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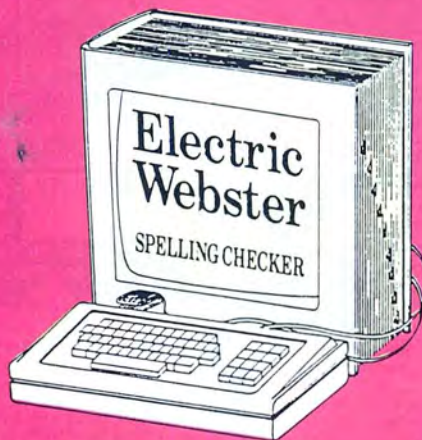
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PowerSoft NewsFlash #14

Anniversary Column!



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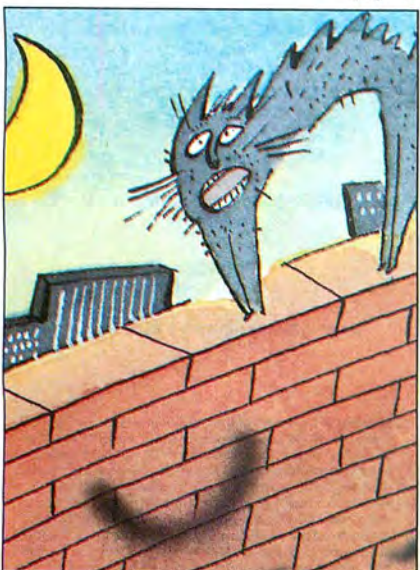
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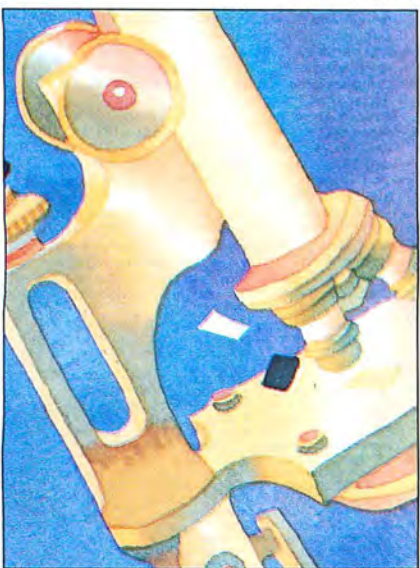
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Features

38. **Tandy Raises the Ante** by *Dave Rowell and Ryan Davis-Wright*
The soul of Tandy's new MS-DOS machines.
46. **The Mean Screen Editing Machine** by *John Ratzlaff*
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Departments

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LOAD 80

Load 80 gathers together selected programs from this issue of *80 Micro* and puts them on a magnetic medium for your convenience. It is available on tape or disk, and runs on the Models I, III, and 4.

Load 80 programs are ready to run, and can save you hours of time typing in and debugging listings. Load 80 also gives you access to Assembly-language programs if you don't have an editor/assembler. And, it helps you build a substantial software library.

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structions provided. If you own a Model I or III disk system, you boot the Load 80 disk and transfer the files to a TRSDOS system disk according to simple on-screen directions. If you own a Model 4, copy the Model 4 programs from the Load 80 disk to your TRSDOS 6.x disk using the COPY command.

Not all programs will run on your system. Some Model III programs, for instance, will run on the Model 4 in the Model III mode, but not in the Model 4 mode. You should check the system requirements box that accompanies the article to find out what system configuration individual programs require.

If you have any questions about the programs, call Keith Johnson at 603-924-9471. Yearly subscriptions to Load 80 are \$199.97 for disk, or \$99.97 for cassette. Individual loaders are available on disk for \$21.47 or on cassette for \$11.47, including postage. To place a subscription order, or to ask questions about your subscription, please call us toll free at 1-800-343-0728 between 9 a.m. and 5 p.m. Or, you can write to Load 80, 80 Pine St., Peterborough, NH 03458.

Directory

Screen Editor

Article: The Mean Screen Editing Machine (p. 46).

System: Model 4, 64K RAM.

Perform full-screen editing on Model 4 TRSDOS 6.2 or DOS-PLUS IV from both DOS level and Basic.

Language: Assembly.

Cassette filespec: SCREDIT.

Disk filespecs: SCREDIT/ASM, SCREDIT/DVR, SCREDITD/DVR.

Correcting Errors

Article: Bit Fixer (p. 54).

System: Models I and III, 32K RAM (Apparat editor/assembler is optional); Model 4, 64K RAM (PRO-Create 4.3a editor/assembler is optional).

Find and correct data errors by coding bytes first.

Language: Assembly.

Cassette filespecs: WRITE3, CHECK3, WRITE4, CHECK4.

Disk filespecs: WRITE3/SRC, WRITE3/CMD, CHECK3/SRC, CHECK3/CMD, HAMMING/ASM, WRITE4/ASM, WRITE4/CMD, CHECK4/ASM, CHECK4/CMD.

Printer Buffer

Article: Spooling Around (p. 96).
System: Model 4 and 4P, 64K or 128K RAM; Series 1 editor/assembler (optional).

A Model 4 printer buffer that requires no extra hardware.

Language: Assembly.

Cassette filespecs: SPOOL,

SPOOL1, SPOOL3, SPOOL4.

Disk filespecs: SPOOL/SRC, SPOOL16/CMD, SPOOL32/CMD, SPOOL4P/CMD.

Tracing Bugs

Article: The Next Step (p. 110).

System: Model 4, 64K RAM;

TRSDOS 6.2; PRO-Create 4.3a editor/assembler (optional).

Use this full-register trace routine to debug Assembly-language programs.

Language: Assembly.

Cassette filespecs: LOCATOR, TRACE.

Disk filespecs: LOCATOR/ASM, LOCATOR/CMD, TRACE/ASM, TRACE/DVR.

Checksum

Article: How to Use *80 Micro* Program Listings (p. 164).

System: Models I, III, and 4; 32K RAM.

Use our checksum program to check the accuracy of the Basic listings you type in.

Language: Disk Basic.

Cassette filespec: B.

Disk filespec: CHECKSUM/BAS.

Loc-Editor

System: Models I and III; 32K RAM.

A program that finds errors for you.

Language: Disk Basic.

Cassette filespec: C.

Disk filespec: LOCEDITR/BAS.

BAS = Basic ASM, SRC = source code CMD, DVR = object code

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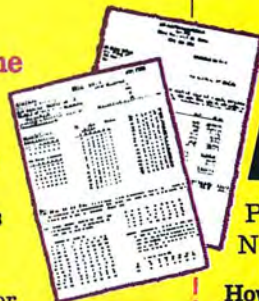


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RFing It

When Tandy announced its new computers in July, it brought to 32 (or thereabouts) the number of models it has released since 1977. Thirty-two models in nine years is some kind of record, and you'd think it would make Tandy the world's authority on how to properly introduce a computer.

You've got to give Tandy credit, then, for setting new standards in screwing up when its 1000 EX and SX failed to pass the Federal Communications Commission's (FCC's) tests for radio-frequency interference (RFI) last summer. The snafu cost Tandy no small amount of embarrassment and, more importantly, about eight weeks of damaged sales.

In case you're not up on your RFI, the FCC requires computer manufacturers to make equipment that won't scramble other communications devices. Makers can apply for class A (business) or B (home) certification. Class B machines require greater RFI shielding on the theory that folks in residential areas have a right to watch fuzz-free television. The EX and SX failed the class B tests.

Tandy was right on top of the RFI problem when the FCC's current regulations went into effect in 1981. The Model III and Color Computer passed without a hitch.

After living with the FCC's code for over five years, Tandy should be able to design FCC-spec computers blindfolded. It should have taken note of the FCC raid at Comdex in April, where agents went around lowering the boom on a number of companies whose equipment didn't comply. In short, Tandy had little excuse for being caught with its pants down.

Tandy's problems were exacerbated by a change in FCC policy that required manufacturers to submit equipment directly to the FCC for testing and thus created long lines of computer makers awaiting approval. But that's no excuse for Tandy; the company's equipment should have been certifiable in the first place.

I wonder how many potential customers walked into a Computer Center after the July announcement only to be told that the computer they were interested in wasn't available. Two months of apologies won't help Tandy's image and certainly won't help the bottom line.

One thing's for sure—Tandy's next new computer will meet every RFI regulation on the planet.



Lucky Us

80 Micro almost got caught in the backwash of Tandy's FCC debacle. We had already scheduled this month's cover story on the three new MS-DOS computers and were debating whether to wait until we received review units before writing the piece. We finally decided that waiting was too risky and sent technical writers Dave Rowell and Ryan Davis-Wright down to Fort Worth to tear the machines apart. In retrospect, we made the right choice; the story would otherwise have been delayed for a couple of months.

Tandy gave Dave and Ryan a hospitable reception and we were able to take a good look at the new computers. We won't review the systems until we've got them in house, where we're not under the watchful eyes of Tandy personnel, but Dave's and Ryan's initial impressions were mostly positive. With its FCC problems in the past, Tandy should enjoy some success with these machines.

Hunt and Be Hunted

Tandy's comeback in the microcomputer market has put it in the peculiar position of being the chased as well as the chaser. While Tandy positions its compatibles relative to IBM's machines, other compatibles manufacturers will have to consider Tandy when devising their marketing strategies.

Tandy's clout as a retailer gives it a sizable advantage over other PC compatibles in the home, school, and small-business arenas. Further, Tandy has cultivated a reputation for reliability and quality service, while clone makers

must fight an image of being quickie operators who might be making garage-door openers next week.

But the clone makers still have one significant argument in their favor: They're cheaper. The ITS Turbo XT, for instance, is \$895 and comes with two drives, 640K of RAM, and a monitor. It also has a one year parts and labor warranty as opposed to Tandy's 90-day warranty. Many other clones, with slightly less muscle, are selling in the \$500 to \$700 range. Prices can only drop; by the time this is published, you could see stripped-down, low-end clones for under \$400.

The guarantee that Tandy will be around in two years to service its products still outweighs the few-hundred dollars you might save with a mail-order clone. But Tandy should not underestimate the ability of some of the clone makers to survive. While many will come with the dust and go with the wind, others will build themselves into respectable and reputable computer manufacturers. They could give Tandy a harder time than IBM is.

The solution for Tandy is, of course, to continue to drop its price and improve its machines. The first and biggest price drop is probably going to have to be on the EX, which at \$799 is no bargain.

Tandy's reputation for good prices somewhat exceeds reality. Consumers will eventually wise up, and Tandy must be ready to respond.

The Model 4

Speaking of prices, is there anything more ridiculous than the \$1,199 tag on the Model 4D? The fact that the 4D costs the same as the SX is so absurd it hardly bears mentioning.

The price is steep because Tandy doesn't want people to buy 4Ds; it wants them to buy 1000s. Our surveys show that Tandy is getting its wish. Among our readers, 4D ownership wavers at around 3.5 percent, while the 1000 is up to 34 percent. (Model 4 and 4P ownership is at 40 percent.)

One has to wonder why Tandy is keeping the 4D in the catalog. I'd like to think it's because some sentimental slob in the Towers would like to see the Z80 line reach its 10th birthday in August 1987. A more likely explanation is that Tandy's profit margin on each 4D is too obscene to give up until every last unit is cleaned out of the warehouses. ■

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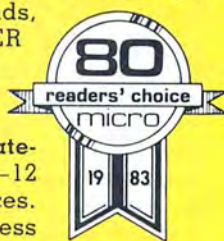
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Cost-Benefit Analysis

After reading "The Modem 100" (September 1986, p. 52) I looked at the cover to see if I'd inadvertently picked up the April gag issue.

Let me see if I've got this straight: Jeff Holtzman's home-brewed, 300-baud modem goes "on the fritz," and since he doesn't think it's worth fixing and a new modem is out of his price range, he builds a \$30 serial-to-parallel converter and writes a 2K program for his Model 100 so his Model 4 can use its internal modem.

What a joke! It could scarcely have cost \$30 to repair his old modem, since you can build a 300-baud, home-brew modem for that or less. (Now *that* would have been a good article.) Considering the time and effort he must have spent beyond the material cost, Radio Shack's \$59.95 modem looks darn cheap. How did Mr. Holtzman afford the Model 4 and the Model 100, anyway?

Regardless of the cost, the Model 100's internal modem is less than ideal. Its noisy signal can confuse dual-speed modems (300/1,200 baud), causing them to hang up. At the newspaper where I work, we've yet to find a dual-speed modem that works reliably with it. Spending \$30 to gain access to it is ludicrous.

The one saving grace of the whole project is the control program's dialing feature. Even so, the 100 uses pulse dialing; you can get a faster connection by just using a touch-tone phone.

Well, I've got to go. My black-and-white TV just went on the fritz, and since I can't afford a new one, I'll just buy a tuner and design some audio circuitry for my Model 4. Should only cost \$45 or so—I'll send you an article.

David Gish
Memphis, TN

Ady's Amplification

As the author of the Stylus and Elixir software packages, I have some legitimate beefs about two Express Checkouts that recently appeared in your magazine.

Regarding the August 1986 review of my Stylus word processor (p. 120), there are about 250 command key actions, and only about 70—a little over 25 percent—are strictly for text. To describe the other 180 commands as "a few interesting extras thrown in" is a gross distortion of the facts. None of the main areas (text, graphics, animation, and



utilities) is shortchanged. The utilities aren't even mentioned in the review.

The reviewer correctly points out that there is no index, but he fails to mention the detailed, two-page contents section and the long appendix on command keys. Help screens are noted, but not their number—it's 47.

The July 1986 review of my Elixir utilities package (p. 116) almost totally ignores Elixir's most important features and contradicts itself. The good, three-star rating is followed by a vehemently negative tone that should do well to discourage readers, who haven't been informed the package contains 55 portable USR routines, a programming tutorial, and separately available source code. Nor are they told that this portability is unique and long overdue.

The review dwells on the relatively trivial, if numerous, applications programs, but makes no connection to the portable routines for which they are primarily demonstrators. The portable machine language is meant to be used for programming tools. The reviewer instead treats the truly massive number of demos in this low-cost, unprofitable package as if they should have been of business-production quality.

Donald W. Ady
Summit, NJ

80 Micro's BBS is open 24 hours a day. It offers programs you can download, special-interest groups, and a classified section. You can reach the board at 603-924-6985; UART settings are 300/1,200 baud, 8-bit words, 1 stop bit, no parity.

Scriptit Pro—and Con

I was dismayed to read Terry Kepner's complimentary review of Scriptit Pro. Mr. Kepner is okay until the second column; after that, he's completely off base.

First, Scriptit Pro loads only about 20 pages—the equivalent of one module—into memory at a time. To open a new module you must exit the document and type N (next). Then you must open the next module by typing the document name, a slash (/), and QQ1. At the 256-page mark, you must open a new document by a different name or you'll end up in an endless loop.

In addition, the program won't convert ASCII documents that are longer than a module. I found that out by sending a 200-page document by telephone; Scriptit Pro converted it to ASCII, but getting it out of ASCII was a different story.

Just for kicks, ask Mr. Kepner to convert a 200-page document to ASCII and then show it to you on the screen, in ASCII, as a single document. He'll spend hours appending all those little modules together.

I've written several books, two with SuperScriptit and a few more with Scriptit Pro, and I can't see much difference between them if you're dealing with long documents. I almost prefer SuperScriptit.

Robert P. Herbst
Perry, FL

Don't Discount Discounters

I've been reading with some alarm about the foolish efforts of computer manufacturers and software publishers to remove their products from the hands of mail-order outlets.

I doubt if regular retail outlets would make any significant sales gains if discounters were eliminated. Some people buy from local retailers because hand holding is important to them, while others like me use mail order because price is a prime concern. I've purchased three computers and numerous software packages through mail order; if the discounters hadn't been there, Tandy would still be waiting to sell me the first computer.

Vance E. Woolley
Midland, TX

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Jump Start

Q: I use NEWDOS80 on a 48K Model III with two disk drives. Some of my programs won't run; they come up with "Illegal function call" upon encountering a USR command. They used to work perfectly.

I can get them to run by starting another program that contains a USR command and pressing the break key. The troublesome programs always work in Level II Basic, but not Disk Basic. (*Ernest Diefenderfer, Wickenburg, AZ*)

A: Disk Basic requires a DEFUSR statement at the beginning of the program to define the entry point of the USR routine. In Level II Basic, you must POKE the routine's address: POKE the least-significant byte (LSB) into location 16526 and the most-significant byte (MSB) into location 16527.

To get the address for the DEFUSR statement, multiply the MSB by 256 and add the LSB. A DEFUSR must appear after any Clear statement. Check your Disk Basic manual for instructions on inserting the DEFUSR command in your programs.

