy Wheel TP-1
 - Brother Daisy Wheel
 - C-Itch Starwriters and Prowriters all, 85 10A, 1550
 - PMC Printer
 - Centronics 737, 739
 - Diablo 620
- OTHERS COMING SOON. Call if you don't see your printer!
24. Unprotected diskette. Unlimited backups can be made.
25. MAILIST/MAILMERGE INCLUDED. CopyArt II comes with a mailist program that stores over 2,000 names on a MOD III diskette. These names can be sorted by any field and have a special field for your code. You can make PERSONALIZED FORM LETTERS that will take the following codes from the mailist and insert them in your text. FIELDS INCLUDE: Mr. or Ms., Last name, First name, Business name, City, State, up to 9 digit ZIP code and your own special 2 character code. ANY OF THESE fields can be inserted within your form letter wherever you want. You can print form letters or mailing labels to all the people on your list or to specific codes only. CopyArt makes it easy.

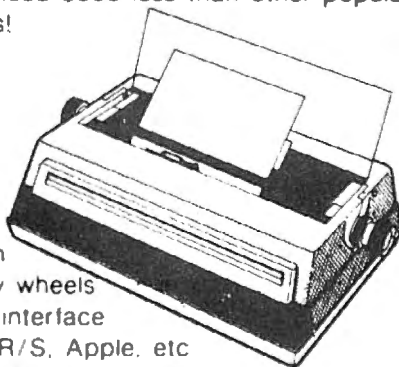
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the next page...



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NEW PRODUCTS

formatting commands for your documents. You can tailor this file to fit your needs.

Elf-Writer provides the printing power of a word processor with a full line of features. It costs \$24.99 from Ceres Software Inc., P.O. Box 1629, Portland, OR 97207, 503-245-9011.

Reader Service ✓ 557



With this inside information, you'll have your computer talking in no time.

Speak Out!

Wouldn't it be neat to have a computer that talked? Two new books from Howard W. Sams & Co. Inc. (4300 W. 62nd St., Indianapolis, IN 46268, 317-298-5400) discuss the theory and practice of synthetic speech: *Introduction to Electronic Speech Synthesis* and *Electronically Speaking: Computer Speech Generation*.

The first, written by Neil Sclater, is a 134-page non-technical investigation into how human-sounding speech is synthetically created by electronic means. It costs \$8.95.

Electronically Speaking: Computer Speech Generation by John Cater is a practical guide to current speech synthesis technology and circuitry, with hardware and software provided that

let you generate speech on a microcomputer. The book is 230 pages long and sells for \$14.95 at participating Sams dealers and bookstores.

Reader Service ✓ 550

Reference Charts

Are you tired of looking up little-known Basic or Profile III commands? If so, then perhaps you should consider buying a wall chart from Crest Software (2132 Crestview Drive, Durango, CO 81301, 303-247-9518). They make easy-to-read reference charts for both of these programs.

Each chart measures 18 by 24 inches and is printed in two colors for quick reference. The Basic wall chart includes all Basic and Disk Basic commands as well as character, decimal, hex, oc-

tal, and binary conversion tables. The Profile III wall chart shows both the Create and Run menus, with each section expanded to show all possible commands with explanations.

Both charts cost \$4 plus \$2 shipping and handling (which covers any quantity ordered).

Reader Service ✓ 568

Energy Supply Source

Owning a surge suppressor is great if you want to avoid power surges and fluctuations. But what do you do when the power goes off completely, leaving you in the dark with lost data? UPS from Bits Power Systems (11020 Audelia Road, Suite B114, Dallas, TX 75243, 214-340-1280) gives you an uninterruptible power supply.



CHILD'S PLAY

AN EDUCATIONAL PROGRAM FOR CHILDREN AGES 2 TO 7 YEARS

This machine language program contains fast **animation**, **sound effects**, **tunes**, and **speech**. The speech has two options: it can be generated by computer or by a VS100 speech synthesizer (speech options described later). The program is easily controlled by a friendly menu-man who points to the options that may be chosen. The main menu contains four sections: • **Learn the Alphabet** • **Learn to Count** • **Learn Shapes** • **Learn Words**. Each section contains three subsections which can easily be manipulated, giving twelve games in all. The menu selection is accompanied by a different nursery rhyme tune for each menu.

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 for 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.

Software available for the TRS80® Models 1, III, and IV. Also soon available for the Timex. 16K tape (no speech) 32K tape 32K disk 48K disk. All programs for

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Unlike other power systems that transfer the operating computer from the utility line to battery-derived power after a power outage, the UPS unit is always on line. Utility line power is used only to maintain a full charge on the internal gel-type batteries.

Both units have visual, audible, and remote alarm functions. UPS's internal batteries provide standard full-load back-up time for 10 minutes. You can attach external 12-volt batteries to a connector that's provided for extended back-up and automatic charging.

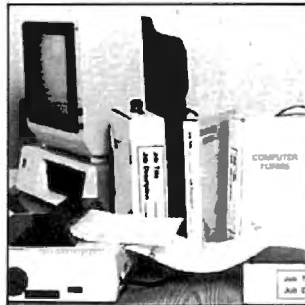
Two power supply models are available: the UPS-200 (200-watt) weighing 35 pounds, and the UPS-400 (400-watt) weighing 55 pounds. The suggested retail price is \$795 and \$995 respectively. Both

models are enclosed in a handsome black anodized brushed aluminum cabinet, and have four standard, grounded output receptacles.

Reader Service ✓ 554

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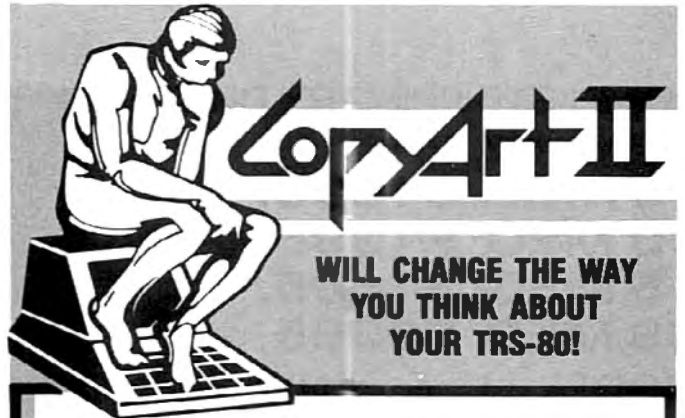
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28. **COMPLETE MARGINS CONTROL.** You tell CopyArt II what margins you desire. You can even change margins within the same text. You may also have parts of your text with 2 columns, some with one etc. It's super easy to use.
29. **BASIC PROGRAMS** can be edited easily. CopyArt is really useful for inserting graphics within quoted strings to give your programs super animation without the hassle of calculating the CHR\$ of the graphics!
30. **VISICALC** files can be loaded into CopyArt II to be manipulated easily. Great when you want to accompany your Visicalc reports with written reports. **GRAPHS** and **BOLDFACING** etc. Visicalc reports up to 255 wide can be loaded.
31. **SPECIAL SCRIPSIT FILE LOADER.** Allows you to load your old Scripsit files without having to save them in ASCII. Copyart will also load Pencil files and other normal ASCII files.
32. Similar to Scripsit, if you have used Scripsit, you can use Copy Art in minutes.
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36. **Professional Manual** in easy to understand English. Copyart II requires a TRS-80 Model I or III, (or PMC-80 or LNW), 48k and 2 disk drives with Newdos-80, Ldos, Multidos, Dosplus or TRSDOS. Double density disk drives recommended for the Model I.