Reluctant Routines

Q: I was told I could write Assembly-language subroutines on my Tandy 1000 with Debug and BLOAD them into memory, but when I try that I get a "Bad file mode" message. Any suggestions? (*Bill Browne, Lake Charles, LA*)

A: The memory-image files used by BLOAD must be created first with a BSAVE instruction, which adds a 7-byte header to the file (the header tells BLOAD where to load the file and how long it is). If you've created a machine-language subroutine with Debug, you must first load it into memory and save it with BSAVE.

Here's one way to do that using Debug from Basic's Shell statement. Assume you've saved your machine-language routine as SUBR.BIN. From Basic, type SHELL "DEBUG SUBR.BIN". Debug will load the subroutine and present the hyphen prompt. Enter R to view the contents of the 8088 registers, and copy the



values for the CS, IP, and CX registers (respectively, the segment, offset, and length of your subroutine).

Suppose CS is 38EB hexadecimal (hex), IP is 0100, and CX is 0059. Enter Q (quit) to return to Basic; the subroutine will still be in RAM. Here's how to use these hypothetical hex values:

```
DEF SEG = &H38EB
'Set the address segment
BSAVE "SUBR.IMG", &H100, &H59
'Save indicating offset and length
```

When you load the saved memory image (SUBR.IMG), specify an offset in the BLOAD statement and, if necessary, a segment with DEF SEG, or the program will load where it was copied from. If you have limited memory, try specifying less memory when loading Basic. This might create enough room for loading Debug and your machine-language subroutine above Basic.

Pesky Line Feeds

Q: How do I change the ROM in a Radio Shack DW II daisy-wheel printer to eliminate the automatic line feed after a carriage return? I understand the DW IIB has an option switch to permit or eliminate the line feed. (*Clifton H. Falls, Walbridge, OH*)

A: Radio Shack has a ROM available for your printer. The cost installed is \$40-\$50.

Golden Keys

Q: How do I assign such characters as A and \$ to the F1, F2, and F3 keys in TRSDOS 6 or later DOS systems? Nobody seems to know the addresses, and I can't find any information on the keys in manuals for the new DOS systems. (*Robert Nash, Vinita, OK*)

A: The addresses for the F1, F2, and F3

keys in TRSDOS 6 follow (LC = lowercase, UC = uppercase):

```
LC F1:2328
UC F1:2329
LC F2:2330
UC F2:2331
LC F3:2332
UC F3:2333
```

POKE the desired character into these addresses. Also, two of Hardin Brothers' The Next Step columns (November 1984, p. 168, and December 1984, p. 156) explain how to write and install a keyboard filter to change the values of the function keys.

Dynamic Duo

Q: Can I use Radio Shack's DoubleDuty to load Software Publishing Corp.'s PFS:file and PFS:report at the same time in my 128K Model 4P? I do several jobs that require alternately loading these two disks. (*Herman Frankel, Sun City, AZ*)

A: Yes. I loaded both PFS:file and PFS:report and switched between the two using DoubleDuty.

Pocket Book Mysteries

Q: I recently purchased a Radio Shack Pocket Computer (PC-2) intending to design my own peripherals and expand the capabilities of this amazingly powerful small computer.

Unfortunately, I have been unable to find technical information about the PC-2. I'm aware that it is a discontinued item, but I would like to know if any technical manuals are available from Radio Shack. (*Tim Worcester, Bainbridge Island, WA*)

A: No technical reference manuals were ever written for the PC-2.

Dormant Keys

Q: I have a Model 4 with 128K that I am planning to upgrade to 1 megabyte. I also want to complete the keyboard matrix. Do you know the ASCII codes for the six remaining unused keys and if anyone offers a replacement keyboard to complete the matrix? (*Claude G. Brown, New York, NY*)

A: The six matrix positions aren't currently included in the keyboard driver. To use them, you must rewrite the driver. The *Model 4/4P Technical Reference Manual* (Radio Shack catalog no. 26-2119) contains a keyboard schematic on p. 42 of the hardware section. I'm unaware of a keyboard and driver being available.

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Font Found

Q: I own a DMP 2100P printer and Tandy's Font Editor and use Allwrite for word processing. I am happy with the printer and a Hebrew font I designed on it, but I couldn't get a font downloaded with TLOAD to work with Allwrite.

Allwrite needs a tab file for widths to allow direct downloading of fonts, and for using the fonts with proportional spacing. How can I create the necessary files out of fonts made with Tandy's Font Editor? (*Rabbi Eisemann, Philadelphia, PA*)

A: Northern Bytes editor Jack Decker has recently revised a font-conversion program that appeared in Vol. 7, No. 2, p. 8, of his newsletter, solving your problem (see Program Listing 1). It will appear on a TAS Public Domain Library disk (probably number 20) to be available from The Alternate Source, 704 N. Pennsylvania Ave., Lansing, MI 48906-5319, 517-482-8270.

The program lets you convert from either a Tandy Custom Font System format file or a Toshiba P351/P1351 format file.

Printing Reinvented

Q: While running The Home Accountant on my Model 4 in Model III mode, I can't get my printer, a Royal Alpha 2015 typewriter with daisy wheel, to line feed. When I answer the prompts for hardware configuration and try the print test, the Royal prints the screen all on the same line. It works fine in Model 4 mode.

Also, is there a way to change Print statements to LPRINT statements so I don't have to type LPRINT modules for an optional printout? (*G.L. Dailey, Jacksonville, FL*)

A: I don't have the equipment here to verify the answer, but you should be able to set the printer to line feed by sending the proper control code. Read the Royal manual to find the code for setting up the line feed, and in Basic type LPRINT CHR\$ followed by the code in parentheses. You might need more than one code, such as the escape or control code.

To answer your second question, here is a short Model III subroutine that gives you the option of printer or screen print (see Program Listing 2).

Printer Dialect

Q: I recently upgraded from a PMC-80 (Model I clone) to a Model 4P with 128K, and I still use my Epson MX-80 with Graftrax. By changing the printer output sections in Model I Scriplus from 3E37E8 hexadecimal (hex) [the source-code equivalent is LD (37E8H),A] to D3 F800 hex [OUT (F8H),A] for the Model III port address, I can use Scriplus in Model III mode—but only for normal printing. Control characters don't affect the output, so I

can't change print fonts or perform any of the other options normally available.

Program Listing 1. FONTCON/BAS. (See p. 164 for information on using the checksums in Listings 1 and 2).

```

5 REM FONTCONV/BAS (PROGRAM LISTING)
10 CLEAR1000:DEFINTA-Z:INPUT"CONVERT FROM <1> TANDY CUSTOM FONT
   OR <2> TOSHIBA FONT":F:IF<1OR2>THEN10
20 LINEINPUT"FILE TO CONVERT: ";A$:IFINSTR(A$,"/FNT")>0ORINSTR(A
   $,"/TAB")>0THENPRINT"DUPLICATE FILE NAMES":END
30 OPEN"1",1,A$:CLOSE:ONERRORGOTO310:OPEN"R",1,A$,1:ONERRORGOTO0
   :T=INSTR(A$,"/"):IFT<0THENA$=LEFT$(A$,T-1)
40 INPUT"OUTPUT TO DRIVE #";T:IFT<0ORT>9THEN40ELSEB$=" "+MID$(S
   TR$(T),2,1)
50 OPEN"R",2,A$+"/FNT"+B$,1:OPEN"R",3,A$+"/TAB"+B$
60 FIELD1,LAS$:FIELD2,LASB$:FIELD3,LASXS,255ASZ$
70 LSETX$="2":Y$=STRING$(255,0):FORX=1TO255:MID$(Y$,X,1)=CHR$(X)
   :NEXT:LSETZ$=Y$:PUT3:Y$=STRING$(255,0)
80 IFP=1THEN260ELSEFORX=1TO256:GET1:NEXT
90 FORX=1TO2:GET1:LSETB$=A$:PUT2:NEXT
100 GET1:LSETB$=A$:PUT2:D$=A$
110 GET1:LSETB$="0":PUT2:P$=A$
120 GET1:LSETB$=A$:PUT2:P=VAL(A$)
130 FORX=1TO3:GET1:LSETB$=A$:PUT2:NEXT
140 GET1:LSETB$=A$:PUT2:T=ASC(A$):IFT=0THEN190ELSEIF(T<14)OR(T>1
   5)THEN320
150 GET1:LSETB$=A$:PUT2:IFT=15THENT=ASC(A$)ELSET=ASC(A$)+128
160 T$="":FORX=1TO2:GET1:LSETB$=A$:PUT2:T$=T$+A$:NEXT:MID$(Y$,T-
   31,1)=CHR$(VAL(T$)+64)
170 T$="":FORX=1TO2:GET1:LSETB$=A$:PUT2:T$=T$+A$:NEXT
180 IFVAL(T$)=0THEN140ELSEFORX=1TO4*VAL(T$):GET1:LSETB$=A$:PUT2:
   NEXT:GOTO140
190 GET1:LSETB$=A$:PUT2:IFA$<>CHR$(0)THEN320
200 IF(PAND1)THENLSETB$=CHR$(27):PUT2:LSETB$=CHR$(61):PUT2:LSETB
   $=D$:PUT2
210 IF(PAND2)THENLSETB$=CHR$(27):PUT2:LSETB$=CHR$(62):PUT2:LSETB
   $=D$:PUT2
220 IF(PAND4)THENLSETB$=CHR$(27):PUT2:LSETB$=CHR$(63):PUT2:LSETB
   $=D$:PUT2
230 LSETB$=CHR$(27):PUT2:IFP$="N"THENLSETB$=CHR$(18)ELSEIFP$="E"
   THENLSETB$=CHR$(29)ELSELSETB$=CHR$(17)
240 PUT2:IFMID$(Y$,96,1)=CHR$(0)THENMID$(Y$,96,1)=LEFT$(Y$,1)
250 MID$(Y$,193,31)=STRING$(31,82):LSETZ$=Y$:PUT3:CLOSE:END
260 GET1:P=ASC(A$):IF(P/16)AND1THENPRINT"FONT FILE CONTAINS IBM
   EXTENDED CHARACTERS - CANNOT CONVERT":ENDELSEP=(PAND7)
270 LINEINPUT"DOWNLOAD AS FONT NUMBER <4> OR <5>? ";D$:IFD$<>"4"
   ANDD$<>"5"THEN270
280 PRINT"SELECT PITCH TO LEAVE PRINTER IN AFTER DOWNLOAD -"
290 LINEINPUT"<N>ORMAL (10), <E>LITE (12), OR <P>ROPORTIONAL: ";
   P$:IF(P$<>"N")AND(P$<>"E")AND(P$<>"P")THEN280
300 LSETB$=CHR$(27):PUT2:LSETB$=CHR$(38):PUT2:LSETB$=D$:PUT2:LSE
   TB$="0":PUT2:LSETB$=MID$(STR$(P),2):PUT2:LSETB$="0":FORX=1TO
   3:PUT2:NEXT:GOTO140
310 IFERR=162THENPRINT:PRINT"ERROR - YOU MUST SPECIFY TWO VARIAB
   LE LENGTH FILES WHEN:PRINT"ENTERING BASIC (I.E. "CHR$(34)"B
   ASIC 2V"CHR$(34)"):PRINT:ENDELSEONERRORGOTO0:OPEN"R",1,A$,1
   :END
320 PRINT"INVALID CHARACTER DETECTED":CLOSE:END

```

Program Listing 2. Model III subroutine to list information to the screen or printer.

```

30 INPUT "SELECT SCREEN (S) OR PRINTER OUTPUT (P)";O$
40 IF O$="S" THEN TK=178 ELSE TK=175
50 A$="A":GOSUB 100:LPRINT "OUTPUT TEXT HERE....":STOP
100 P=VARPTR(A$):P2=PEEK(P+1)+256*PEEK(P+2)
110 FOR X=P2 TO P2+30:IF PEEK(X)=178 OR PEEK(X)=175 THEN POKEX,T
   K:RETURN

```

I version on the Model III, you need to know the codes sent to the printer by one of the four printer routines in Scripsit itself. You'll have to change the 3AE738 hex at addresses X'665E', X'7A97', and X'7A9E' to D3F800 hex.

How do I send control characters with this new configuration? Also, how can I get the program to recognize the right shift key as a shift key? (*James R. Pittney, San Francisco, CA*)

A: You can easily solve both problems by upgrading to Model III Scripsit, which Scriplus modifies for the same capabilities. Newer releases of Model I and III Scripsit have versions for both models inside the binder. If you have one of the older versions containing only the Model I disk, ask your local Radio Shack dealer about getting a copy of the Model III version. You might need to show proof of purchase or present the original disk and binder.

If you are determined to use the Model

Doubly Spaced-Out

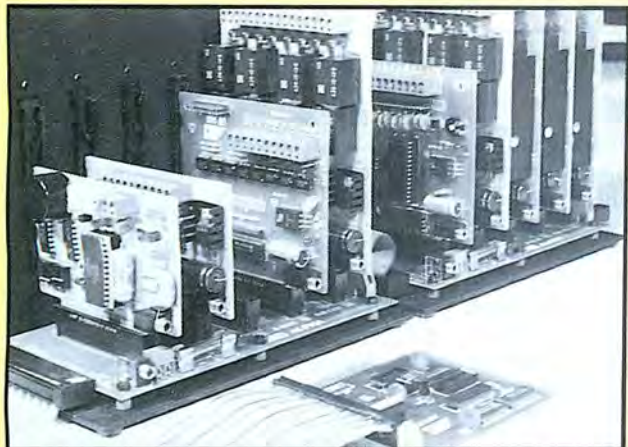
Q: We have a Daisy Wheel II Printer that we successfully use with a Model 4. When we try to use it with a Zenith Z100, however, everything comes out double-spaced. Can you help? (*James H. Welch, Fort Myers, FL*)

A: You can send escape code 21 to turn off the line feed (use code 22 to reenable it). This method doesn't work if your printer has an old ROM; a new ROM costs \$40-\$50 installed.

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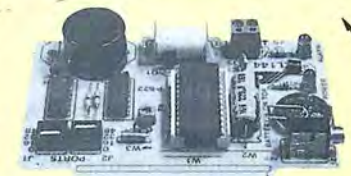
- **What would I need?** Select the A-BUS cards, and slip them into a motherboard. Plug the adapter into your computer and connect them with a cable.

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Memory Isn't Cheap

Q: I have a Tandy 1000 with a Tandy 256K Memory Expansion Board for a total 384K of usable memory. I would like to upgrade to a full 640K without buying another board. Can I convert the existing board to 512K by replacing the 64K RAM chips with 256K chips and changing the controller chip on the board? (Jeffrey R. Cavins, Dayton, OH)

A: Sorry, but I've heard of no way of enabling the board (catalog no. 25-1004) to handle more memory. It's a waste of one of your three slots, which is why Tandy is discontinuing it. If you need the other two slots now or in the future, you have no choice but to replace the board with one that holds 512K (plus a clock and an RS-232 port).

Color by Numbers

Q: I recently tried to use the screen function on my Tandy 1000A to find the background color of a position on screen. The manual said that in the command A = SCREEN (X,Y,1), A equals the screen color at position X,Y and is in the range 1-16.

After setting the screen to various colors and running the command, I found that A was returning values in the range of zero to 127 and that this number gives both the foreground and background color of a screen position if you use the following program:

```
10 S = SCREEN (X,Y,1)
20 FOREGROUND = S MOD 16
30 BACKGROUND = INT(S/16)
```

(Dale Harris, Chicago, IL)

A: This information is useful because the 1000's GW-Basic manual inadequately explains how to use the Screen function in text mode. I would add that the range of numbers returned by Screen goes up to 255 if you use values between 16 and 31 for the foreground color (the blinking foreground). The 3000's Basic manual correctly documents the Screen function, but its calculation for background:

```
(((attribute-foreground)/16) mod 128)]
```

is needlessly more complex than yours. An IBM Basic manual I checked gives a background formula that doesn't work at all.

The foreground and background values you specify in the text Color statement are not always what you get back with the Screen function. To get blinking foreground colors, add 16 to the value of the foreground color you want. Screen, however, returns a background value between 8 and 15 (the actual background value plus eight) to indicate that the foreground is blinking. Despite what the Tandy 1000 Basic manual says, you

can't, under any condition, specify a background value higher than 7 with the Color statement.

Readers Respond

Line Feeds, Part 2

Recent letters on generating single-line spacing on Radio Shack printers used with MS-DOS computers prompted Jerry Rogers of Northridge, CA, to pass along another suggestion. Jerry uses a vintage Radio Shack Line Printer VI to do statistical work with a Model 4 and an IBM PC. On the PC, he sends the Basic statement LPRINT CHR\$(27)+CHR\$(28) to put the printer in 12-lines-per-inch mode. Extra line feeds from PC programs are no longer a problem.

Magnetic Meteor

Lynn Hebert (Wallingford, VT) has an answer to Pat Anderson's September 1986 question (p. 17) about transferring Zaxxon and Meteor Mission from tape to disk.

Meteor Mission uses a tape-loading routine at 7F9C hex that loads the main program. Upon execution, a block move shifts the entire program up by 80 hex, obliterating the loader and entry address. There's still a way to get the program on disk, however.

First, put a machine-language monitor in high memory above B017 hex, then load Meteor Mission from tape. Hold the break key and press reset to get into Level II Basic. Use the System command to go to your monitor.

Copy the code from 7F80 to 7FE6 hex. Go back to Basic and load Meteor Mission again, but this time, watch the count-down. When there's one second to go, break, reset, and jump to the monitor again. Look at the code from 7F00 to 7F66 hex; the first part of it should be the same as your copy of the code at 7F80 to 7FE6. If it isn't, you broke too soon. Using your monitor, make sure the code from 7F00 to 7F66 hex is the same as your copy of the code from 7F80 to 7FE6.

In effect, you're stopping the loading process just before completion and entering the last part by hand. You now have the complete program in memory starting at 4300 hex, ending at 7FFF with a transfer point at 7292. Move it to high memory by entering the following code above B017 hex:

```
21 FF 7F 11 FF AF 01 00 3D ED B8
```

and jump to the monitor. Append the following code to the program beginning at B005 hex:

```
21 00 73 11 00 43 01 00 3D ED B0 C3 92 72
You can now boot TRSDOS and enter
DUMP MISSION/CMD:1 (START = 7300,
END = B017, TRA = B005). The same
```

technique works with Cosmic Fighter, Defense Command, and Stellar Escort (all from Radio Shack Games Packs 2 and 3).

Zaxxon is easier to transfer. First load it from tape, press break, and reset at the skill-level prompt. The program now resides at 4300 to 7FFF hex, with an entry at 4543. Go to your monitor and move the program up with the following:

```
21 FF 7F 11 FF AC 01 00 3D ED B8
```

Then jump back to the monitor. Append the following at AD05 hex:

```
21 00 70 11 00 43 01 00 30 ED B0 C3 43 45
Boot TRSDOS and enter DUMP
ZAXXON/CMD:1 (START = 7000,END =
AD17,TRA = AD05). You can do the
same with Frogger, which resides at
4400 to 74FF hex with an entry at 5546.
```

Seeking Help

► Roger G. Lavoie (69 Tickle Road, Westport, MA 02790) is looking for documentation on LTERM 3.0A.

► Richard Meronek (AFI Box 864, APO 09673-2055) seeks a supplier of replacement cassettes for the Seikosha GP-700A Color Dot Matrix printer.

► Lowry Riggins (626 Lakeshore, Monroe, LA 71203) wants to know how to merge data from Small Computer Co.'s FilePro 16 to Satellite Software International's WordPerfect 4.1.

► Thomas Kregeloh (Schwarzenbergstrasse 22, 2100 Hamburg 90, West Germany) seeks a way to quiet the Model 4P's fan. He knows turning the fan off permanently is out of the question, but wonders if anyone has had luck installing a switch with a "thermo sensor."

► Jack M. Farwell (Quail Hollow Farm, Route 1, Dowelltown, TN 37059) uses VisiCalc 1.0 on a Model 4 in III mode to tabulate both his mortgage and car payments. He seeks a formula that won't automatically round off nonintegers, especially interest rates. He also asks how to bulk-delete old VisiCalc programs so he can save useful formulas without carrying over the corresponding column and row entries.

► Mark Myers (705 Parkview Drive, Chattanooga, TN 37411) is looking for a way to use Do and JCL files with Small Computer's Profile III+ so he can print reports and labels. He is unable to do so in LDOS and TRSDOS 6.2. He can access JCL files from menus, but control returns to the keyboard upon entering Profile.

► Ronald Williams (138 Ellicott St., Rochester, NY 14619) is looking for a program to keep track of tournament rounds. He needs one that takes the winning players from each match and advances them to the next round. ■

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Lotus 1-2-3	✓					✓		✓					495 ⁰⁰
Symphony	✓	✓	✓			✓		✓		✓	✓		695 ⁰⁰
Framework	✓		✓	✓		✓		✓		✓	✓		695 ⁰⁰
Enable	✓		✓			✓	✓	✓		✓	✓		695 ⁰⁰
Smart	✓		✓			✓	✓	✓		✓	✓	✓	895 ⁰⁰

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Tandy Passes FCC Inspection—Finally!

Tandyland

After weeks of delay, the Federal Communications Commission (FCC) certified the Tandy 1000 EX and SX computers for home use (a Class B certification) on September 15. Tandy originally planned to ship the new computers within a week after their July 30 announcement but was stalled by the FCC's testing for radio-frequency interference (RFI).

The FCC certifies whether computers meet U.S. electromagnetic-emissions standards. Until last summer, the FCC allowed companies to perform their own tests and submit the data for approval. It changed this policy after discovering that some companies were sending in spurious data. The FCC now tests all products itself. The decision resulted in a backlog of computers to test, including Tandy's.

According to reports published in *InfoWorld* and *Micro MarketWorld* in September, the Tandy computers were originally refused certification because of "higher than acceptable" radio-frequency emissions. Both publications highlighted that certain Radio Shack Computer Centers were advertising and accepting deposits for the computers, contrary to FCC regulations regarding noncertified products. Tandy subsequently instructed the stores to stop taking deposits and to cease promoting the computers.

Though refusing to specify the exact measures needed to obtain certification, Ed Juge, director of marketing, said that Tandy "cooperated fully with whatever the FCC wanted us to do. It is not unusual for changes to be made in a product." According to Juge, Tandy shipped the required test data to the FCC in the middle of July. The FCC then asked for samples of the computers.

After receiving certification, Tandy had to ready the computers for shipping. "We don't have them boxed and ready to go. There is some finishing to do on them," Juge said. Tandy stubbed its toe badly on this one.



Photo 1. The Deskpro 386, Compaq's new 32-bit computer.

Everybody is beating up on IBM.

First it was Tandy with its July announcement of the 3000 HL, a more affordable and expandable machine than IBM's new PC/XT 286 (see item below). Then, in September, Compaq released the Deskpro 386 (see Photo 1). Compaq was the first major computer manufacturer to have a working 32-bit 80386 machine, which reportedly runs software three to four times faster than an IBM PC/AT 80286 computer.

The Deskpro 386 is available in two configurations: the Model 40 and the Model 130. The Model 40 costs \$6,499 and comes with a fast-access, 40-megabyte (MB) hard disk, a 1.2MB disk drive, a 32-bit 16-megahertz (MHz) 80386 microprocessor, six expansion slots (three 8-bit and three 16-bit), and 1MB of RAM (expandable to 10MB on the system-memory board). The Model 130 has a 130MB hard disk and costs \$8,799.

In its September 16 issue, *PC Week* reported that IBM will announce a series of new machines in January, which supposedly will include inexpensive (8086) and higher-priced (80286 and 80386) models. IBM hopes to start regaining market share with the new computers. It might be too late.

This is going to be a fun season for computer shoppers. Not to be outdone by Tandy and Compaq, Apple also an-

nounced a new computer in September, the Apple IIGS (the GS stands for graphics and sound). The computer costs \$999 and comes with 256K of RAM (expandable to 8MB), 128K of ROM (expandable to 1MB), eight expansion slots, a 2.8MHz 65C816 central-processing unit (CPU), a detached keyboard, a mouse, and a built-in clock. The IIGS features a graphic user interface (the same as the Macintosh's), high-resolution (640- by 200-pixel) four-color graphics, and a 15-voice sound chip.

Tandy will go head to head with Apple for the home and education markets, pitting the 1000 EX and SX against the Apple II machines. May the best computers win.

IBM must think the Tandy 3000 HL

is a pretty good idea. On September 2 the company announced its own small-size 80286 computer. IBM's new XT 286, like Tandy's 3000 HL, is marketed as a "souped-up" PC/XT (see Photo 2). The base configuration includes 640K RAM, three drive slots in front—with one 5¼-inch, 1.2MB disk drive and a full-height 20MB hard drive—and eight expansion slots (three 8-bit and five 16-bit). The 20MB drive isn't a fast-access AT type; it is the same drive IBM uses in the PC/XT.

The IBM XT 286 runs at 6MHz with no wait states, as opposed to Tandy's 3000 HL, which is speed-switchable between 4MHz and 8MHz. The XT 286 comes with IBM's new Enhanced Keyboard and a list price of \$3,995. The retail price might be as much as \$800 lower.

By comparison, the base model 3000 HL costs \$1,699 and features 512K RAM, three front drive slots (with one 5¼-inch 360K disk drive), seven internal slots (four 8-bit and three 16-bit), and a parallel port. A fully equipped 3000 HL (with a color-graphics adapter, MS-DOS, Basic, color monitor, and 20MB hard drive) costs between \$3,400 and \$3,800, depending on whether you use a hard-disk card or an internal hard disk. Tandy also offers the 3000 HL equipped with a

half-height, fast-access 40MB hard drive. The price? About \$4,000 (without video card or monitor). For the same amount of money, you get twice the capacity of the XT 286—and a much faster hard drive.

Despite its billing, the XT 286 resembles an AT more than it does an XT. It has more 16-bit slots than 8-bit slots and uses the AT-style 1.2MB disk drive. In contrast, Tandy made the 3000 HL more like an XT than an AT: It has more 8-bit slots than 16-bit slots and a 360K disk drive. The lines that determine what is an AT and what is an XT are becoming blurred.

Because it is more AT than XT, the XT 286 will probably cannibalize sales of IBM's other AT computers. (You could probably say the same about the 3000 HL's effect on sales of the 3000.) IBM dropped the AT 239, its 6MHz AT model with a 30MB hard drive. Given the recent price drops of AT machines (some mail-order firms are selling stripped-down versions for \$1,125), expect to see similar discounting on the new XT/AT hybrids within the next year. This will further push down prices of the low-end 8088 machines.

A few days after IBM's introduction, Sperry Corp. and Compaq Computer introduced new AT computers. Sperry's is a small-size AT. Compaq's Deskpro 286 Model 20 is an 8MHz version of the Deskpro 286 with a 20MB hard drive.

Tandy's earnings report for fiscal 1986 (see the Table) shows improved overall sales but lower earnings in the fourth quarter. The reason? According to the press release accompanying the report, "The fourth quarter results were adversely affected by the relatively low sales gain in the Radio Shack Division, the increased expenses in implementing a new computer-marketing program, expansion expenses associated with our Tandy Name Brand Retail Group, and other items, mostly of a nonrecurring nature, associated with the InterTAN spin off, the VideoConcepts acquisition, and the significant increase in the provision for income taxes."

Yes, there is life left in the Model 4 world. The long-awaited TRSDOS 6.3 upgrade is almost ready. Logical Systems Inc. will start shipping the upgrade no later than January 1; it began accept-

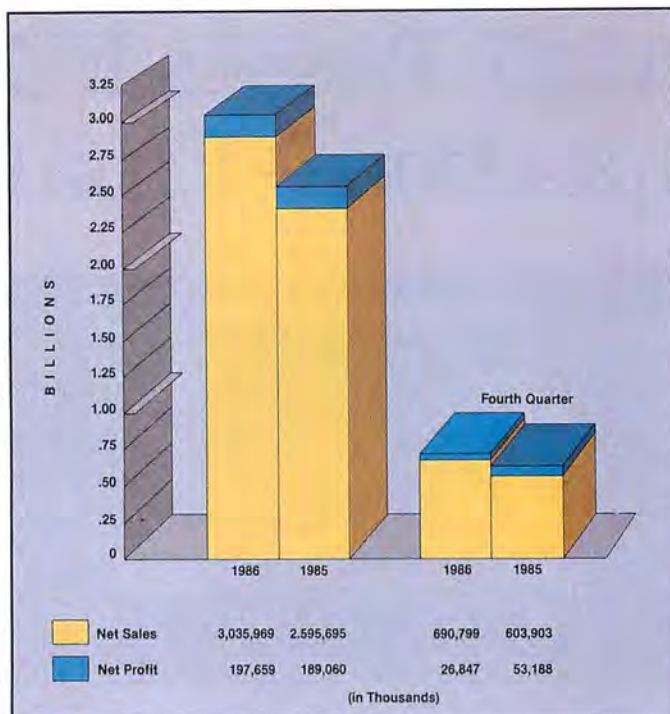


Table. Tandy's fiscal 1986 earnings report.

ing orders on November 1. Bill Schroeder, president of Logical Systems, is optimistic about sales: "With over a half-million Model 4's out there, we expect tens of thousands of people to upgrade their DOSes."

TRSDOS 6.3 will have about 20 new features. The main improvement, of course, will be a time stamp that you can set up to the year 2000. Previous versions of TRSDOS 6.x choked when you input a date after December 31, 1987.

The directory will also have time stamping, with the hour, minute, and a.m./p.m.



Photo 2. IBM's small-size 80286 computer, the XT 286.

designation added. Logical Systems altered the directory format to make room for it; utilities will be on disk to help you convert disks and files to the new format.

The company upgraded Basic, too. Most of the changes are in the Basic overlay file (Basic/OV1). "It's a full Basic, much like the one that Model III programmers have been using. Users will be able to copy and delete lines, will have single function-key editing, and a full cross-reference utility," according to Schroeder.

The DOS will have a full-screen text editor to simplify file building (JCL files, for example). Logical Systems also corrected all known bugs and fixed inconsistencies.

Though this is a significant upgrade, TRSDOS 6.3 was made to be downward compatible with other versions. "We have been work-

ing on this off and on for the past year and a half," Schroeder said. "That was the nice thing about it: There wasn't any time pressure to get it done until 1987. It was beta-tested in June and is now in delta-test (late August). I haven't seen an error report for over a month and a half."

Tandy was thinking of sending a letter to registered Model 4 owners, according to Schroeder, but Fort Worth had not confirmed this as of press time.

In other DOS news, Misosys is offering a new LDOS 5.3 incorporating some of the features of TRSDOS 6.3. Roy Soltoff, president of Misosys, said that LDOS 5.3 will have date and time stamping, some Basic enhancements, and easier editing capability. "The new LDOS will be more compatible with TRSDOS commands," he added.

Both the Model I and Model III versions should be out by the first of the year. The Model I version will require a double-density disk-controller board. An alternate keyboard driver that lets you use the Model 4 function keys will also be available, along with RAM drivers that support memory boards for the TRS-80 line.

Misosys is now mailing *The Misosys Quarterly*, a newsletter containing information on LDOS 5.x and TRSDOS 6.x. The first issue (Summer 1986) included messages from the LDOS/TRSDOS special-interest group (SIG) on CompuServe, DOS hints and patches, programs, and programming tips. If you're after hard-core information, this is the place to get it. ■

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- 4 - Purge TRS-80™ diskette
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- 6 - Exit

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TRSCROSS allows you to "TAG" all files to be moved in ONE pass!

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TRSCROSS will even FORMAT a TRS-80 disk right on your PC!

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TRSCROSS will READ FROM and COPY TO the following TRS-80 double-density formats: TRSDOS 1.2/1.3, TRSDOS 6.2*, LDOS 5.1.4*, DOSPLUS 3.5, NEWDOS/80*, & MultiDOS.

DOS formats listed above flagged with * signify that earlier versions of these DOS's are readable as well, but one or more sectors may be skipped due to a format problem in that version of the DOS. One or more sectors may also be skipped on NewDOS/80 formats. (Disks that were formatted with SUPER UTILITY + or SU4/4P do not, and have never had this problem.) TRSDOS 6.02.01, or higher should not have this problem. Disks formatted in any 80 track format, any single density or mixed density (Model I "boot" disks) are not supported.

TRSCROSS requires: PC or compatible computer, 128K and a normal 360KB (40 track drive) PC drive. Double-sided operation is fully supported. If you have more than one disk drive, fixed drive, or RAM disk, operation will be much smoother. TANDY 1000 requires extra memory card because of the required DMA chip that resides there. TANDY 3000 is supported as long as you have a 360KB drive to use for transferring, rather than the hi-density drive. TANDY 2000 is not supported at this

time due to a difference in disk controller and floppy drives. TANDY 1200 is OK. "Special" data files like PROFILE +™ would need to be converted to ASCII on a TRS-80 first before they would be of any use on a PC or compatible.