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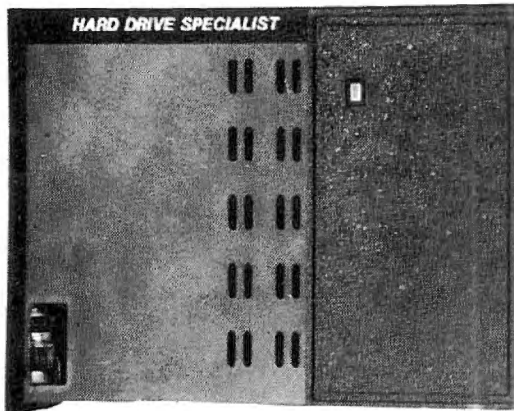
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Priced from \$5.20 to \$24.45, depending on the kind and weight of paper you desire, the paper is available from Computer Peripheral Products Inc., 4690 Joliet St., Denver, CO 80239, 800-874-2238.

Reader Service ✓ 555

a choice of paper feed options. Almost every MT-440 operation is faster than in previous Mannesmann Tally printers, including print head speed, slew speed (vertical paper advance), print head turn-about, and accelerated tabbing.

The printer runs at 400 characters per second (cps) in the draft mode and 100 cps in the letter-quality mode. The MT-440 uses an 18- by 40-dot matrix in the draft mode, and a 9- by 7-dot matrix in the letter-quality mode. It prints 10, 12, or 16.7 characters per inch. The MT-440 includes full dot-addressable graphics as standard.

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High-Speed Serial or Parallel Printer

When you're looking for fast printing speed, take a look at Mannesmann Tally's MT-440, a high-speed serial dot-matrix printer. It features variable-quality printing, operator-programmable type pitch, and

The MT-440L, which produces draft-quality print only, retails for \$2,395. The MT-440L, which adds letter-quality capability, costs \$2,695. Both models are

Programs work on TRS-80 Mod I/III, all DOS.

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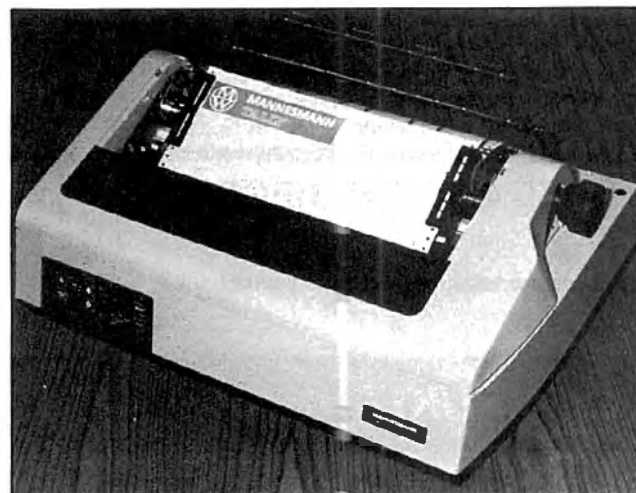
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SUPERTAX I: Using either screen or printer output, SUPERTAX I generates clear and concise summaries of Page 1 and 2 and Schedule A of FORM 1040, allowing you to see at a glance and quickly comprehend your tax situation. This program also prints an OVERALL SUMMARY of the return showing Adjusted Gross Income, Itemized Deductions, Taxable Income, Regular Tax, Income Averaging Tax, Minimum Tax and Payment Due or Refund — all of which are calculated by the program. SUPERTAX I also calculates the moving expense deduction, investment credit, taxable capital gains, political and child care credits, medical limitations, and much more. Input is fast and easy and changes can be made in seconds. This program actually makes tax planning a breeze.

SUPERTAX II: Includes the efficient SUPERTAX I program as well as the more detailed SUPERTAX II program which makes all of the SUPERTAX I calculations, but which also PRINTS THE INCOME TAX RETURN. This program prints Page 1, page 2, Schedules A, B, and G (income averaging) of the FORM 1040 as well as FORM 3468 (investment tax credit) on standard government forms or on blank computer paper for use with transparencies. Any input item can be changed in seconds and the entire return recalculated almost instantly.

SUPERTAX III: This package includes both the SUPERTAX I and SUPERTAX II programs PLUS a program to calculate and print Schedule C of the FORM 1040. Also included is a stand alone depreciation program which calculates and prints your depreciation schedule using both the old rules and the new ACRS rules. Output from the depreciation program is designed to serve as a supplement to IRS FORM 4562.

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SUPERTAX III — \$59.95



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NEW PRODUCTS

available with either serial or parallel interface from Manesmann Tally Corp., 8301 S. 180th St., Kent, WA 98031, 206-251-5500.

Reader Service ✓ 579

A Potpourri of Utilities

All you Models I and III programmers can save time and increase your output with Super-Q, a package of seven utility programs.

Super-Q consists of MAP, which displays or prints sorted lines with command verbs; VAR, which does the same thing as MAP only with numeric values instead of lines; SPEED, which reorganizes variables tables and initializes variables by search frequency for the fastest run-time; COMPRESS, which reduces memory overhead,

allowing maximum free space; SCREEN, which prints screen or dumps screen to disk; HEX, which does hex math in DOS or Basic command mode; and a tutorial on how to eliminate garbage collection. Super-Q reduces execution time by up to 60 percent without a compiler, and cuts development time by as much as 70 percent.

This utility package costs \$39.95 plus \$2.95 for shipping from Accurate Data Service, P.O. Box 339, Tenafly, NJ 07670, 201-568-1610. Major credit cards are accepted.

Reader Service ✓ 558

Complete Word Processing

The Word Machine 3.0 Plus is an integrated word processing and spelling

correction system for your Model I, III, or 4. The word processor is an upgrade to the Word Machine 2.0. Besides the above-mentioned features, this newer version has several useful enhancements, including a simplified command structure for loading and saving files, and an additional Edit command for specifying ASCII printer codes embedded in the text.

Another important feature is a new Pause command within the text that lets you type data into specific fields within a line during printout without altering the text buffer. This feature, in combination with a multiple-print option, adds a useful form-letter facility. Headers, footers, and page numbering are also available with this upgraded version.