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Instant III Mode

While trying to interrupt my Sysgen startup JCL routine on my Model 4, I made an interesting discovery. While executing the Boot command, you can reach Model III Basic by pressing the break key immediately (not simultaneously) after pressing the enter key.

This works with my All-write work disk and my Basic disk, but not with my Visi-Calc disk.

Allen C. Mattson
Hartford City, IN

Color Keeper



Making Tracks

The Model 4 DeskMate system disk lacks two files: Memdisk/DCT and SYS11/SYS, the files you need to run Memdisk and JCL files. I've found a way to make room on the disk for these files.

Every Tandon 40-track, single-sided disk drive can format 42 tracks, giving you an extra 6K. Put a system disk in drive zero and a blank disk in drive 1. Then type:

```
FORMAT :1 (CYL=42,DIR=20,
Q=N)
```

DIR = 20 keeps the directory on track 20; the format places it on drive 21 otherwise. Next, back up your DeskMate system disk to the blank 42-track disk.

Finally, copy both Memdisk/DCT.Utility and SYS11/SYS.LSIDOS to the DeskMate system disk you just made. This leaves 2K free for you to write a short JCL file. I used

this space for a JCL file that lets me use both Memdisk and Spool while using DeskMate.

Since I have a four-drive system (zero to 3), I put Memdisk on drive 4:

```
SYSTEM (DRIVE=4, DRIVER=
"MEMDISK")
C
D
Y
SPOOL (BANK=1,DISK=0)
DM
```

The above JCL file initiates Memdisk as drive 4, bank 2, double density, and creates a 32K print spooler in bank 1. I call it DM/JCL and have an AUTO DO = DM/JCL on the DeskMate system disk. You must do a disk swap to see drive 4. Remember to copy from your Memdisk to a regular disk before shutting off the system.

David T. Bergen
Grand Lake, CO

Many programs let you set the Tandy 1000 video colors from DOS. However, none of them restores the set color after you've typed CLS, even if you have installed ANSI.SYS.

You can circumvent the problem by patching IO.SYS for the colors you desire. Thereafter, the screen color you selected will be restored each time you type CLS.

A problem with patching IO.SYS is a hidden, read-only system file. The fact that it is hidden isn't a problem for Debug; it will load IO.SYS. The problem results from DOS's refusal to write to a read-only system file; once patched, you cannot rewrite IO.SYS back to the disk.

The Figure is a Debug script file called Patch.IO. It overcomes the problems associated with patching IO.SYS. Lines 1-9 change IO.SYS's file attribute to that of an archive file, allowing Debug to work on it. Lines 10-15 load IO.SYS, perform the color patch, and rewrite IO.SYS back to disk.

Line 13 changes the color value (MOV BH, 1F). The hexadecimal value 1F specifies a blue background (the first digit) with white letters (the second digit). Lines 16-25

change the file attribute back to a hidden, read-only system file and return you to DOS. Use this script file (excluding line numbers) by entering DEBUG < PATCH.IO at the DOS prompt.

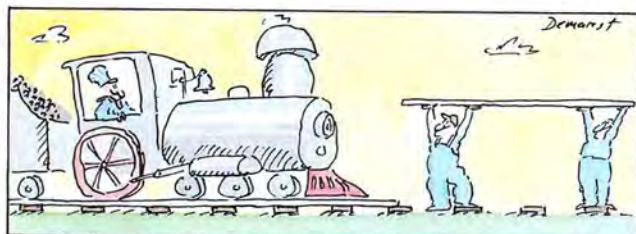
You could color code your various system disks by patching each for a different screen color. That way, you could tell immediately which disk you booted up.

This patch works with MS-DOS 2.11.00 only.

Robert L. Smith
Lee's Summit, MO

Figure. Patch.IO.

```
01 E 81 'IO.SYS' 0
02 A
03 MOV AX,4301
04 MOV CX,20
05 MOV DX,81
06 INT 21
07 INT 20
08
09 G
10 N IO.SYS
11 L
12 A 251
13 MOV BH,1F
14
15 W
16 E 81 'IO.SYS' 0
17 A 100
18 MOV AX,4301
19 MOV CX,27
20 MOV DX,81
21 INT 21
22 INT 20
23
24 G
25 Q
```





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80 MICRO Review, November 1985

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The Professional Look Is Easy

Unlike other advanced software packages, LeScript is one of the easiest you'll ever use. One reason is, LeScript displays your text on the screen the way it is going to look printed - with headers, footers, indents, columns, footnotes, page numbers, line spacing, the works. LeScript even has the incredible ability to show you right on the screen the words that are italic, boldface, underlined, subscripted. A feature that is so necessary, yet unheard of among the competition.

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Better BetterBasic

by John B. Harrell III

★★★★

BetterTools 2.0 runs on the Tandy 1000/1200/2000/3000 (384K) and requires BetterBasic Version 1.1 or 2.0 and two disk drives. Software Associates, 6220 W. Airport Blvd., Houston, TX 77035, 713-726-0706. \$95.

BetterBasic is an excellent alternative to GW-Basic. As I stated in my review of this product (June 1985, p. 33), it is functionally equivalent to the Basic interpreter provided with all MS-DOS computers. BetterBasic also provides a fully structured alternative language with separate modules, procedures, and many other structured control statements. It provides high compatibility with Basic while significantly extending the programming language.

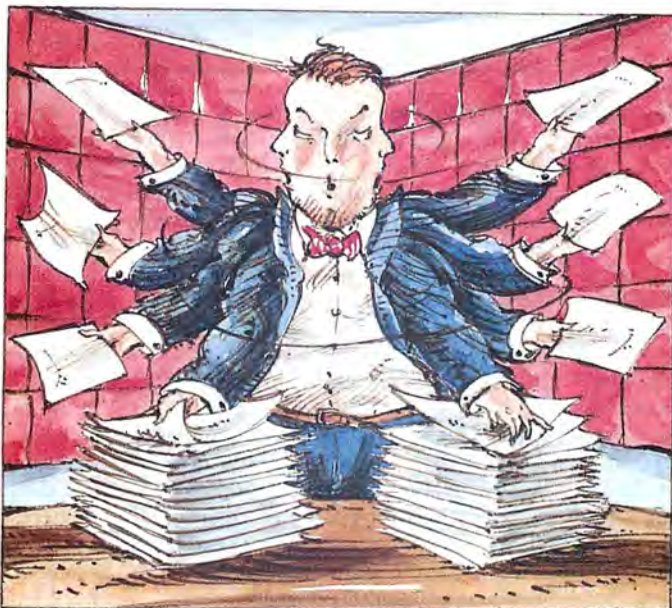
One feature of BetterBasic is that it lets you add features by writing new modules and including them in your configuration file. BetterTools is an excellent example of this extensibility; it provides over 150 powerful statements aimed at reducing your programming time.

The distribution disk contains 17 new modules that you can integrate into the BetterBasic environment. Each one adds features to BetterBasic, and you can pick and choose those you want to include. BetterTools provides full source code to let you customize these modules.

BetterTools Modules

The Chrono module provides additional date and time functions to calculate the day, date, time, and month as formatted string text. You can also calculate the Julian day number for a given date—this greatly simplifies date arithmetic. Chrono adds a new function to provide an elapsed-time value; this lets you calculate accurate time intervals within programs.

The Develop module, one of the main program-development tools in this package, allows single-command access to all



the extended ASCII characters and their decimal and hexadecimal representations. Similarly, you can use a single command to call up a display of all colors and their BetterBasic names.

When Develop is active, a single command displays the full BetterBasic error-message text for an error number. This feature is extremely helpful. In my review of BetterBasic, I objected to continually having to refer to the reference manual to determine error messages. Develop also adds a log function that automatically writes to disk a transaction of the beginning and ending times for each session, as well as any other message you wish to add to the file.

The Disk module adds new functions that simplify manipulation of disk files and directories. Disk lets you obtain a full directory of any path (including using wild-card specifications) on your

disk and displays it in a format similar to that of the DOS directory command. Simple commands return the current working directory name, get or set file attributes, or parse filespecs into component parts.

The Encrypt module provides facilities for encrypting or decrypting data. You can establish multilevel passwords and encode or decode files or strings under full program control. Unfortunately, this module responds so slowly that I had little use for it.

Exmath adds many mathematical functions. A full complement of hyperbolic functions, as well as

modifications to the normal transcendental functions, lets you specify the angular input in radians, degrees, or gradians. Additional functions are for factorials, permutations, combinations, simple roots, inverses, and angle/time conversion.

The Input module provides a greatly enhanced Inputat function for extraordinary control over user input fields. It has excellent error checking, as well as screen-color control for highlighted prompting.

The Kernel module sets several low-level functions used by some of the other modules to determine the type of machine, number of communication ports, RAM size, ROM date, contents of the environment, and so on. You also get "sleep" (delay) and "chirp" (alarm) functions, extended keyboard-scan control, and enhanced string functions.

The Keyboard module adds functions to place strings in the keyboard buffer for simulated type-ahead and to clear the buffer. Other functions in the module allow finer manipulation of the function keys, setting the numeric-lock state, and program control over enabling or disabling the keyboard.

The Logo module provides an easy interface for displaying a program logo on startup. A simple command sequence specifies the program name, version number, and copyright information. You

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can use this same command to optionally display a graphics screen image for the logo.

The LPT module adds functions for enhanced printer control. You can test for printer status, add jobs to the DOS print queue (version 3.x), and send control codes to the printer.

BetterTool's Makescrn module is exceptional, letting you design a screen that you can invoke with a simple command. Menu selections define the size, color, and text formatting within the screen, and the information is compiled into a file that can be retrieved instantly. You can design help screens with integrated graphics and text, or write program-control instructions anywhere in your programs.

The Qsort and Sort modules define procedures for sorting general arrays of information. Both procedures use identical calling sequences. Sort is fine for small volumes of data or where memory size is limited. Qsort is much faster but requires more memory space, as it is recursive. These procedures allow "tag" sorting to reduce sorting time. In tag sorting, certain elements within a predefined list are marked and sorted without rearranging the entire list.

When you want to sort an array, only the tagged elements move. You can sort the input array and reorder a point array at the same time. (In C and other languages, you'd have to provide pointers for the tag sort and write the modules from scratch; with Qsort it becomes academic because the modules are there, ready to use.) This is much faster than attempting to reorder arrays of large data structures.

The Regis module provides identifiers for easy access to CPU registers used in the Syscall statement. The Screen module has statements to control display of the screens created by the Makescrn module. Screen also provides an easy-to-use menu-selection statement that you can use with an On. . .GOTO statement for selecting program options.

The Stack module implements a software-controlled stack that you can use for additional parameter control. The Video module provides several new features for screen control, such as centering text on a given column, setting and determining attributes, selecting and using monitors, and controlling the message-status area.

Conclusion

If you are programming in Basic, you will find BetterBasic an exceptional alternative. BetterTools is a great extension to this system and is full of powerful programming aids.

However, BetterTools has two signifi-

***If you use
BetterBasic,
I highly
recommend
BetterTools.***

cant problems. First, most of the 17 modules are dependent on some other module, either in BetterBasic or BetterTools. Attempting to load all the modules turns into a nightmare as you try to get all the dependencies correct. Software Associates should provide a prototype configuration file that contains all the modules for loading in the correct sequence.

The second problem is more serious. I ran most of my testing on an IBM PC/XT with 512K bytes of RAM operating under PC-DOS 3.1. Initially, I could not get BetterTools to load the Develop module without hanging up the computer. When I rebooted the system using PC-DOS 2.10, the same configuration ran fine and functioned normally.

When I contacted Software Associates, they informed me that BetterBasic has a conflict with Borland International's SideKick that causes the problems. I tried a clean configuration (no SideKick or SuperKey) using both PC-DOS 3.0 and 3.1 with mixed success—sometimes BetterTools would load properly and sometimes it would not. This appears to be a significant operating-system conflict on the IBM PC.

While the documentation for BetterBasic and BetterTools states that the minimum hardware configuration should have 256K of RAM, I feel that more is necessary. Loading all the BetterBasic modules virtually exhausts the minimum RAM, leaving little for programs or development tools. For example, on my 512K PC I had approximately 140K bytes left over after loading the entire system—I started with over 470K bytes (clean system).

On a more positive note, Tandy 2000 owners can use most of the features in BetterTools as delivered with BetterBasic 1.1. Simple modifications to the source code in other areas should dramatically increase the usefulness of these tools on the 2000.

If you use BetterBasic, I highly recommend BetterTools as a software extension. You must remember my reservations when considering your purchase, but this is a substantial product and worth the price. ■

An Inexpensive CAD Solution by Bobby Ballard

★ ★ ★

ProDesign II runs on the Tandy 1000/1200/3000 (512K) and requires one disk drive. American Small Business Systems, 118 S. Mill St., Pryor, OK 74361, 918-825-4844. \$299.

ProDesign II follows the software-pricing trend of recent years: lower and lower. In a world of \$1,000 CAD (computer-aided design) programs, ProDesign II's low price might be its best feature.

What You Get

ProDesign II arrives on two disks with a 125-page manual, a quick-reference card, and a keyboard-template card. ProDesign II's features include screen editing using windows, on-screen rotation, text capabilities, varying line weights, color graphics, area fill (paint), and an undo command. It supports output to most dot-matrix printers and pen plotters and input from various digitizing tablets and mice.

Many of the functions you would expect in a CAD program are here, but ProDesign II has features that you would not expect to find in such an inexpensive package. Some CAD programs require additional overlays (extra software cost) to handle autodimensioning and area fill, while ProDesign II includes these features. A hard disk, plotter or printer, digital mouse, and graphics tablet are optional. I ran ProDesign II on a Tandy 1000 with 640K, two drives, a standard RGB monitor, and a Tandy Digital Mouse without any problems.

Installing the software is easy. You can custom-design printer and plotter codes if your hardware is not in the installation file. You do not need a hard drive to use ProDesign II effectively, unlike many more costly packages. This is an important consideration if you are putting together a low-cost CAD system.

Working with ProDesign II is different from most CAD packages. If you have a high-resolution display, the program puts your entire drawing on the screen at once. With a standard video display, ProDesign II uses a virtual-screen design; the complete drawing remains in the data base as you move about the virtual screen in window fashion, viewing a quarter of the drawing at a time. You shift through the actual screens by using function keys F1-F4. You can also use the zoom feature to highlight areas of a drawing, moving in and out of specific areas to create and edit details or smaller features. Another function zooms and ro-

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tates a drawing in one move by selecting points diagonal to your current position.

Look It Up

Entering ProDesign II commands requires the keyboard, not the click-and-point menu system you might find on more expensive CAD systems. This can be a disadvantage unless you use ProDesign II often enough to remember all the commands. Otherwise, you might spend a great deal of time consulting the manual. Although I was surprised at how quickly I learned some commands, it was difficult to keep them all straight.

Some of the commands are mnemonic—S is snap grid lock—while others are more difficult to memorize. I found myself asking whether) or (draws a semicircle, a quarter circle, or an arch. It would have been much easier to learn this system if it had a menu instead of keyboard assignments. The quick-reference card is in key order rather than grouped by functions, so it's difficult to look up a function. A more convenient approach to the reference card would have grouped all the drawing, movement, and file-in and file-out commands together.

The documentation pays little attention to CAD terminology. The manual constantly refers to sections, as in "delete section," when it actually means an area or window. To a professional draftsman or designer, the word "section" refers to a particular type of drawing or viewpoint.

Some of the commands are difficult to work with at any level. It's awkward and tedious to erase a line; you have to know the starting point of that line and then hit it precisely to erase it. The gravity-point command helps some with this, but it is still cumbersome to use safely. Other commands are not as intuitive as they should be. At times, this sends you back to the manual to refresh your memory.

ProDesign II supports various line weights and eight basic line styles, including solid, dotted, dashed, and dash-dot. You select / for the line type and enter a number from 1 to 8 representing the various types. They are referenced on the back of the quick-reference card. You can select a variety of line weights for each supported style.

Conclusion

Although ProDesign II sports an attractive price, it has limitations that you might not want to tolerate. ProDesign II is not for the professional, who will find the program limiting and frustrating. It is a matter of getting what you pay for. The subtitle of this software package, The Easy-to-Use CAD System, is misleading. While you might not need to learn much, ProDesign II is unwieldy for everyday use and for serious applications. ■

Stop Flicking Around

by Hardin Brothers

★★★★★

FlickerFree runs on the Tandy 1000/1200/3000 and requires one disk drive. Steve Gibson, 9 Lago Sud, Irvine, CA 92715, 714-854-1520. \$39 plus \$1.50 shipping and handling.

Like almost every other MS-DOS computer, the Tandy 1000 has an excruciatingly slow video display. Try using Type to list a text file to the screen and watch how slowly it scrolls by. Although the Tandy 1000 and your video monitor are capable of much faster screen displays, a program in ROM makes the screen go slowly in order to be compatible with the IBM PC and its earliest (and weakest) color graphics cards. If you let the Tandy 1000's video hardware run as fast as it could, you'd be amazed at the difference.

That's the secret of a program called FlickerFree: It lets your Tandy 1000 video display run three to seven times faster than its natural speed. Not only does FlickerFree speed up the video display, it is one of the easiest programs I've ever used. When loaded, FlickerFree presents an easy-to-use menu that you control with the arrow keys. The menu is smoothly painted onto the screen, partially covering whatever was there originally. When you are finished with the menu, it erases smoothly and your original screen is left intact.

The first of six menu categories lets you turn FlickerFree on or off and lets you read a file of information about the program. When you choose to leave the information page, it scrolls off sideways and the original screen and menu reappear.

The second option sets FlickerFree's speed for those times when you want to slow down the video display. There are seven steps in FlickerFree's throttle, from fastest to slowest. At full speed, you might find yourself frequently reaching for the Hold key as a long directory listing races by.

The next menu category tells FlickerFree whether your computer video system is subject to snow or static. If it is, FlickerFree has to slow down the display somewhat. The Tandy 1000 video system should never have a problem with static.

Finally, you can choose to save the current FlickerFree setup to the program on disk. Once you decide on a set of colors and a display speed, you'll probably save it and then forget it. With FlickerFree running, you rarely have any sense of screen jitter or flicker, even

though text is going by more quickly than usual. On either a monochrome or color screen, the results are superb.

Once you've loaded FlickerFree (and you'll probably add it to the AUTO-EXEC.BAT file that runs when you boot up), it stays resident in memory, consuming about 7,200 bytes. Unlike other memory-resident programs, FlickerFree doesn't care whether it is loaded first, last, or between other programs. The documentation states that it is compatible with all other memory-resident programs, and I haven't been able to disprove that claim.

Besides the main FlickerFree program, the package supplies two other programs. The first, the pretentious-sounding FlickerFree Performance Analyzer (FPA), begins by loading a text file of your choice into memory (a file is on the distribution disk for you to use if you wish). After loading, FPA displays the entire file with FlickerFree disabled, then with FlickerFree enabled and set to its highest speed. FPA uses the DOS clock to time both displays and shows you how long each took and the percentage increase in speed with FlickerFree enabled. Although the FPA program isn't very useful, the increased performance with FlickerFree is impressive and you'll probably want to run this program occasionally just to remember how slow screen displays used to be.

Such a wide variety of programs is available, both commercially and on bulletin-board systems, that it would be a miracle if FlickerFree (or any memory-resident program) were compatible with them all. The third program on the FlickerFree disk, FFIIX, is meant to alleviate conflicts between FlickerFree and other programs. Just give FFIIX a list of programs that don't cooperate with FlickerFree and it holds those names in a small piece of memory. When you run one of those programs, FFIIX turns FlickerFree off before the program starts and back on when you return to DOS. As with FlickerFree, you can load FFIIX and its list of programs as part of your AUTO-EXEC.BAT file.

FlickerFree is so simple to use that you might never have to read its 20 pages of quite thorough documentation. The best part of the manual is the guarantee—if you are dissatisfied with the program for any reason, cut the documentation and disk in half and return them with a short note for an immediate refund.

I'm impressed with this program. It works well, makes my computer more powerful, and is inexpensive. It should work as well on the Tandy 1200 and 3000 as it does on the 1000 and deserves a place in every computer owner's program library. ■

Have Modem, Will Travel

by Terry Kepner

★★★

The **Travelcomm 1200** is a 300-/1,200-baud portable modem. Touchbase Design, Green Acre Lane, Northport, NY 11768, 516-261-0423. \$249.

For modem portability, nothing beats the **Travelcomm 1200**. This tiny unit weighs 6.5 ounces, features autodial capability and direct connection to telephone lines, is battery-operated, and measures a mere 4 by 1 by 2.4 inches (almost the size of a cigarette pack).

Setup

Using the **Travelcomm 1200** is simple: Plug the unit into your computer's RS-232 port, insert your phone line's modular end into the **Travelcomm 1200**, load your communications software, tap the enter key twice, dial by typing in the numbers on your computer, and wait for the call to go through. If you get no response after 30 seconds (that is, if the **Travelcomm 1200** doesn't pick up a carrier signal from the phone line), the modem automatically disconnects.

The **Travelcomm** connects to your computer via a DB-25 RS-232C male connector. Connection to the phone line is by a standard telephone modular plug. In most cases, this means that you unplug your phone and insert the connector in the **Travelcomm 1200**. If your phone system still uses the old four-pin plugs, you need an adapter. The **Travelcomm 1200** operates according to the Bell 212A (1,200 baud) and Bell 103 (300 baud) standards.

A standard 9-volt battery supplies power, and alkaline batteries will give you about 25 to 30 hours of operation. The **Travelcomm 1200** constantly monitors the RS-232 port for activity (it is never off unless you remove the battery). When installed, it detects the RS-232C voltages and starts looking for data pulses from your computer. Pressing the enter key while your computer is in terminal mode tells the unit what baud rate you are using (300 or 1,200). Pressing enter a second time "wakes up" the unit; it "lifts" the phone hook and prepares to dial.

The modem ignores alpha keystrokes and tone dials numeric keystrokes. If 30 seconds pass without the appearance of a carrier signal on the phone (no answer or a busy signal), the unit hangs up and waits for two enter keystrokes to tell it to go back to work. When a carrier appears, the unit becomes transparent and sends all keystrokes directly out the phone

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line. After you hang up, the Travelcomm 1200 automatically shuts down 30 seconds after it loses the carrier.

The Travelcomm 1200 uses three light-emitting diodes (LEDs) to help you monitor what is happening: One indicates 1,200-baud operation, the second indicates the presence of the carrier signal, and the third stays steady when it picks up a dial tone and blinks as it dials or receives a busy signal.

Drawbacks

Unfortunately, the Travelcomm 1200 has a few problems. First, you have no way of knowing when the battery is getting weak. (The instructions claim that dialing becomes erratic or garbage begins to appear in the transmission.) This can be frustrating if it's late at night and you're in the middle of an important transmission. Also, you never know whether the trouble is a bad connection or a weak battery. I would have liked an LED to indicate a "battery good" condition, even if it does reduce the amount of time I can spend on line. And a jack for an optional power supply would be nice.

Second, the unit can't pulse dial. If you live in or happen to be traveling through one of those few areas that won't accept tone dialing, you have only two choices: Use an extension phone to dial (if one is available) or use a Y connection modular adapter to attach the modem and your phone to the line simultaneously.

Finally, the 30-second time limit isn't always enough. I tried using it in an office with a custom phone system that took an average of 15 to 20 seconds to connect me to an outside line—the remaining time was insufficient to complete a long-distance call. However, if you time it right, you can sometimes fool the Travelcomm into giving you more time by typing two carriage returns when the first 30 seconds is almost up.

Conclusion

The instructions that accompany the Travelcomm 1200 leave much to be desired. They are haphazard: At one point, they refer you to section 5 for details when the booklet isn't divided into sections (or chapters, for that matter).

The Travelcomm 1200 arrives with a modular 6-foot phone cable, so you won't have to buy one should your phone be wired to its modular cable, and a battery (how about that—a battery-operated device that includes the battery). Overall, the Travelcomm 1200 is a dandy portable modem that requires neither space nor special skills to operate. It lets you communicate at high speed while on the road but doesn't penalize you with unnecessary weight or complicated wiring. ■

Cheap, but Not Easy by Wynne Keller

★ ★

The Wordprocessor runs on the Tandy 1000/3000 (256K) and requires one disk drive. Indian Ridge Enterprises, 508 Second St., Jack London Square, Oakland, CA 94607, 415-268-1631. \$29.95.

This word processor is an inexpensive entry in a crowded field. In the IBM market, it is possible to spend anywhere from \$10 for a good public-domain program like PC-Write (Quicksoft) to \$495 or so for a commercial package. Indian Ridge's word processor is cumbersome because you access most commands through complicated control-key sequences and because what you see on the screen is often not what appears on the printout. While the program can do proportional spacing, a feature not available in many programs, it is difficult to use and unforgiving of errors.

Hardware Requirements

The program supports only a few printers with drivers designed for them, a serious limitation if your printer is not one of them. If The Wordprocessor does not support your printer, the program will probably be unable to do proportional printing, subscript, superscript, and possibly underlining and boldface, even if your printer is normally capable of these features.

The printers supported are the Qume Sprint II, Epson MX/RX Series, Epson FX series, Diablo/Xerox 630, IBM Printer, and IBM Quietwriter. You should use the standard driver for any printer that does not emulate these supported printers. Indian Ridge supplies a helpful list of many printers and the driver to select for each. I used the standard driver because the program did not support my printer (a C. Itoh Prowriter without Epson emulation).

The Manual and Support

The manual is identical to other manuals from Indian Ridge: The type style is difficult to read and occasional errors can cause confusion. For example, the command for boldface type is control-Z followed by a comma. However, the manual's poor text quality makes the comma look the same as a period. The section describing the commands says to press control-Z, with no mention of the comma. Eventually the user works out this and similar problems, but it is annoying at first.

Manufacturer support is available for \$5 for calls five minutes or under, \$1 per minute thereafter. The program is not copy-protected.

Editing Text

On startup, the program displays a standard format line across the bottom of the screen; your position as to page and line number is continuously displayed. You can change the defaults by accessing the menu (control-Z, Z, A). Any change made to the format line is effective from that point on—it does not affect the entire document. It is possible to import an ASCII file to the program, although my attempt to do so ran into many editing problems. It is better to type directly into the program to create your text.

For cursor control, The Wordprocessor somewhat imitates the system made infamous by Micropro's WordStar. WordStar was the original standard for word processing in the MS-DOS environment and was a capable program but extremely difficult to learn because of the complex cursor-movement controls.

Indian Ridge copies WordStar's inner cursor-control diamond (control-D, E, X, S) for small cursor movement and for word movement (control-F, A) but goes its own way for large-scale movements (for example, control-Z, F moves to the end of a line). With control-W, you get a brand new set of cursor movements of varying amounts depending on which number you press afterward (number 1 for character, 2 for word, 3 for sentence, and so on).

The Wordprocessor supports the arrow keypad to a limited degree. The insert and delete keys work, with insert acting as a toggle key and delete active each time you press it. Insert causes the text to open up on screen, then close when you press insert again. The arrows move the cursor in the expected direction, but you cannot get enhanced motion from the keypad (for example, to go to the beginning or end of a line). Home goes to the top left of the screen, the end key is not used, and page up/down jumps to the previous or next pages (not screens). Many word processors use the keypad to obtain virtually all cursor movement by combining the arrows with shift or control for large-scale motion. Such systems are much easier to learn and remember.

Text enhancements are also difficult. For example, you mark boldface type by typing control-Z,8 to mark the beginning, moving the cursor, and pressing control-Z,9 to mark the end. Nothing shows on the screen for bold or underline in the normal view mode. To see these features, you must switch view modes, and various markers appear in the text to indicate the format commands. The manual explains these markers, but they appear as so much gibberish when viewed on screen that it

Indian Ridge has modeled the program after the archaic approach of WordStar.

doesn't make sense to decipher them. It is easier to get a printout so you can see how the document looks and then correct any inappropriate markings.

The Wordprocessor right-justifies text by doubling the existing spaces between each word in a line. If this is insufficient to bring the end of the line to the margin, it will give up the effort. Therefore, the user must see to it that hyphens are added whenever right-justification fails. The text does not justify on screen, so you must make a printout to find the problem spots.

When you make changes to the text, it is often necessary to perform a word-wrap to reshuffle the screen and make the lines the correct length. This is also necessary before you attempt proportional print. Wordwrap is available from the menu and works on a paragraph or a page, but The Wordprocessor has no option to wrap the entire document. When I attempted justification, the program doubled letters instead of adding spaces, a highly undesirable solution. However, since the program does not show justification on screen, this could have been a problem between the printer driver and my printer.

The program beeps to signal errors but does not explain what has gone wrong. This beeping occurs frequently for no obvious cause. Simple commands like pressing the delete key suddenly fail to work (for some reason, it is impossible to delete the first character of any line—a considerable nuisance).

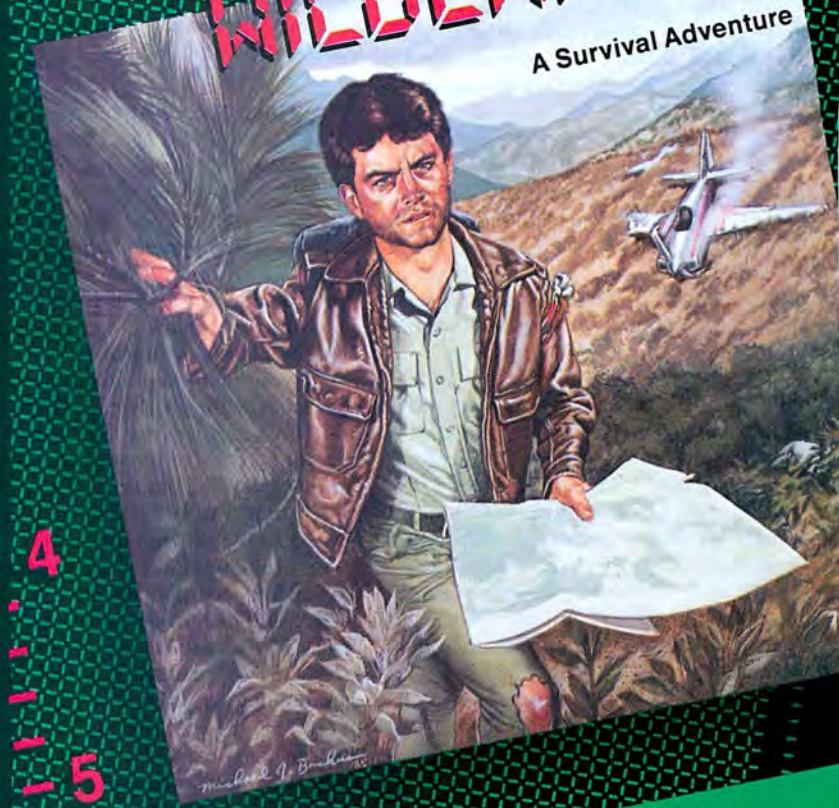
The automatic indent also behaves inconsistently, refusing to accept indent settings on some occasions but not on others. At the phrase "Print menu," the program locks up if a printer is not installed, even though the screen shows the option to use escape to return to the document. The program gets a low bug rating because of these and other difficulties.

When you delete text with the delete key, the program doesn't move text up to fill in the spaces until you go to the menu and command it to do a word-wrap. However, if you use control-Y to

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make the deletion, the text moves up.

It is not possible to save your document from time to time and continue working. Saving the document takes you to the menu, from which it is impossible to get back without reloading your document from disk. When typing file names, you cannot make any errors because the program permits no editing of the file name, not even with the backspace key. A disk directory is available from the program.

The Wordprocessor has a system for saving phrases to be reused. These phrases can be a maximum of 20 lines long, and you can save each one to disk with a one-letter name label. There is no phrase directory, but you can obtain a printout of saved phrases. If you reuse a label, the new phrase overwrites the old.

Printing Documents

The printing options are in a separate menu available from within the document. The program supports a one-line header or footer, and you can specify the starting page number, number of copies to print, where to start printing (from the cursor position in the document if desired), and optional pause between pages. It is possible to specify precisely how many characters per inch and lines per inch, as well.

Since my printer is capable of proportional print, I tried switching to that mode and then used the standard driver to produce a report. Although the document did print in proportional mode, my tab settings were ruined, text did not justify, and so on. Obviously, the standard driver cannot handle proportional print. With this or any other word processor, you must have a driver that matches your printer to take advantage of any special print functions. Even with my printer back in normal mode, I could not get a report that had correct right-justified print, and the page numbers printed strangely as double digits. I was also unable to vary the character-per-inch and line-per-inch settings on the printout.

The only advantage to this program seems to be its ability to produce proportional print and precisely control line and character spacing according to your specifications. If you have one of the supported printers and are willing to put up with the editing headaches to obtain these features, the program might be worth investigating.

Indian Ridge has modeled the program after the archaic approach of WordStar. You could argue that the makers of WordStar wanted a word processor that could work on any MS-DOS machine. However, Indian Ridge limits its software to IBM compatibles, so the approach is difficult to justify. ■

Basically Fast by Bruce Tonkin

★ ★ ★ ★

QuickBasic 2.0 runs on the Tandy 1000/1200/3000 (256K) and requires one disk drive. Microsoft Inc., 10700 Northup Way, Box 97200, Bellevue, WA 98009, 206-882-8080. \$99.