The Spell-Check/Correct system compares your text against a literal 30,000-word dictionary. A single command from within the word processor accesses this lexicon. Your text and possible misspellings are automatically displayed on the screen. You have the option to accept Word Machine's spelling, add it to a personal dictionary, or correct the word in context.

Word Machine 3.0 Plus costs \$65 complete; the Spell-Check/Correct system alone costs \$50. To operate this system, you'll need 48K of user memory and at least one disk drive. To place an order, or to get further information, contact Pel-Tek, P.O. Box 1026, Southampton, PA 19866, 800-523-2445.

Reader Service ✓ 575

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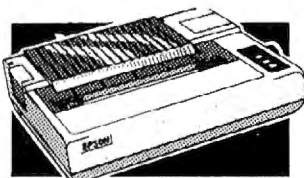
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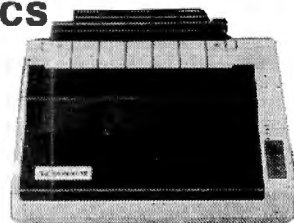
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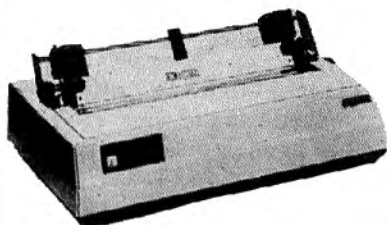
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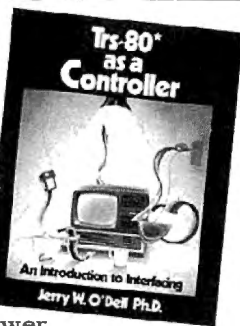
All you need is a TRS-80 Model III with 16K RAM, Level II BASIC, and a few other parts that you will no doubt find useful at a later date. You can also use a Model I, with the conversions provided. The components you'll need are all readily available.

The book begins with a description of the Model III and Z80 and all the chips, circuits, prototyping boards, and other devices used in TRS-80 interfacing. There are also helpful suggestions throughout for expanding the projects into more complex applications.

BK7394 \$12.97 softcover ISBN 0-88006-061-1
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For credit card orders, call **TOLL-FREE 1-800-258-5473** or mail your order with payment of \$12.97 each plus \$1.50 per book shipping and handling to: Wayne Green Books Sales, Peterborough, NH 03458.

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Reader Service ✓ 571

Speed-up for the Model 4

Now you can run your Model 4 at 5.07 MHz with the Alpha Super4 speed-up board. You can install the board in seconds; it requires no trace cuts, wire cuts, or soldering. All you do is unplug one IC, insert that IC in the Super4

board, and insert the board in the socket formerly occupied by the IC.

Super4 is transparent to the user. Your Model 4 operates as normal, only faster. Model III software works in the fast mode under all popular operating systems. Super4 lets you run double-density disks on an 8-inch drive.

This speed-up board costs \$79.95 from Alpha Technology Inc., P.O. Box 1908, Huntsville, AL 35807.

Reader Service ✓ 576

Color Graphics Printer

Pacific Technology Services' JDL 750 variable print-quality printer has some unique features that separate it from other printers on the market. It offers color, easy-to-insert cartridge ribbons, a pause button to stop printing, automatic cassette sheet feed that sorts sheets of paper in collated form and accepts paper 7 to 16½ inches wide and up to 16½ inches long, and a keypad on the

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NEW PRODUCTS



The TTX 1280 Portaprint is a 3-pound, portable, ac- or battery-powered thermal matrix printer for the Model 100.

printer's front panel so you can select print style (courier, gothic, or italics) and print speed (54-115 cps) at the touch of a button.

The JDL 750 offers a 151-character carriage. You can move paper through the printer in three ways: friction feed, tractor feed, and automatic cassette sheet feed. It prints in six colors: red, yellow, blue, green, orange, and violet, using a three-color cartridge ribbon. This lets you produce vivid color graphics.

The printer costs \$3,200 and is available with both RS-232C and Centronics parallel interfaces. For further information, contact Pacific Technology Services, 332 Pine St., Suite 610, San Francisco, CA 94104, 415-956-3926.

Reader Service ✓ 566

Portable Printer

All you Model 100 owners will be pleased to learn about the TTX Portaprint Model 1280 thermal printer. Weighing in at just 3 pounds, it measures 11 by 4½ by 2 inches (ideal for your briefcase), and runs on either batteries or ac power.

In the battery mode, the bidirectional printer prints at 40 cps. When powered

conventionally through any ac outlet, its printing speed doubles to 80 cps.

Portaprint comes with both a character and graphics mode. The former offers enlarged characters (40 characters per line), compressed characters (132 characters per line), and shadow printing. The latter mode features 72 by 72 dots per inch. Thermal roll paper and cut paper are both supported by friction feed.

As for printing noise, forget it. Unless you're watching it, you won't know it's printing. This lightweight printer costs \$199 from Teletex Communication Corp., 3420 E. Third Ave., Foster City, CA 94404, 415-341-1330. Reader Service ✓ 569

Model 4 Host/Terminal

LS-Host/Term is a high-level Host/Terminal package for Model 4's TRSDOS 6.0. The package includes a complete host system that works in conjunction with the Terminal portion of the package. The terminal portion emulates an Adds-25 terminal. LS-Host/Term supports full cursor positioning and reverse video.

This package includes all the features of TRSDOS 6.0 COMM, to enhance emulation of the Adds terminal. LS-Host/Term offers full upload and download capability for file transfer, as well as spooled printer support and all other high-level functions of COMM, while maintaining Adds-25 protocol for handling video and keyboard input/output.

With LS-Host/Term you can use a Radio Shack DT-1 as a remote work station in conjunction with a Model 4, or another Model 4 is an Adds-25 terminal. LS-Host/Term also lets you use the Model 12/16 under

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Xenix, or as a terminal to a Model 4 running the Host portion of the package.

The package costs \$199 plus \$3 shipping from Logical Systems Inc., 8970 N. 55th St., P.O. Box 23956, Milwaukee, WI 53223, 414-335-5454.

Reader Service ✓ 556

A Pocket Full of Fun

If you've been looking for programs for your pocket computer, look no further. Pocket Computer Programs by Nat Wadsworth, editor of the Pocket Computer Newsletter, is a collection of business, math, engineering, home, and entertainment programs for the Sharp PC-1500 and Radio Shack PC-2.

Some of the programs featured include personal calendars, amortization

programs, trip expenses, number conversions, simultaneous equations, regression analyses, Fourier transforms, histogram plots, and shopping lists. Each application includes an introduction by the author, a complete program listing, and a sample run.