When Microsoft released QuickBasic a year ago, I thought it was a versatile and easy-to-learn programming language. Now version 2.0 is out and Microsoft has added features that make it a finer upgrade than I might have hoped. Even my 12-year-old daughter can run QuickBasic, and I can't think of a better way to teach programming or a more painless way to learn.

The new manual is a comprehensive 600 pages, with plenty of examples and descriptions of every command and statement, not just those peculiar to this compiler. It's far better and more complete than Tandy's Basic manual or those sold by IBM and Compaq.

Microsoft has added a library manager that makes modular development much easier and encourages separate compilation of often-used modules. You no longer need "include" files or long link commands. The only nit to pick with the library manager is that its files are not compatible with library managers for other Microsoft languages. The compiler also supports data space in excess of 64K for numeric arrays. Data space can expand to fill all of memory, although string data is still limited to 64K.

Another addition is the block If...Then...Else. You can now write "if a > b then" followed by line after line of statements (possibly including other blocks beginning with Else...If, and terminating each of them with a simple End...If). With one swoop, many of the reasons for GOTOs disappear, and code modularity and readability are enhanced. As nice as all this is, it pales in comparison with the biggest advance: Basic compilers have become easier to use than interpreters.

Speed Edit

QuickBasic now comes with an integral full-screen editor. It's not a word processor, but it's fast at editing program text. You can load and save, search and replace, cut and paste, and delete or undo. The time to load a 40K text file from a RAM disk is so fast I couldn't measure it; save times were equally speedy.

You can compile programs in memory and run them with a single keystroke. If there are any errors, the cursor jumps right to them when compilation is done. You can correct one and press a function

key to go to the next. When the program compiles correctly, you can run it while still in QuickBasic. If it doesn't run properly, you use the editor to make changes and recompile. Compilation goes at about 500 to 1,500 lines per minute on a standard IBM PC or compatible, so you won't have long to wait. When everything is working to your satisfaction, save the program to disk as either a text file, a file linked with the stand-alone library, or an EXE file ready to run with the run-time library.

If you like to edit with a mouse, the editor supports one. If you don't, the commands are laid out logically and are easy to remember. Most commands are a single keystroke. If you can't remember a command, pull-down menus and a help screen are at your disposal.

If you've made any changes in your program, QuickBasic warns you if you try to load another program or quit. It's next to impossible to accidentally destroy your program. You don't have to pay royalties on programs compiled with QuickBasic, even for ones using the run-time package. Tests comparing this upgraded version to the older QuickBasic showed minor speed increases of up to 5 percent. These increases were more noticeable for programs compiled to use the run-time package (as much as 20 percent in some cases).

Be Cautious

A word of warning: The Tandy 1000 uses part of its memory for the video display, so the requisite 256K is actually closer to 224K. Also, you might not be able to compile some programs with just 256K. I recommend at least 384K for a Tandy 1000, and I've resized my RAM disk to give me 416K just to be sure. Unfortunately, QuickBasic 2.0 pretends that the 1000's keyboard is an IBM PC keyboard, so the arrow keys won't work. Instead, the arrow keys are the 2, 4, 6, and 8 keys on the numeric keypad. Aside from this quirk (which Microsoft has documented), QuickBasic 2.0 runs on the 1000 without any problems.

I think Microsoft has created a blockbuster product, and if you bought the previous version prior to May 15, you pay only \$30 for the upgrade. Overall, I don't know of a faster way to develop and debug software or a better set of tools for the purpose. The block If...Then...Else feature and support for DOS and BIOS interrupts, combined with the user-defined library of subprograms and the library manager, make sophisticated programming easier than ever before. QuickBasic is quick, doesn't need line numbers, supports numerous sophisticated features, and is good for writing modular software. ■

Continued on p. 122

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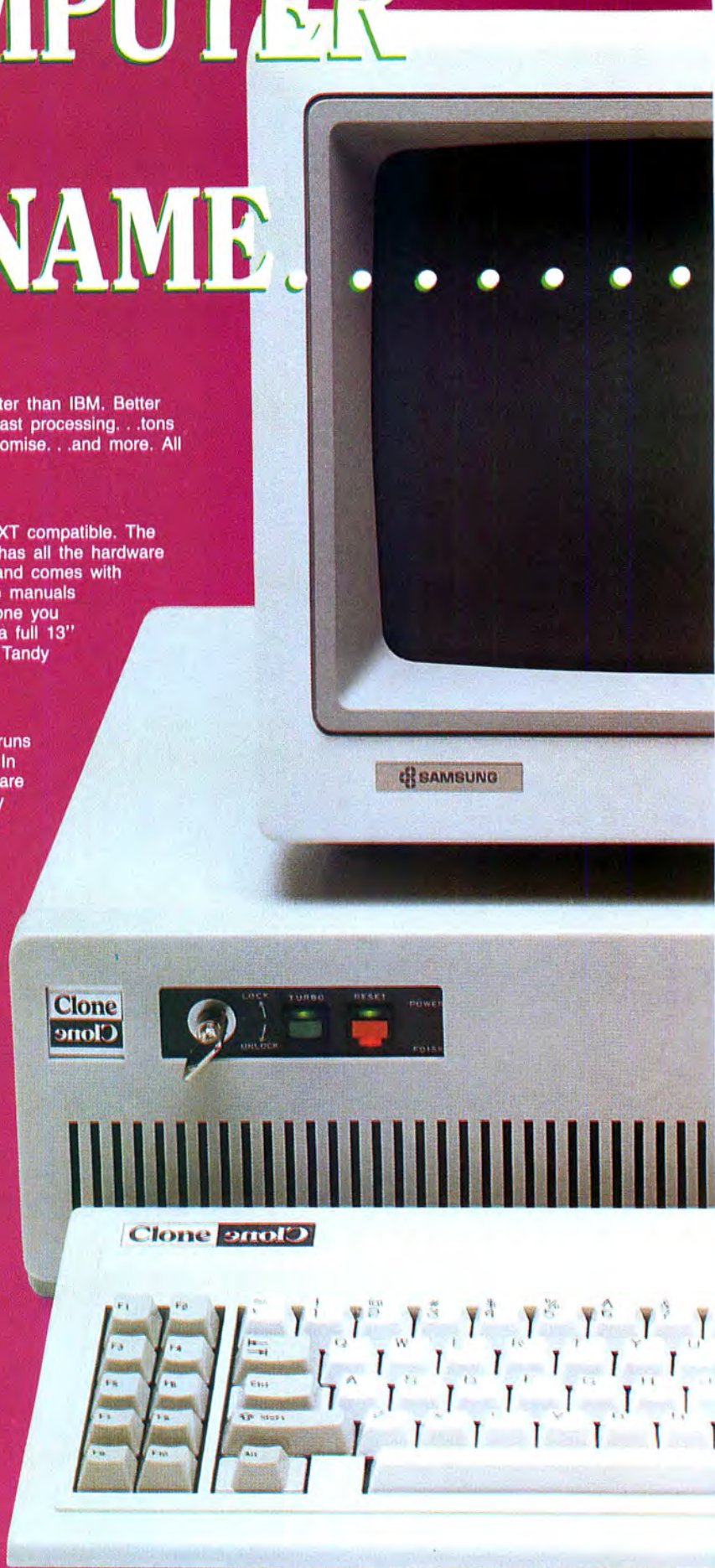
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PC-DeskMates, a powerful multi-function memory resident utility, is included so you can start using the Clone when you receive it. You get an alarm, clock, calculator, calendar, notepad, phone dialer, typewriter, and access to DOS level commands. The Clone also comes with Qmodem, the famous modem program which enables you to access the world of telecommunications. PC-Write, probably the best shareware word processor available, is also furnished. Your Clone comes ready to work for you.

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IBM Standard Bus:	YES	YES	NO	YES
Operating System:	MS-DOS 3.2	EXTRA	MS-DOS 2.11 (3.2)	MS-DOS 3.1
Disk BASIC:	YES	IN ROM	YES	YES
MS-DOS and BASIC Ref. manuals:	YES	EXTRA	EXTRA	YES
Standard System RAM:	640K	256K	256K (384K)	512K
Cost to Expand RAM:	-0-	\$\$	\$259 (\$129)	\$
Keyboard:	'AT' STYLE	STD	NON-STD	STD
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Video Outputs:	BW/NTSC/RGB	EXTRA	NTSC, RGB	B/W, RGB
Disk Drive Capacity:	1-360K	1-360K	1-360K (2-360K)	2-360K
Max Number of Internal Drives:	4	4	1 (2)	2
Internal Expansion Slots:	8	5	1 (5)	4
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8087 Math Co-Processor Option:	YES	YES	NO (YES)	YES
Sturdy Steel Case:	YES	YES	PLASTIC	PLASTIC
Standard Parallel Ports:	1	0	1	1
Standard Joystick and Light Pen Ports:	YES	NO	J (J/LP)	NO
Standard Serial Ports:	2 (1 Optional)	0	0	1
Warranty	1 YEAR	90 DAYS	90 DAYS	15 MONTHS
Clock/Calendar	YES	NO	NO	YES
Cost Ready-to-Run	\$699	\$3,063	\$1,398 + (\$1,683 +)	\$1,295
8MHz Option	\$799			

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IBM XT cost figures*: Video Display Adapter \$250; Video Display \$275; IBM XT computer \$2,145; Additional Ports, serial port, game port, parallel port, 640K RAM \$308; DOS 3.2 and BASIC \$85; Total \$3,063. Does not include the battery back-up clock calendar. No light pen port.

Tandy 1000 cost figures*: DOS 2.11 and BASIC reference manuals \$29+; Memory Plus Expansion Board (to 384K) \$129+; 256K Additional RAM \$129+; One serial Port \$79+; Battery Back-up Clock Calendar \$99+; Composite Monochrome Monitor \$129+; Model 1000 EX Computer \$799; Model 1000 SX Computer \$1199; We were not able to equip the Tandy 1000 to directly compare with the Clone because of the 1000's inherent design limitations.

*The above prices are list prices as best we could determine. Both the IBM and Tandy are available at a discount.

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Tandy Raises The Ante



Photo 1. Tandy 1000 EX.

by Dave Rowell and Ryan Davis-Wright

After delays in getting FCC certification, Tandy's new computers are finally in the stores. Here's what you can expect to find.

These are remarkable times for Tandy. In 1984, it pulled off a mass-merchandising coup with the introduction of the Tandy 1000. The 1000 set a new price standard for MS-DOS computers and reinstated Tandy among the ranks of leading micro manufacturers. Now Fort Worth is seeking to reinforce its position with the three new MS-DOS computers shown in Photos 1-3 above: the 1000 EX, the 1000 SX, and the 3000 HL (see Table 1).

In August, we took our first look at the machines. Since the FCC did not certify them until the second week of September (delaying their arrival in Radio Shack stores until the third week), we were unable to test the computers in our Peterborough, NH, office in time to make this issue. Instead, we traveled to Fort Worth, where Tandy allowed us a sneak preview. What follows is not a review, but rather a description of what we saw and learned about the newest additions to Tandy's line.

Market Mystique

Though the Tandy 1000 was a landmark machine, its deficiencies were leg-

end. It had only three slots, one of which had to be used for memory and direct-memory access (DMA). You couldn't install an alternate video adapter. It lacked an 8087 socket (though one was added on the 1000A). And it had a host of hardware bugs. Though software compatible with the IBM PC, the 1000 was clearly hardware incompatible.

Tandy originally designed the 1000 to compete against the IBM PCjr, and much about its hardware design—from its internal video, to its lack of a DMA chip, to the setup of its hardware interrupts—mimics that machine. (That explains why the 1000 was hardware incompatible with the PC—so was the PCjr.) By the time the 1000 appeared on the scene, the PCjr was a dead issue. Consequently, people compared the 1000 with the IBM PC and were quick to take note of its design deficiencies. Tandy, to its credit, quickly set about fixing the incompatibilities. The result is that Tandy's new computers are more within the mainstream of PC compatibility.

Like any decent car manufacturer, Tandy now offers a variety of models in the same line. The company discovered it's easier to sell a machine that fits a particular need than it is to invent one to meet all needs. Rather than promote the EX and SX as "everything" machines (as it did with the 1000), Tandy has split the potential market in two: home and education users

on one side; small-business and sophisticated home users on the other.

Market reaction to the 1000 formed the basis of this two-tier strategy, according to Ed Juge, Tandy's director of marketing. Customers were of two minds about the 1000: Half wanted more expansion slots and PC compatibility, while the other half thought the machine too complicated and wanted something simpler. The EX and SX are designed to satisfy these groups of users.

The 1000 EX: Back to School

Though Tandy has aimed the low-priced 1000 EX (\$799) at both the education and home markets, the machine includes many features designed to specifically woo schools: small-footprint, built-in keyboard; headphone jack; and a chrome-plated hasp that slides out for secure lock down. Tandy expects huge sales of the EX and predicts it will be the hottest PC in America.

Is the EX a PC? Though it runs MS-DOS software, the EX is a strange beast. It lacks almost everything associated with a PC, such as slots and expandability. (Instead of boards, it uses modules to expand memory and capability.) Though it's really a scaled-down 1000 SX and can run 50-percent faster than a PC, it looks more like a home computer than a PC.

Inside the EX's slim white case, you'll find the standard 1000 keyboard, a 360K 5¼-inch floppy drive, and 256K of RAM. It comes with MS-DOS, Basic, and Personal DeskMate, a Windows-like version of DeskMate. You'll also find ports for two joysticks, a parallel printer (edge connector), and both



Photo 2. Tandy 1000 SX.



Photo 3. Tandy 3000 HL.

RGBI and composite monitors. Gone are the 1000's little-used light-pen port and the handy orange reset button.

Although the keyboard is inside the EX case, it looks and feels the same as the old 1000's—12 function keys across the top, a separate arrow-key cluster, and more-than-adequate typing action. The minor keyboard incompatibilities that 1000 owners have learned to overcome are also there. Only the indicator lights for the number-lock and capital keys are changed: They're now above the numeric keypad, next to the power light.

Like the original 1000, the EX is software compatible with the PC and provides audiovisual features of the PCjr—three-voice sound and special graphics modes that make colorful programs like King's Quest possible. The headphone jack is new. Plugging in a pair of headphones disables the internal speaker, and a dial controls the loudness of both sound sources. Like the 1000 SX, the EX runs its 8088-2 microprocessor at 7.16 megahertz (MHz)—a 50-percent faster clock speed than the original 1000's. With the DOS Mode command, you can switch the EX to the industry standard 4.77MHz for any speed-related compatibility problems.

A loss of expandability stems from the EX's compact size: It can't handle standard PC cards of any size. You're limited to Tandy (and third-party) Plus expansion cards. You can add no more than two, along with a special board for adding memory (to 640K) and DMA. The lack of DMA on the base model reduces PC-software compatibility with some copy-protected programs, many of which are

games aimed at the home market.

A panel on the left top slides back to reveal space for the three Plus boards (with slots out the back), but only one pronged connector to the system bus. To add more than one expansion card, you must first install the special EX memory-expansion card. It provides another 128K (total 384K), a DMA chip, eight sockets for another 256K, and two more Plus expansion plugs. A fully configured EX can have 640K, two floppy drives (one internal and one external), a battery-powered clock, and an RS-232 or an internal 1,200-baud modem. The EX has a 48-watt(W) power-supply capacity (compared to 54W on the original 1000) to match expected load.

Tandy offers both 360K 5¼-inch and 720K 3½-inch external floppy drives that cable into the back of the EX. A stylish stand (\$30) holds both a monitor and external floppy drive neatly above the EX. The MS-DOS 2.11.24 that comes with the EX supports 3½-inch drives and provides DOS 3.x extras such as Vdisk (a RAM-disk driver) and Xcopy (a utility that copies a whole directory to a new directory). For \$30, you can upgrade to MS-DOS 3.2, which provides network support.

The 1000 SX: A New League

The 1000 SX is every 1000 user's dream machine. It looks the same as the 1000A, except for the disk-drive panels, which are white instead of black. All features of the 1000A remain, but the SX gives you plenty of new power for only a modest price increase. Its \$1,199 price tag includes 384K (with DMA), two 360K floppy drives, and an 8088-2 microproces-

sor that runs 50-percent faster than its predecessor. The SX also has two more expansion slots (five total), and Tandy has increased its power-supply rating—67W compared to 54W on the 1000A.