This soft-bound 154-page book costs \$12.95 from Hayden Book Co., 50 Essex St., Rochelle Park, NJ 07662, 201-368-2202.

Reader Service ✓ 574

Information Please

Superlog Advanced Electronic Notebook is a free-format information utility for your Model I, III, or 4. It's interrupt-activated from within another running program by a single keystroke combination. Superlog's files are structured

to simulate a ringbound notebook which you can display on your screen one page at a time. Its text editor lets you read, write, erase, or modify any part of any page, or transfer information between pages at will.

After you finish with Superlog, the program restores the previous screen and the interrupted program resumes normal operation. Superlog supports multiple files per disk, and up to 32,767 pages per file on hard disk. Some of its features include text wrap-around, rapid search with a wildcard option, and password protection for files.

Superlog runs under LDOS 5.3.1 or 5.1.4. It costs \$119.95 plus \$5 shipping and comes with a user's manual, a Help file, and five utility programs.

For more information, contact KSoft, 318 Lakeside Drive, Brandon, MS 39042, 601-992-2239.

Reader Service ✓ 580

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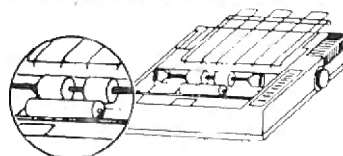
✓ 442

GOOD NEWS FOR EPSON MX-80 and RX-80 OWNERS

MICRO-GRIP FRICTION FEED

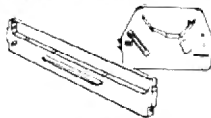
Add inexpensive friction feed to your MX-80 or RX-80. Easily installed with screwdriver, no soldering. Does not disturb tractor feed. Also fits printers based on Epson design such as IBM PC, Commodore and H-P Dot Matrix printers

Wt. 1 lb. ONLY \$39.95/ea.



CARTRIDGE RIBBONS FOR...

EPSON MX 70/80	\$5.00/ea.	RS LP III, V	\$5.85/ea.
EPSON MX 100	9.75/ea.	RS LP VI, VIII	7.00/ea.
RS Daisy Wheel II M/S	5.75/ea.	RS DMP 400	5.50/ea.
RS LP I, IV (Zip Pack)	2.75/ea.	DIABLO Hytype II M/S	4.50/ea.
RS LP I, II, IV (Cart.)	5.85/ea.	OKIDATA 84	5.00/ea.



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9-1/2" x 11" Blank, 20 lb. 1 pt., 1000/ctn.
(Extra fine perforations r. & l.) ONLY \$16.25/ctn.
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Order in increments of 5,000

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We require a minimum order of \$10.00, not including shipping charges. Prices effective 7/1/83 and subject to change without notice. To keep prices competitive we operate on cash basis. Credit extended to Federal agencies, but all other institutions and individuals send payment with order; our prices DO NOT include shipping. No C.O.D. orders accepted. We ship via UPS or motor freight. Include street address, we don't ship to P.O. boxes. Freight charges added to credit card purchases. No merchandise returned without prior written authorization from us. Merchandise ordered in error or not wanted is subject to 25% restocking charge and limited to merchandise credit only.



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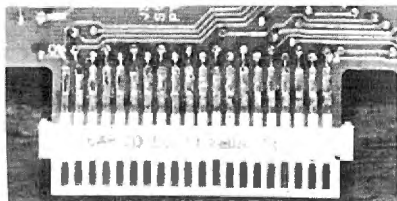
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Gold Plug 80

Eliminate disk reboots and data loss due to oxidized contacts at the card edge connectors. **GOLD PLUG 80** solders to the board edge connector. Use your existing cables. (if gold plated)

GOLD PLUG 80 Mod I Mod III



GOLD PLUG 80 Mod I (6)

Keyboard/EI (mod I)

Individual connectors

GOLD PLUG 80 Mod III (6)

Internal 2 Drive Cable

Mod III Expansion port

new
SPECIAL PRICE

\$44.95

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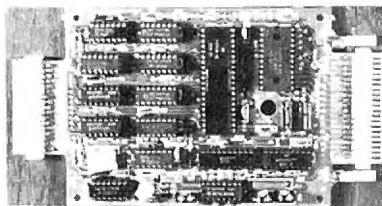
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TRS-80+ MOD I, III, COCO, TIMEX 1000, OSBORNE, T199/4a others

COCO MODULE INSTALLATION AVAILABLE

COCO Disk Module



Ground tab extensions

COCO Disk Module (2)

Ground tab extensions

Disk Drives (all R.S.)

Gold Disk Cable 2 Drive

Four Drive Cable

new
SPECIAL PRICE

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The **GOLD PLUG 80** extends the existing connection 1/2". The ground tab extensions extend the ground tabs 1/2" to contact the ground clips. The ground reduces the RFI interference to the monitor.

The Gold Plug 80

GOLD PLUG 80-E.A.P. COMPANY

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✓ 216



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Dealer Inquiries Invited

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Integrated Software
 • Advanced Editor
 • Word Processor
 • Smart Terminal

State-of-the-Art Performance From Your Model III(IV) for \$89.95

- **ADVANCED SCREEN EDITING**
 - Fast hor/vert scrolling
 - Instant Help Screens
 - Edits any file /BAS- /CMD
 - User defined personality
 - Macros for complex tasks
 - Screen snapshots (graphs)
 - Column editing features
 - Ranges, Vetos, & strings
 - Block move, load, save
- **ON SCREEN WORD PROCESSING**
 - Text justification (L.C.R.)
 - Paragraphs - indents - margin
 - Proportional spacing
 - Odd/Even Top & Bot titles
 - Page numbering (anywhere)
 - Model III graphics
 - Customizes to your printer
 - Word wrap, auto tabs
 - Partial document printing

- **DOS SHELL**
 - Exec DOS cmds and return
 - Exec BASIC & /CMD prgrms
 - Use macros in programs
- **TELECOMMUNICATIONS**
 - Up to 1200 Baud (interrupt)
 - Horizontal scrolling screen
 - Macros handshake with host

- **FREEBEE PROGRAMS** (source files included)
 - CONNECT: Supports Hayes SMARTMODEM features
 - DRAW: Hor/vert scrolling screen graphics editor
 - LPRINT: Screen images on EPSON, PROWRITER, and OKIDATA (92)
 - HELP: Frame oriented relational query Data Base

REQUIRES: 48K, 2D. Drives SUPPORTS: Most Mod III DOSes
 Unprotected diskette Programmed tutorial

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 —Registered owners can upgrade to IBM or Tandy 2000—
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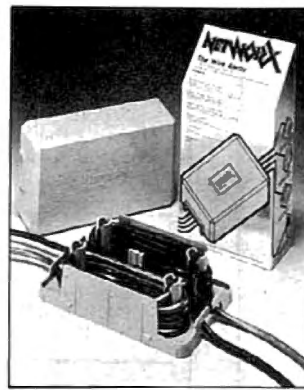
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✓ 296



NEW PRODUCTS



Keep your work space tidy and free of extension cords with the Wire Away from Networx.

standard RS-232 cable and the RS-232 connector on your computer. The Key costs \$300 from Staff Computer Technology Corp., 10457 J Roselle St., San Diego, CA 92121, 619-453-0303.

Reader Service ✓ 565

Wrapping It Up

Extension and power cords always seem to get in your way. You trip over them, they're messy, and they're a hazard to children and gnawing pets. Now there's a solution. Wire Away is a hand-size unit that accommodates up to four 18-gauge power cords (a total of 14 feet) that wrap around posts inside the device. A snap-on lid conceals the wires, giving your office a neat appearance.

The Wire Away has a suggested list price of \$12.95 from Networx, 203 Harrison Place, Brooklyn, NY 11237, 212-821-7555. It comes with four screws so you can install it under a table or desk.

Reader Service ✓ 567

Basic Help

What Super Utility Plus is to disk utilities, Impact! is to Basic. It's a self-relocating, machine-language

module that gives you several extended functions for Basic. Unlike other extensions, however, it doesn't require special formats, Basic commands, or any modification to Basic/CMD or LBasic/CMD.

With single commands, you can search for and replace a particular key word or string, remove remarks, compress/decompress a program, renumber, trace a program without destroying the screen display by either line number or step, set breakpoints, remove extraneous colons, join lines, move blocks of lines, display memory usage statistics for a given program, and much more.

Compatible with most current TRS-80-compatible DOSes, Impact! retails for \$39.95 from Powersoft Products, 11500 Stemmons Expressway, Suite 125, Dallas, TX 75229, 214-484-2976. Note that Impact! is not compatible with the Model 4.

Reader Service ✓ 559

Better Word Processing

MagicBind upgrades WordStar, Electric Pencil, and other CP/M-based word-processing programs by adding the important features missing from each program. Some of these features include true proportional spacing and kerning, text screening with page-break display, automatic footnotes (up to 15 per page) with user defined designations, automatic handling of widow/orphan lines, multi-column printing, and over 60 other functions.

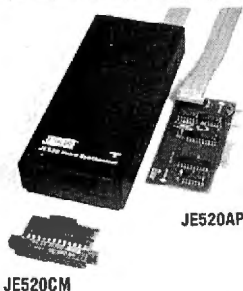
MagicBend also supports file merging, automatic chapter and paragraph numbering, and form-letter printing. The program also generates bibliographies,

HOME COMPUTER ACCESSORIES

KEYBOARDS — POWER SUPPLIES

DISK DRIVES AND CABLE

VOICE SYNTHESIZER FOR APPLE AND COMMODORE



• Over 250 word vocabulary affixes allow the formation of more than 500 words • Built-in amplifier, speaker, volume control, and audio jack • Recreates a clear, natural male voice • Plug-in user ready with documentation and sample software • Case size: 7 1/4" L x 3 1/4" W x 1-3/8" H

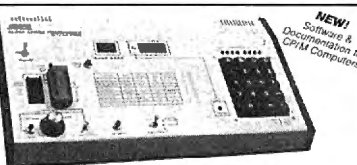
APPLICATIONS: • Security Warning • Telecommunication • Teaching • Handicap Aid • Instrumentation • Games

The JE520 VOICE SYNTHESIZER will plug into your computer and allow you to enhance almost any application. Utilizing National Semiconductor's DIGITALIZER™ Speech Processor IC (with four custom memory chips), the JE520 compresses natural speech into digital memory, including the original inflections and emphasis. The result is an extremely clear, natural vocalization.

Operating Modes: • VOCABULARY EXPANSION MODULE

• Expands to over 1000 basic words • Allows selection of up to 6 additional word sets

Part No.	Description	Price
JE520CM	For Commodore 64 & VIC-20	\$114.95
JE520AP	For Apple II, II+, and IIx	\$149.95



JE664 EPROM PROGRAMMER 8K to 64K EPROMS — 24 & 28 Pin Packages

Completely Self-Contained — Requires No Additional Systems for Operation • Programs and validates EPROMs • Checks for properly erased EPROMs • Emulates EPROMs or EPROMs • RS232C Computer Interface for editing and program loading • Loads data into RAM by keyboard • Changes data in RAM by keyboard • Loads RAM from an EPROM • Compares EPROMs for content differences • Copies EPROMs • Power Input: 115VAC, 60Hz, less than 10W power consumption • Enclosure: Color-coordinated, light tan panels with molded and places in black brown • Size: 15 1/4" L x 8 1/4" W x 3 1/4" H • Weight: 5 1/4 lbs.

The JE664 EPROM Programmer erases and programs various 8-Bit Word EPROMs from 8K to 64K memory capacity. Data can be entered into the JE664's internal 8-Kbit RAM in three ways: (1) from an ROM or EPROM, (2) from an external computer via the optional JE665 RS232C BUS; (3) from its panel keyboard. The JE664's RAMs may be accessed for erasure purposes from the panel's test socket to an external microprocessor. In programming and emulation, the JE664 allows for recognition, change and validation of program content. The JE664's RAMs can be programmed quickly to a 115VAC (or any other) always present address bus. The EPROM to be programmed later without necessity of "UV" erasing. The JE664 displays DATA and ADDRESS in convenient hexadecimal (alphanumeric) format. A "DISP" EPROM DATA and ADDRESS in convenient hexadecimal (alphanumeric) format. A "DISP" EPROM DATA and ADDRESS in convenient hexadecimal (alphanumeric) format. A "DISP" EPROM DATA and ADDRESS in convenient hexadecimal (alphanumeric) format.

JE664-A EPROM Programmer... \$995.00

JE665 — RS232C INTERFACE OPTION — The RS232C Interface Option implements computer access to the JE664's RAM. This allows the computer to manipulate, store and transfer EPROM data to and from the JE664. A sample program listing is supplied in MBASIC for IBM PC computers. Documentation is provided to allow the software to other computers with an RS232C port: 9600 baud, 8-bit word, odd parity and 2 stop bits.

JE664-ARS EPROM Prog. w/ JE665 Option... \$1195.00

EPROM JUMPER MODULES — The JE664's JUMPER MODULE (Personality Module) is a plug-in module that pre-sets the JE664 for a programing personality to the EPROM and configures the EPROM socket connections for that particular EPROM.