Tandy supplies MS-DOS 3.2, GW-Basic, and the new DeskMate II with the SX. The DOS and Basic manuals cost extra. DeskMate, Tandy's integrated package for neophytes, can be memory resident. Both the operating system and DeskMate II support networking. Compared to MS-DOS 2.1, 3.2 provides improved subdirectory and drive support (including 720K 3½-inch floppy drives), plus more utilities. However, it does take up more (11.6K) RAM.

The hardware for a parallel printer, floppy-drive controller, and video is built into the main circuit board, as it is on the 1000A. The DMA chip and all RAM up to 640K also socket onto the motherboard. A 640K 1000 SX with monitor and printer has all five slots open. (However, you're still limited to 10-inch, or shorter, expansion cards.) Two joysticks, light-pen ports, and a speaker jack are also built in.

The SX comes with two TEAC 55B 360K 5¼-inch floppy drives—one more than comes with the 1000A—but having two limits your hard-drive options somewhat. Unless you remove a floppy, you'll need Tandy's new 20-megabyte (MB) hard-disk card (more on this later).

Tandy made the SX more hardware compatible than the 1000A. Not only does the SX support RGBI color- and composite-video monitors with its built-in circuitry, it can use half-size external video boards like Hercules' and EGA-type boards. An internal DIP (dual in-line pack-

Tandy 1000 EX; \$799

- Intel 8088-2 microprocessor, speed-switchable between 4.77 and 7.17MHz
- 256K RAM
- One 360K 5¼-inch disk drive
- MS-DOS 2.11, Basic, Personal DeskMate

Options

- MS-DOS 3.2 upgrade
- 720K 3½-inch external disk drive
- 360K 5¼-inch external disk drive
- Monitor platform
- Memory Plus Expansion Adapter (128K with DMA, can add another 256K)
- Plus RS-232C Option Card
- Plus Digi-Mouse Controller/Calendar Board
- Plus 300-Baud PC Modem
- Plus 1,200-Baud PC Modem
- Plus Network 4 Interface

Tandy 1000 SX; \$1,199

- Intel 8088-2 microprocessor, speed-switchable between 4.77 and 7.16MHz
- 384K RAM (upgrade to 640K on motherboard)
- Two 360K 5¼-inch disk drives
- MS-DOS 3.2, Basic, DeskMate II
- Five 8-bit expansion slots (10-inch)

Options

- 20MB hard-disk card
- Dual Display Graphics Adapter
- Deluxe Text Display Adapter
- 8087 math coprocessor
- Internal 1,200-Baud PC Modem
- Plus Upgrade Adapter Board (to use Plus modules)

- Digi-Mouse Controller/Calendar Board
- 20 + 20-Megabyte Disk Cartridge System (Interface Kit required)

Tandy 3000 HL; \$1,699

- Intel 80286 microprocessor, speed-switchable between 4 and 8MHz
- 512K RAM (upgrade to 640K on motherboard)
- One 360K 5¼-inch disk drive
- Two additional front drive slots
- Seven expansion slots (four 8-bit, three 16-bit)
- Built-in parallel adapter
- Real-time clock with CMOS battery backup
- 84-key AT-style keyboard
- 80287 math-coprocessor socket

Options

- MS-DOS 3.2, Basic, DeskMate II
- 1.2MB 5¼-inch disk drive
- Hard-drive controller
- 20MB hard disk
- 40MB hard disk
- 20MB hard-disk card
- 1MB memory-expansion board (2MB filled)
- 80287 math coprocessor
- 20 + 20-Megabyte Disk Cartridge System (Interface Kit required)
- 20-Megabyte Internal Disk Cartridge System
- Deluxe Graphics Display Adapter
- Dual Display Graphics Adapter
- Deluxe Text Display Adapter
- Enhanced keyboard
- 4-User Board

age) switch disables the internal video circuitry. The same DIP switch also has settings to free some hardware interrupts for use by expansion boards. One good result is that the SX, unlike the 1000A, can use unmodified PC hard-drive controller boards. Support for an optional 8087 math coprocessor is also improved. The SX BIOS (basic input/output system) also checks for the presence of an 8087 when you boot and sets the proper bit in low memory if you've installed one.

The SX operates in its faster mode (7.16MHz) by default. If you should run into speed-related problems with a program, you can slow the SX down to 4.77MHz with the Mode command. You can toggle clock speed from within machine-language programs also, but not from within Basic. We ran several benchmarks with the SX running in fast mode. The Norton Utilities' Sysinfo program gave a reading of 1.4 (40-percent faster), and two interpreted GW-Basic programs—a For. . .Next loop and a graphics program—both ran 26-percent faster than in slow mode.

The 3000 HL: The HD's Little Brother

The new 3000 HL (not to be confused with the 3000) fills in Tandy's line nicely. Fort Worth needed a mid-range computer to replace the soon-to-be dead 1200, which was always seen as a fill-in. (At the July press conference, a Tandy spokesman referred to the 1200 as "merely a clone.") It is explicitly PC compatible, attractively priced (\$1,699), and has a wide range of expansion options.

The 3000 HL comes with 512K of RAM (expandable to 640K on the main board for \$99.95) and one 360K 5¼-inch floppy drive (no hard drive). It's smaller than its big brother, the 3000 HD, by two inches in both width and depth. Compactness, however, comes with a loss in expansion slots—it has four 8-bit slots and only three 16-bit slots. Although the HL's 80286 CPU can address up to 16MB of RAM, you can fit in only two Tandy 2MB expansion boards (4MB total) if you use the third 16-bit slot for an added hard drive.

Because it cut so many AT features from this 8MHz (fast) 80286 machine, Tandy feels compelled to bill it as a high-powered XT clone. (See Table 2 for a price comparison of the 3000 HL and IBM's new PC/XT 286.) But in addition to the 80286 CPU and a 16-bit data bus, the HL retains many AT features: an AT-style keyboard, battery-powered storage of clock and configuration information, and a socket for an 80287 math coprocessor. Like the 3000 HD and the IBM PC/AT, you must buy and install a video board and monitor. It doesn't have a key and lock like the AT, however.

What makes the 3000 HL an XT compatible? It's mainly the switchable clock

Table 1. Vital statistics of the Tandy 1000 EX, the 1000 SX, and the 3000 HL.

3000 HL (including 20MB drive); \$1,699

- 4/8MHz 80286 (one wait state)*
- 20MB drive (\$799)
- Hard-drive controller, uses one 16-bit slot (\$399.95)
- 360K disk drive*
- 128K upgrade to 640K (\$99.95)
- MS-DOS, Basic, DeskMate II (\$99.95)
- Video adapter (\$249.95)
- Parallel-printer port
- Three open 8-bit slots
- Two open 16-bit slots

Cost of a fully configured HL: \$3,807.75 (\$4,807.75 with the 40MB hard drive).

IBM PC/XT; \$3,995

- 6MHz 80286 (no wait states)*
- 20MB disk drive*
- Hard-drive controller (no slot used)*
- 1.2MB disk drive*
- 640K RAM*
- MS-DOS, Basic (\$95)
- IBM video adapter (\$244)
- IBM color monitor (\$680)
- Serial/parallel card*
- One open 8-bit slot
- Five open 16-bit slots

Cost of a fully configured IBM PC/XT 286: \$5, 014. (Discounts might range up to 15 percent.)

*standard equipment

Table 2. A Tandy 3000 HL and IBM PC/XT 286 price comparison.

speed. Running at 8MHz, the HL produces a rating of 7.7 on the Norton scale (7.7 times as fast as a standard IBM PC). Not all software and hardware that run on an XT can handle such speed, however, so the HL can be slowed to half speed (4MHz) through software. Like the PC/XT, the HL also comes with a 360K floppy drive. The Tandy 3000 and the IBM PC/AT provide a 1.2MB floppy drive.

The 3000 HL's metal case (with plastic front) measures 6 $\frac{1}{8}$ by 17 by 15 $\frac{1}{2}$ inches; it provides room for three half-height drives, or one half-height and one full-height unit. You can add another 360K floppy drive, a 1.2MB high-density floppy drive, or a couple of internal hard drives. The HL can also handle Tandy's new internal, 5 $\frac{1}{4}$ -inch, 20MB cartridge unit. Unlike the 3000 HD, all HL drive spaces open to the front.

The floppy-drive controller and printer port (DB-25) are built into the main circuit board—essentially providing you with a free expansion slot. The controller supports only 360K drives, however, so adding a 1.2MB drive means using a precious 16-bit expansion. You might as well just put in a hard-drive controller (\$400 from Tandy) that also supports two floppy drives of any type. (A jumper then disables the on-board floppy controller.) Tandy offers a 20MB internal hard drive (\$800) with an average access time of 65 milliseconds (ms) and a very fast (21 ms) internal 40MB hard drive (\$1,800).

You must purchase the HL operating system software as an extra. MS-DOS 3.2, GW-Basic, and DeskMate II, plus manuals, will run you \$99.95. Although the HL is a 16-bit 80286 computer, Tandy doesn't recommend running Xenix on it for several reasons. To make a usable Xenix system, you must add a 1.2MB floppy drive (to read the Xenix program disks), a high-performance hard drive, and several MB of RAM. You will have created a crippled 3000 HD (no more expansion slots) with no cost savings.

From a hardware point of view, the 3000 HL's DMA can address only 1MB of RAM. Xenix uses DMA to address all RAM. A hobbyist interested in Unix might find this acceptable, but 1MB isn't enough for a serious Xenix system. The MS-DOS expanded-memory system doesn't use DMA to address memory above 1MB, so you can use whatever memory you can fit into the HL's limited 16-bit slots (6.6MB with the RAM currently offered).

Is the 3000 HL a super-XT or a mini-AT? The answer depends on what you need from a computer. If you're going to run MS-DOS 3.2 with expanded memory up to 4MB, the HL is as good as an AT. If you want to run Xenix with more than 1MB of RAM, you'll need a Tandy 3000 HD or an AT.

A More Powerful HD

Tandy has also introduced a higher-per-

formance, 640K, 40MB 3000 HD. It's the same fast-running AT clone as the old HD, but the new half-height 40MB drive zips, producing readings of 4.5 milliseconds (ms) for track-to-track access time and 21 ms for average random-access time. MS-DOS 3.x can't accommodate hard drives larger than 32MB, so Tandy provides utilities that let you put two smaller logical drives on the physical drive.

Other small changes are the slight upgrade to MS-DOS 3.2 (from 3.1) and a modified cooling system. Instead of one large, front-mounted fan, the new 3000 HD has two smaller ones that exhaust through the enclosed power supply in the right rear. There is no air filter, but you can order one (they're in stock). The new 3000 HD has a new BIOS version (1.01.00).

Desk Set

Tandy has never been known for its software development, but if the new DeskMates are any indication, Fort Worth is getting better at it. The original DeskMate was a serviceable integrated product that provided new users with an introduction to simple programs. Now DeskMate is available in two versions: DeskMate II (for the Tandy 1000 SX and the 3000s) and Personal DeskMate (for the 1000 EX).

DeskMate II isn't much different from the original. The biggest change is that it lets you drop out of DeskMate, run another program, and then pick up in DeskMate where you left off. Tandy also made the software more network compatible. Nagging problems in the original DeskMate, such as its inability to generate ASCII text, have been fixed.

The real surprise is Personal DeskMate, a graphics-oriented desktop application that resembles Microsoft Windows. Like DeskMate II, Personal DeskMate serves as an introduction to computer programs, but in some ways it is a better product. In addition to the usual Text, Filer, Worksheet, and Telecom applications, it also has a calendar, notepad, and paint program—all available from a central desktop.

Personal DeskMate follows Windows' conventions for integrating functions, and it allows you to maneuver around the programs easily using the keyboard instead of a mouse. You also can use the Color Computer mouse plugged into one of the joystick ports, instead of the clock/mouse Plus board. With the keyboard, you move around the desktop by pressing the tab key. To select a program, you press the enter key. Once in a program, you can page through the functions using an alternate-function-key combination. To execute a function, you press enter or the spacebar.

The only problem with Personal DeskMate is its modular design. Each function is a separate module and must be loaded from disk. The program operates

from a central core, which then calls each module and loads it into memory. Though this involves frequent disk access, Tandy said it was the only way to fit the program into the standard 256K memory on the 1000 EX.

One way of circumventing the problem is to transfer selected modules onto a RAM disk (which is why the system utility Vdisk is on the EX's DOS). Of course, you need sufficient memory and must know how to use a RAM disk. An easier solution would have been for Tandy to include some batch files that transfer the modules automatically.

New Peripherals

Tandy has come up with some real turkeys in previous attempts to give MS-DOS users the products they need. The external 10MB hard-disk drive was one, as was the truly forgettable 256K memory-expansion board. Tandy's new products, however, compensate for past mistakes (see Table 3).

Now that the 1000 SX has alternate-video capability, Tandy is offering two video boards, which you can also use with the 3000s. The Dual Display Graphics Adapter works with either the color CM-10 (the CM-2's successor) or the monochrome VM-3 monitor. With the CM-10, you can display up to 16 colors (with special software) with 640- by 200-pixel resolution. The VM-3 has a razor-sharp display (720- by 348-pixel resolution) in a Hercules-compatible mode. The Deluxe Text Display Adapter lets you use Tandy's VM-1 monochrome monitor or the top-of-the-line CM-1 color monitor. Previously, you could use these monitors only on the 2000 or 3000. Both give you 640- by 400-pixel resolution.

Further rounding out the options for the EX are a 3 $\frac{1}{2}$ -inch 720K disk drive and the standard 5 $\frac{1}{4}$ -inch 360K drive. While IBM offers its 3 $\frac{1}{2}$ -inch disk drive as an internal option for all computers, Tandy is waiting to see how the market develops before offering it for its other machines.

IBM offers its enhanced keyboard as standard equipment with the AT. Tandy has unveiled an enhanced keyboard for its 3000 models and is offering it as an option. The company is working on an interface box that will let 1000 owners use either the 3000's AT-style keyboard or the enhanced keyboard.

Instead of offering a hard-disk version of the 1000 SX, Tandy is offering a 20MB hard-disk card, which drops into the computer's rightmost slot. This has some benefits. If you have problems with the card, you can take it out and continue to use your computer while the hard drive is at the shop.

After distributing Iomega Corp.'s 10MB Disk Cartridge System for the past couple of years, Tandy has upgraded to the high-

CM-10 Color Monitor (640- by 200-pixel resolution)	25-1022	\$459.95
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DWP 520 printer	26-2800	\$995
DWP 230 printer	26-2812	\$399.95

- * Tandy 3000 only.
+ Tandy 1000 EX only or can be used with the Memory Plus Expansion Board.

Table 3. Some new products in the 1987 catalog.

performance 20 + 20 system, which features dual 20MB cartridges. Tandy also offers Iomega's bootable 20MB Internal Disk Cartridge System, which fits into one of the half-height front drive slots on the 3000. Since you can change cartridges at will, both systems give you unlimited storage.

Tandy has moved forward with its Express Order Hardware program and is now offering over 60 products. The 1987 *Tandy Computer Catalog* has a four-page Express Order Hardware section featuring modems, speed-up boards, video adapters, keyboards, hard-disk cards, memory enhancers, and multifunction boards. The offerings are still limited, but they represent a good start.