J664 EPROM Jumper Mod. No.	EPROM	Programming Voltage	EPROM MANUFACTURER	PRICE
AM05A	2708	25V	AMD, MOTOROLA, ASE, TRITEC, TI	\$14.95
AM15A	2716, 2732, 2764	25V	Intel, Motorola, NEC, NEC, TI, AMD, MOTOROLA	\$14.95
AM16A	27C02, 27C04, 27C16, 27C32	25V	Motorsola, TI, Hitachi, DPL	\$14.95
AM20A	2712	25V	AMD, Fujitsu, NEC, Hitachi, VNA, Mitsubishi, National	\$16.00
AM22A	27128	21V	Fujitsu, Intel	\$14.95
AM24A	27C016, 27C032, 27C064	21V	Motorsola	\$14.95
AM26A	2764	21V	Intel, Fairchild, Oki	\$14.95
AM27A	27C512A	25V	TI	\$14.95

4-Digit Fluorescent Alarm Clock Kit



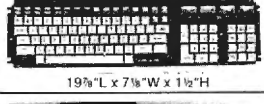
• Bright 4-digit 0.5" high display • 10 minute snooze alarm • AM/PM indicator • Automatic display dimmer

The JE750 Clock Kit is a versatile 12-hour digital clock with 24-hour alarm. The clock has a bright 0.5" high blue-green fluorescent display. The display will automatically dim with changing light conditions. The 24-hour alarm allows the user to disable the alarm and immediately re-enable the alarm to activate 24 hours later. The kit includes all documentation, components, case and wall transformer. Size: 6 1/4" L x 3 1/4" W x 1 3/4" D.

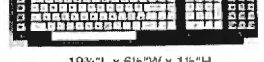
JE750 Alarm Clock Kit... \$29.95



21 1/4" L x 9 8/8" W x 3 3/8" H



19 7/8" L x 7 7/8" W x 1 1/2" H



19 3/4" L x 6 1/2" W x 1 1/2" H

106-Key 8-Bit Serial ASCII Keyboard • Numeric and cursor keypad • 10 user definable keys • 7 LED function displays • Security lock • N-key rollover • Uses Intel 8048/B748 • Color: white w/black panel • Documentation included • Weight: 6 1/2 lbs. **KB139... \$59.95**

Micro-Switch 106-Key Keyboard 8-Bit Serial ASCII • Numeric and cursor keypad • 8 user definable keys • Japanese/English characters • 8 LED function displays • Documentation incl. • Fits DTE-22 enclosure • Wt: 3 1/2 lbs. **KB106SD29-4... \$29.95**

SMK 103-Key Unencoded Keyboard Numeric and cursor keypad • SPST mechanical keyswitches • 40-pin header connection • Features: escape, control, cursor keypad, user function and special function keys • Fits DTE-22 enclosure • Weight: 3 1/2 lbs. **KB9000... \$19.95**

Power/Mate Corporation +5VDC @ 3 Amp REGULATED POWER SUPPLY • Input: 105-125/210-250VAC at 47-63 Hz • Output: 5VDC @ 3.0 Amps/6VDC @ 2.5 Amps • Line regulation: 0.05% • Load reg.: 0.1% • Open frame mounts on any 1 of 3 surfaces • Size: 4 1/4" L x 4 7/8" W x 2 1/4" H • Weight: 2 lbs. **EMAS/6B... \$29.95**

Power/Mate Corporation +5VDC @ 6 Amp REGULATED POWER SUPPLY • Input: 105-125/210-250VAC at 47-63 Hz • Output: 5V @ 6A/6V @ 5A • Line reg.: 0.05% • Load reg.: 0.1% • Open frame mounts on any one of three surfaces • Size: 5 1/4" L x 4 7/8" W x 2 1/4" H • Wt: 4 lbs. **EMAS/6C... \$39.95**

Switching Power Supply for APPLE II, II+ & IIe™ • Can drive four floppy disk drives and up to eight expansion cards • Short circuit and overload protection • Fits inside Apple computer • Fully regulated +5V @ 5A, +12V @ 3A, -5V @ 5A, -12V @ 5A • Direct plug-in power cord included • Size: 9 1/4" L x 3 1/2" W x 2 1/4" H • Weight: 2 lbs. **KHP4007... \$79.95**

POWER SUPPLY +5VDC @ 7.5 AMP, 12VDC @ 1.5 AMP SWITCHING Input: 115VAC, 50-60Hz @ 3 amp/230VAC, 50Hz @ 1.5 amp. Fan volt./power supply select switches (115/230VAC). Output: 5VDC @ 7.5 amp, 12VDC @ 1.5 amp. 8 H. BK. pow. cord. 1 1/2" W x 1 1/4" L x 3 1/4" H, Wt. 6 lbs. Part No. PS94VDS... \$39.95 each

POWER SUPPLY 4-Channel Switching Microprocessor, mini-computer, terminal, medical equipment and process control applications. Input: 90-130VAC 47-60Hz. Output: +5VDC @ 5A, -5VDC @ 1A, -12VDC @ 1A, 12VDC @ 1A. Line reg. @ 2% (ripple 30mV p-p, load reg. @ 1%, Output current: Adj. 30 mA max. output @ 10%, 5-3/8" L x 1-7/8" W x 4-15/16" H, Wt. 1 1/4 lbs. Part No. FCS-604A... \$69.95 each

DISKETTES AND ACCESSORIES

5 1/4" and 8" Diskettes			
5 1/4" — 5 1/4" Diskettes		8" — 8" Diskettes	
Part No.	Description	Brand	Price
UM1401	5 1/4" 5DD0 Soft Sector with Hub Ring and Envelope	100	\$24.95
UM0004	5 1/4" 8DD0 Soft Sector with Hub Ring (Bulk)	100	146.95
UM0401	5 1/4" 5DD0 Soft Sector with Hub Ring and Envelope	10	22.95
UM0402	5 1/4" 5DD0 Soft Sector with Hub Ring and Envelope	100	236.95
UM1801	5 1/4" 5DD0 Soft Sector with Envelope (96TPI)	100	34.95
UM0214	5 1/4" 5DD0 Soft Sector (96TPI) (Bulk)	100	206.95
UM1201	5 1/4" 5DD0 Soft Sector with Envelope (96TPI)	10	43.95
UM0917	5 1/4" 5DD0 Soft Sector (96TPI) (Bulk)	100	209.95
8K (ESKE) — 5 1/4" DISKETTES			
SK10	5 1/4" 5DD0 Soft Sector with Hub Ring and Envelope	100	20.95
SK10B	5 1/4" 5DD0 Soft Sector with Hub Ring and Envelope	100	149.95
SK20	5 1/4" 5DD0 Soft Sector with Hub Ring and Envelope	10	26.95
SK20B	5 1/4" 5DD0 Soft Sector with Hub Ring (Bulk)	100	135.95
ULTRA MAGNETICS — 8" DISKETTES			
UM1726	8" 5DD0 IBM Compatible (128 B/S, 26 Sectors) and Envelope	100	34.95
UM0823	8" 5DD0 IBM Compatible (128 B/S, 26 Sectors) Bulk	100	228.95
UM0278	8" 5DD0 Soft Sector Uniformly formatted with Envelope	100	45.95
UM0040	8" 5DD0 Soft Sector Uniformly formatted with Envelope	100	229.95
UM0041	8" 5DD0 Soft Sector Uniformly formatted with Envelope	100	229.95

DISKETTE ACCESSORIES

Disk Minder

• Attractive, functional disk storage system • 50 (8") or 75 (5 1/4") disk storage capacity • Easy filing and retrieving • Protects disk from dust contamination • Mounted from durable smoked plastic with front carrying handle • Size: 7" W x 8 1/2" H x 3 1/4" D • Weight: 2 lbs.

Part No. Description Price

DM7C Stores 75 (5 1/4") Diskettes... \$19.95 each

DM7D Stores 50 (8") Diskettes... \$29.95 each

MINI-PAK

• Stores 10 (5 1/4") diskettes • Protects disk from dust contamination • Durable smoked plastic • Size: 8 1/4" x 5 1/4" x 1 1/4" H

Part No. Description Price

MP-10 Stores 10 (5 1/4") Diskettes... \$2.95 each

Diskette Envelopes

Sieves for Bulk-Purchased Diskettes

• Tear proof • Longevity • Anti-static protect • Wear resistant

Part No. Description Price

MP201 10 White 5 1/4" Envelopes... 10 for \$1.49

MP201-100 100 White 5 1/4" Envelopes... 100 for \$10.95

MP201 10 White 8" Envelopes... 10 for \$1.95

MP201-100 100 White 8" Envelopes... 100 for \$17.95

Vinyl Pages

For 3-Ring Binders

Protects disks from dirt, scratches, dust, spills, and other contaminants. Reduces the risk of getting out near your disk when used. Size: 5 1/4" x 11"

Part No. Description Price

PC001 2 Pocket 5 1/4" Vinyl Page... 10 for \$7.95

PC001-2 4 Pocket 5 1/4" Vinyl Page... 10 for \$8.95

PC001-2 4 Pocket 8" Vinyl Page... 10 for \$7.95

PC014-2 2 Pocket 8" Vinyl Page... 10 for \$8.95

Mail Pak™

• Holds up to 3 diskettes • Ideal for mailing and retail pack aging • Dust proof and theft proof • Transparenc sleeve allows identification

Part No. Description Price

MP-05 Holds 3 ea 5 1/4" Diskettes... \$2.49 each

MP-08 Holds 3 ea 8" Diskettes... \$3.85 each

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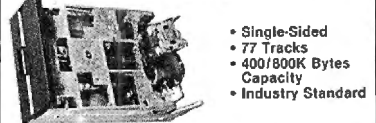
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8" FLOPPY DISK DRIVE



• Single-Sided • 77 Tracks • 400/800K Bytes Capacity • Industry Standard

The FDD100-8 8" Floppy Disk Drive (Industry Standard) features single or double density. Recording mode: FM single, MFM double density. Transfer rate: 250K bits/sec. single density; 500K bits/sec. double density. The FDD100-8 is designed to work with the single sided soft sectorized IBM diskette 1 of ea disk cartridge. Power: 115VAC @ 60/60Hz. ± 24VDC @ 1.7 amps max. ± 5VDC @ 1.2 amps max. Unit as pictured above does not include case, power supply, or cables. Size: 9 5/8" W x 14 1/4" D, Weight: 12 lbs. Incl. 95pg. manual.

FDD100-8... \$169.95 ea.

5 1/4" APPLE™ Direct Plug-In Compatible Disk Drive

• Uses Shugart SA390 mechanics • 143K formatted storage • 35 tracks — compatible with Apple controller • Complete with connector and cable — just plug into your disk controller card • Size: 6 1/4" x 3 1/4" W x 2 3/8" H • Weight: 4 1/2 lbs. Part No. ADD-514 \$195.95

5 1/4" TEAC DISK DRIVE

Single-Sided Half-Height 5 1/4" Drive • Single or double density • 48 TPI • 40 tracks • 6ms track to track • 5W power consumption • Brushless DC direct-drive motor • 180Kbytes formatted storage • One year warranty parts and labor

Double your work space with the TEAC 5 1/4" FLOPPY DISK DRIVE. Because the TEAC FD55A Drive is half the height of conventional drives, you can fit up to four TEAC drives in the same space where two conventional drives fit. Or, have room for two Teac disk drives and a hard disk drive. Includes operating manual. Requires: +5VDC @ 55A and +12VDC @ 3A. Size: 5 1/4" W x 1 1/4" H x 8" D. Wt: 3 lbs. **FD55A... \$249.95**

5 1/4" SHUGART DISK DRIVE

Double-Sided Half-Height 5 1/4" Drive • Single or double density • 48 TPI • 40 tracks • 400Kbytes formatted storage • 6ms track to track • Brushless DC direct-drive motor • One year warranty parts and labor • Media and interface compatible with the SA450 formatted by the industry's largest and most experienced engineering, training and service organization, the SA450 is the smart solution for a wide range of desktop applications. Includes operating manual. Requires: +5VDC @ 7A and +12VDC @ 75A. Size: 5 1/4" W x 1 1/4" H x 8" D. Wt: 3.5 lbs. **SA455... \$259.95**

5 1/4" PANASONIC DISK DRIVE

Double-Sided Half-Height 5 1/4" DRIVE Shugart SA455 Equivalent • Single or double density • 48 TPI • 40 tracks • 6ms track to track • 327Kbytes formatted storage • One year warranty parts and labor

The JACS1 is perfect for word processors, personal and portable computers, small business computers and terminal a.o.s. Includes operating manual. Requires: +5VDC @ 9A and +12VDC @ 1A. Size: 5 1/4" W x 1 1/4" H x 8" D. Wt: 3 lbs. **JA551-2... \$239.95**

SIGNAL CABLES

5 1/4" DRIVES USE 34-PIN ASSEMBLIES 8" DRIVES USE 50-PIN ASSEMBLIES *S = SOCKET CONNECTOR *C = CAR-EDGE CONNECTOR

SINGLE DRIVE CABLE

Drive	Style	Part No.	1-4	8"
5 1/4"	M	S34-36-C	7.95	7.25
5 1/4"	M	S34-60-C	8.95	8.39
8"	M	S50-36-C	10.95	9.95
8"	M	S50-60-C	12.49	10.95

DUAL DRIVE CABLES

Drive	Style	Part No.	1-4	8"
5 1/4"	P	S34-36C-18C	12.59	11.19
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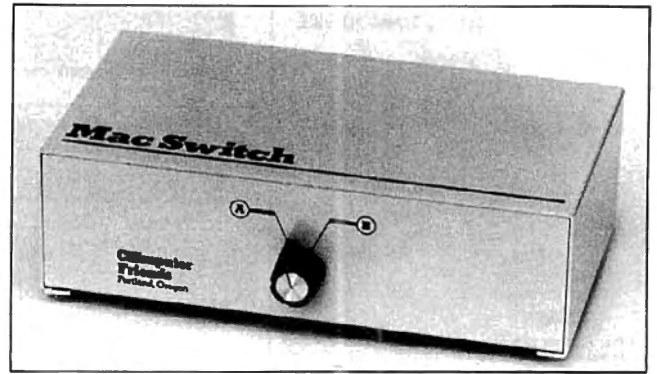
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customized wills, contracts, and other legal documents. MagicBind does away with time-consuming and error-prone manual chores.

This Assembly-language program costs \$250, including documentation in a three-ring binder and a disk with a program and data files that demonstrate basic formatting functions. It is sold by Computer EdiType Systems, 509 Cathedral Parkway 10A, New York, NY 10025, 212-222-8148.

Reader Service ✓ 581

described in the book.

Proportional Spacing on WordStar costs \$20 from Writing Consultants, 11 Creek Bend Drive, Suite 144, Fairport, NY 14450, 800-227-3800 ext. 7018.

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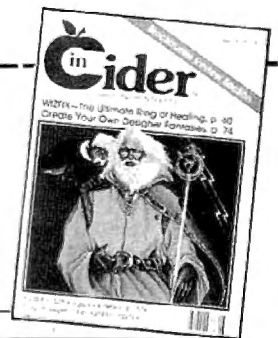
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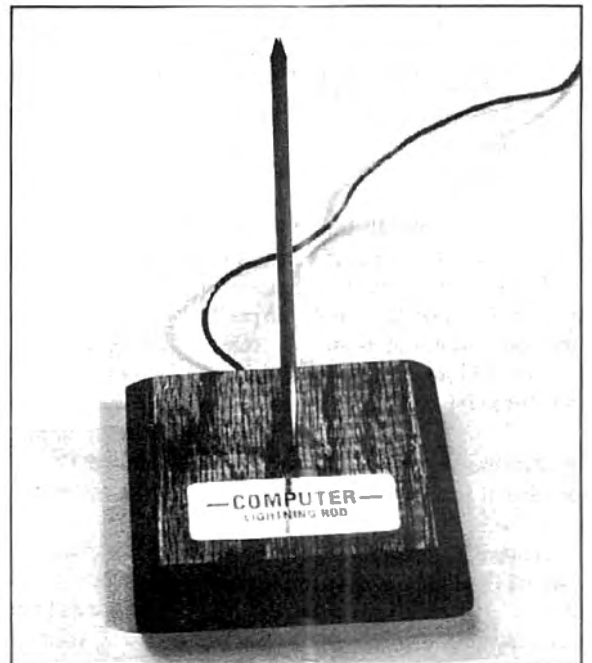
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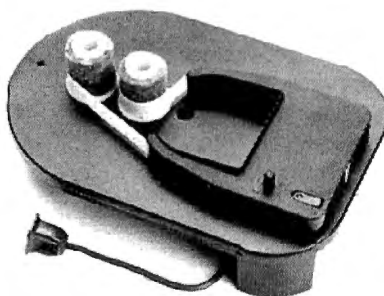
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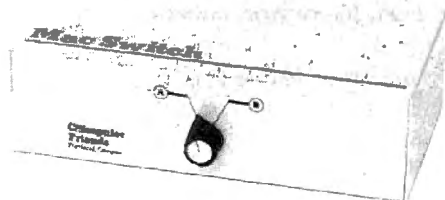
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POWER

The LNW80 2 performs miracles with the computing power of 96K RAM (standard) of user memory matched with a mass storage capability which handles 5¼" floppy disks and 5¼" hard disk drives. And while the unit comes with built-in

controllers for 5¼" and 8" floppy disks (single/double sided, single/double density, up to 4.5 Megabytes capacity), the LNW80 2 also gives you the unique ability to read and write diskettes from a greater variety of other popular computers than does any other microcomputer. So regardless of how big you grow, you will never end up with thumb-twiddling down time while you expand to a more powerful system. The LNW80 2 will always have enough muscle to handle your biggest and toughest jobs.

FULLY EQUIPPED

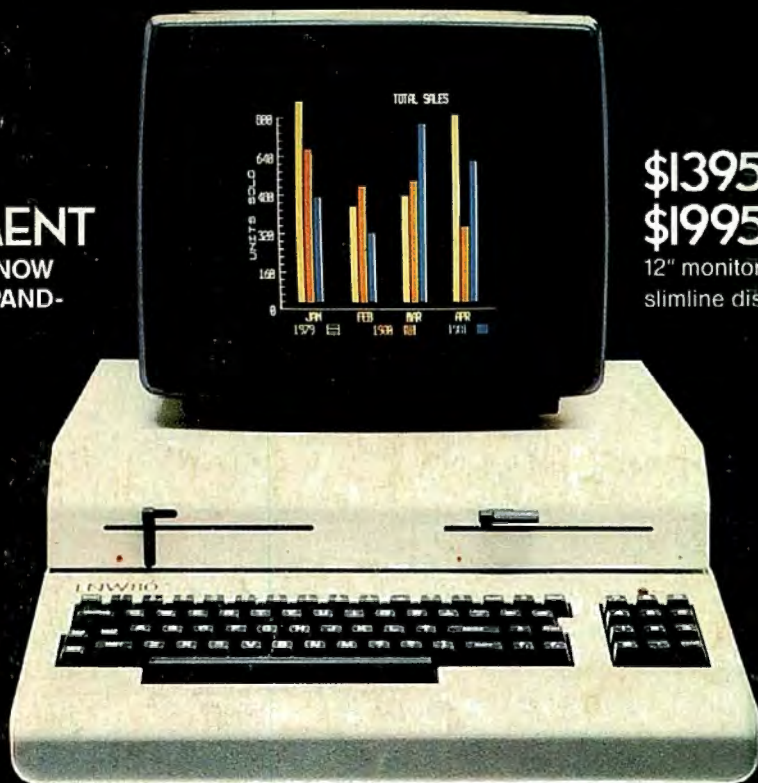
The LNW80 2 was developed to anticipate the needs of both expansion and compatibility. So the computer was designed with enough built-in features to keep you from having to spend a small fortune as you move down the road to higher levels of user sophistication. Standard features include high and low resolution graphics in both color and black-and-white, an asynchronous serial communication channel, and a wide variety of tape, printer, monitor and hardware expansion ports. In addition, the LNW80 2 contains an array of quality construction features that fully justify its remarkable one-year limited warranty.

So if you're looking for a microcomputer that will satisfy your performance needs as you grow and develop, take a long, hard look at the LNW80 2. It's the one microcomputer built to meet the challenges of tomorrow—for a long time to come. For more information and the name of the dealer nearest you, write or telephone:

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