Two years ago, few people believed Tandy could make the transition from TRSDOS to MS-DOS. The company silenced the skeptics by learning to play the MS-DOS market and by pricing its products aggressively. The computer industry moves at a fast pace, however, and Tandy will have to run fast just to maintain position. For the time being, at least, it is ahead of the pack. ■

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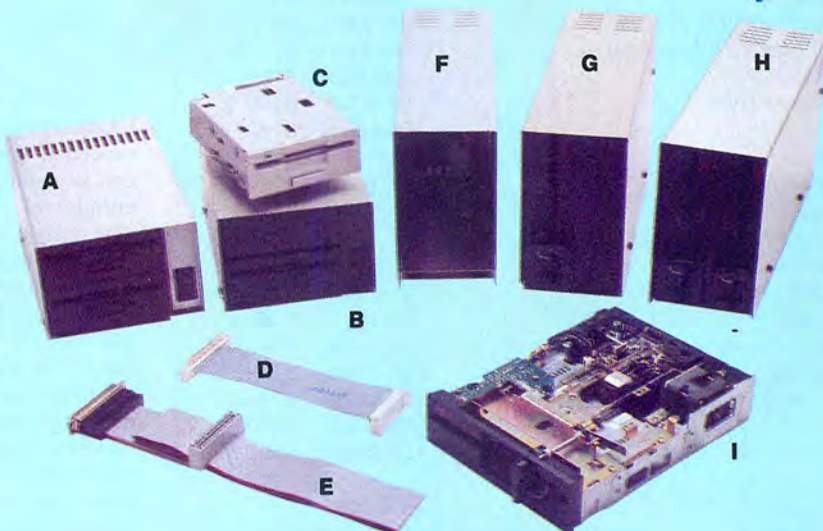
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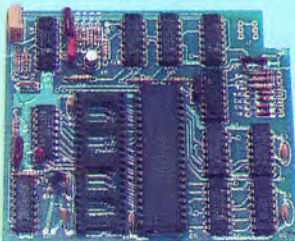
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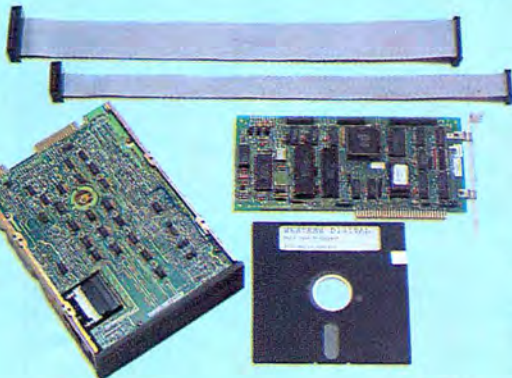
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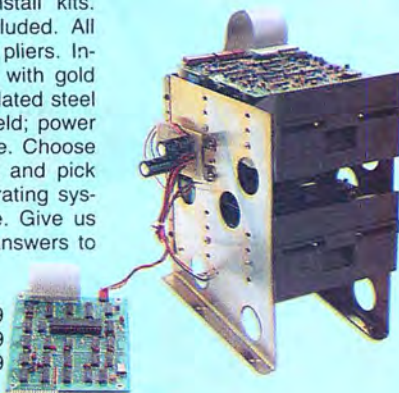


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THE MEAN SCREEN EDITING MACHINE

Free yourself from the Model 4's limited editing abilities.

Most popular microcomputers allow full-screen editing. IBM PCs and Commodore 64s, for example, let you change program lines anywhere on the current screen. TRS-80 machines, on the other hand, have line-oriented editing only in Basic and little editing capability in DOS.

Once you are used to full-screen editing, the line-oriented variety (or no editing at all) seems primitive by comparison. I've written a program that allows full-screen editing on Model 4 TRSDOS 6.2 from both DOS level and Basic (a DOSPLUS IV version is available from Load 80). You need no longer feel confined the next time you want to go back and edit a DOS command or program line.

Walking the Line

To use Basic's line editor, you have to specify which line will be edited (as in EDIT 20, for example) and issue cryptic commands to make the changes. It is not a what-you-see-is-what-you-get situation, and it is certainly not intuitive. You can easily become confused about the current state of the line, and you might need to practice the whole procedure beforehand.

Screen-oriented editing is easy and intuitive. You can make changes anywhere on the screen by moving the cursor to the appropriate place and overtyping, inserting, or deleting. What you see is what you get—as long as you press enter or return after making the changes.

Screen Editor (see the Program Listing)

by John Ratzlaff

is modeled after the IBM Basic editor, but goes beyond it by providing full-screen DOS editing. Its one restriction is that it can operate on only one screen line at a time. Longer Basic lines will be cut off.

To try Screen Editor, type the Listing into your editor/assembler and assemble it to disk as SCREDIT/FLT. Install it with the following commands:

```
SET *SE SCREDIT  
FILTER *KI *SE
```

(You can use a specification for any nonexistent device in place of the *SE.) A message indicates where the filter was installed in high memory.

Once Screen Editor is installed and working, you can save it in a configuration file so it is automatically there next time you boot the computer. Use the TRSDOS SYSGEN command.

You can now use the F2 function key to go right into the overtyping edit mode from



System Requirements

Model 4
TRSDOS 6.2
Assembly language
Editor/assembler

either DOS or Basic. The cursor changes into a large block. When you press F2 again, you're in the insert mode, and a cursor appears as a two-part block (F2 continues to serve as a toggle between the two editing modes). F3 is the delete key.

There are two ways to exit the edit mode: Press the break key to cancel all your changes, or press enter to save the line under the cursor. The old cursor returns in either case. (You don't have to move the cursor past a character for the character to be sent, as you do with the Apple editor.)

Final Edit

If you're using the TRSDOS Click filter, you must install it before Screen Editor to avoid getting an annoying series of clicks when the program sends long lines to the command processor.

Another conflict can arise if F2 and F3 have already been programmed to activate a different function. If you want to retain the old function, modify Screen Editor's source code to reprogram a different set of keys as function keys.

A final note: Screen Editor might not work in future TRSDOS versions because I used an undocumented memory location in the video-driver module to store the character under the blinking cursor. ■

You may reach John Ratzlaff at 75 Academy Drive, Candler, NC 28715, or through CompuServe's TRS80PRO SIG.

Back Issues

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Program Listing. Screen Editor.

```

00100 ;SCREDT full-screen editor for Mod 4
00110 ;by JMR 5-25-86
00120 ;
00130 ;Keys used:
00140 ;in normal mode, <F2> enters Edit mode (indicated by large block cursor)
00150 ;in Edit mode, <Enter> sends the entire line that the cursor is on
00160 ;<Break> aborts Edit mode
00170 ;<F2> toggles Insert mode (indicated by a different cursor)
00180 ;<F3> deletes character under the cursor
00190 ;arrows move cursor around screen
00200 ;
00210 ;works in DOS and BASIC under TRSDOS 06.02
00220 ;
00230 SVC      MACRO  #NUM
00240 LD        A,#NUM
00250 RST      28H
00260 ENDM
00270 ;
00280 VDCtrl  MACRO  #NUM
00290 LD        B,#NUM
00300 SVC      @VDCtrl
00310 ENDM
00320 ;
00330 @DSP   EQU     2
00340 @EXIT EQU    16H
00350 @GTDCB EQU    52H
00360 @VDCtrl EQU   0FH
00370 @FLAGS EQU   65H
00380 @ERROR EQU   1AH
00390 @HIGH$ EQU   64H
00400 @GTMOD EQU    53H
00410 @DSPLY EQU   0AH
00420 @HEX16 EQU   63H
00430 @CHNIO EQU   14H
00440 ;
00450 ;----- Install filter -----
00460 ;
00470 ORG      3000H
00480 START  PUSH  DE ;save DCB pointer
00490 LD      (MODDCB),DE ;put in filter
00500 SVC      @FLAGS
00510 BIT      3,(IX+2) ;is SET being used?
00520 JR      NZ,SKIP0
00530 LD      HL,MSG1 ;'Must use SET' etc
00540 ABORT  SVC      @DSPLY
00550 LD      HL,-1
00560 SVC      @EXIT ;abort to DOS
00570 SKIP0  LD      DE,'OD' ;*DO device
00580 SVC      @GTDCB ;gets addr in HL
00590 LD      (DODCB1+2),HL ;store *DO DCB addr
00600 LD      (DODCB2+2),HL
00610 LD      DE,MODNAM1
00620 SVC      @GTMOD ;find $DO module
00630 JR      Z,SKIP1
00640 LD      HL,MSG2 ;couldn't find it
00650 ABORT
00660 SKIP1  LD      HL,0007 ;DE now points to current $DO module
00670 ADD     HL,DE ;calculate position of byte under cursor
00680 LD      (U1+1),HL ; in $DO driver
00690 LD      (U2+1),HL
00700 LD      (U3+1),HL
00710 LD      (U4+1),HL
00720 LD      (U5+1),HL
00730 LD      B,0
00740 LD      HL,0
00750 SVC      @HIGH$ ;get HIGH$ in HL
00760 LD      (OLDHI),HL ;save in header
00770 LD      BC,FINAL-SCREDT ;length of routine to move
00780 PUSH   BC
00790 XOR     A ;clear C flag
00800 SBC     HL,BC ;HL now contains new HIGH$
00810 LD      B,0
00820 SVC      @HIGH$ ;set HIGH$
00830 INC     HL ;new addr. for SCREDT
00840 PUSH   HL
00850 LD      BC,SCREDT ;current addr.
00860 XOR     A ;clear C flag
00870 SBC     HL,BC ;HL now contains offset to new location
00880 PUSH   HL ;transfer to BC
00890 POP    BC
00900 LD      IX,RELTBL ;point to relocation table
00910 LOOPR  LD      L,(IX) ;get addr. to be relocated
00920 LD      H,(IX+1)
00930 LD      A,H ;done yet?
00940 OR     L
00950 JR      Z,SKIPR
00960 PUSH   HL ;transfer addr. to IX
00970 POP    IX
00980 LD      L,(IX) ;get actual value to be changed
00990 LD      H,(IX+1)
01000 ADD     HL,BC ;add offset
01010 LD      (IX),L ;put new value back
01020 LD      L,(IX+1),H
01030 INC     IX
01040 INC     IX
01050 JR      LOOPR
01060 SKIPR  LD      HL,SCREDT ;source

```

Listing continued

Listing continued

```

01070      POP      DE          ;destination
01080      POP      BC          ;byte count
01090      PUSH     DE
01100      LDIR     ;move it!
01110      POP      DE          ;retrieve new start addr.
01120      POP      HL          ;retrieve DCB addr.
01130      LD       (HL),47H    ;store DCB type byte
01140      INC      HL
01150      LD       (HL),E      ;store filter addr. in DCB
01160      INC      HL
01170      LD       (HL),D
01180      LD       HL,HEXBUF   ;point to buffer for hex conversion
01190      SVC     @HEX16
01200      LD       HL,MSG3
01210      SVC     @DSPLY      ;display success message
01220      LD       HL,0        ;no error
01230      RET
01240 ;
01250 MODNAM1 DEFM  '$DO'
01260 DEFB  0DH
01270 MSG1  DEFM  'SCREDT must be installed with SET'
01280 DEFB  0DH
01290 MSG2  DEFM  '$DO module not found! SCREDT not installed!'
01300 DEFB  0DH
01310 MSG3  DEFM  'SCREDT filter installed at '
01320 HEXBUF DEFM  '----H'
01330 DEFB  0DH
01340 RELTBL DEFW  RX1
01350 DEFW  RX2
01360 DEFW  RX3
01370 DEFW  RX4
01380 DEFW  RX5
01390 DEFW  RX6
01400 DEFW  RX7
01410 DEFW  RX8
01420 DEFW  RX9
01430 DEFW  RX10
01440 DEFW  RX11
01450 DEFW  0
01460 ;
01470 ;----- TRSDOS memory header -----
01480 ;
01490 SCREDT  JR      HERE
01500 OLDHI  DEFW  0          ;previous HIGH$
01510 DEFB  MODDCB-MODNAM2   ;name length
01520 MODNAM2 DEFM  'SCREDT' ;module name
01530 MODDCB DEFW  0          ;addr of this module's DCB
01540 DEFW  0          ;reserved
01550 ;
01560 ;----- data table -----
01570 ;
01580 MODE  DEFB  0          ;bit 7=Enter mode, 6=Edit, 5=Insert
01590 CURS DEFB  0          ;cursor char
01600 ROW  DEFB  0          ;current row #
01610 COL  DEFB  0          ;current column #
01620 ;
01630 ;
01640 ;----- Filter begins here -----
01650 ;
01660 HERE   JR      C,FILTER ;go if @GET request
01670 ;
01680 CHAIN  PUSH     IX
01690 LD      IX,(MODDCB) ;get DCB pointer
01700 RX1    EQU     $-2
01710 SVC   @CHNIO ;continue with device chain,
01720 POP   IX
01730 RET
; then return to caller
01740 ;
01750 FILTER LD      HL,MODE
01760 RX2    EQU     $-2
01770 BIT   7,(HL) ;Enter mode?
01780 JR    NZ,ENTER
01790 PUSH  HL
01800 CALL CHAIN ;call current *KI driver
01810 RX3   EQU     $-2
01820 POP   HL
01830 RET   NZ ;return if error or no key hit
01840 BIT   6,(HL) ;Edit mode?
01850 JR    NZ,EDIT
01860 CP    82H ;<F2>?
01870 JR    Z,SKIP2
01880 CP    A ;return w/Z flag set (no error),
01890 RET   ;key pressed in A
01900 ;
01910 SKIP2 SET   6,(HL) ;return on Edit mode
01920 LD    C,@BPH ;new cursor
01930 VDCTL 8 ;set cursor character
01940 LD    (CURS),A ;save old cursor
01950 RX4   EQU     $-2
01960 XOR   A ;return empty
01970 RET
01980 ;
01990 ;----- process Enter mode -----
02000 ;
02010 ENTER LD    A,(COL) ;get column #
02020 RX5   EQU     $-2
02030 COLCNT CP    80 ;done yet? (column count goes here)
02040 JR    NC,DONE
02050 INC   A ;next column

```

Listing continued

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```

02060 LD (COL),A ;save for next time
02070 RX6 EQU $-2
02080 DEC A
02090 LD L,A
02100 LD A,(ROW) ;get row #
02110 RX7 EQU $-2
02120 LD H,A
02130 VDCTL 1 ;get char from video
02140 CP A
02150 RET ;return with char in A
02160 DONE RES 7,(HL) ;turn off Enter mode
02170 DODCB1 LD IY,0
02180 RES 3,(IY+0) ;turn video back on
02190 LD A,0DH ;return with a CR
02200 CP A
02210 RET
02220 ;
02230 ;----- check for keys in Edit mode -----
02240 ;
02250 EDIT CP 80H ;<Break>? Abort Edit mode
02260 JR NZ,SKIP3
02270 RES 6,(HL) ;turn off Edit mode
02280 RES 5,(HL) ;turn off Insert mode
02290 PUSH AF ;return with <Break> key
02300 RESTORE LD A,(CURS) ;get old cursor char
02310 RX8 EQU $-2
02320 LD C,A
02330 VDCTL 8 ;set cursor char
02340 POP AF
02350 CP A
02360 RET
02370 ;
02380 SKIP3 CP 0DH ;<Enter>? Go into Enter mode
02390 JR NZ,SKIP4
02400 RES 6,(HL) ;Edit mode off
02410 RES 5,(HL) ;Insert mode off
02420 SET 7,(HL) ;Enter mode on
02430 VDCTL 4 ;fetch current cursor position
02440 LD A,H
02450 LD (ROW),A ;row #
02460 RX9 EQU $-2
02470 XOR A ;start at column 0
02480 PUSH AF ;return (later) with no key
02490 LD (COL),A ;column #
02500 RX10 EQU $-2
02510 U1 LD A,(0000) ;get char. under cursor
02520 LD C,A
02530 VDCTL 2 ;display char.
02540 LD L,79 ;start at last col.
02550 LOOP VDCTL 1 ;get char.
; ; ;blank?
02560 CP ;
02570 JR NZ,FOUND ;exit at 1st non-blank
02580 DEC L ;go backward
02590 JR NZ,LOOP
02600 FOUND INC L ;store one more than last non-blank
02610 LD A,L
02620 LD (COLCNT+1),A
02630 RX11 EQU $-2
02640 DODCB2 LD IY,0
02650 SET 3,(IY+0) ;set *DO to NIL
02660 JR RESTORE ;restore old cursor
02670 ;
02680 SKIP4 CP 82H ;<F2>? Toggle Insert mode
02690 JR NZ,SKIP5
02700 LD A,(HL) ;get mode byte
02710 XOR 20H ;toggle bit 5 - Insert mode
02720 LD (HL),A ;replace it
02730 BIT 5,A
02740 LD C,0B3H ;insert mode cursor
02750 JR NZ,SKIP4A
02760 LD C,0BPH ;edit mode cursor
02770 SKIP4A VDCTL 8 ;set cursor char
02780 XOR A
02790 RET
02800 ;
02810 SKIP5 CP 83H ;<F3>? Delete
02820 JR NZ,SKIP6
02830 VDCTL 4 ;get current cursor position
02840 LD A,L
02850 CP 79 ;are we at last column?
02860 JR NZ,SKIP5A
02870 LD A,' '
02880 U2 LD (0000),A ;if so, put a space under cursor
02890 JR DONE1
02900 SKIP5A INC L ;next column
02910 VDCTL 1 ;get next char and
02920 U3 LD (0000),A ; put it under cursor
02930 LOOP2 LD A,L
02940 CP 79 ;done yet?
02950 JR NC,DONE2
02960 INC L ;next column
02970 VDCTL 1 ;get char at next position
02980 DEC L
02990 LD C,A
03000 VDCTL 2 ;put it here
03010 INC L ;next column
03020 JR LOOP2
03030 DONE2 LD C,' ' ;place a space at last col

```

Listing continued

Listing continued

```

03040          VDCTL  2
03050 DONE1   XOR    A          ;return empty
03060          RET
03070 ;
03080 SKIP6   CP      08H          ;check for arrows (08-0BH)
03090          JR      C,SKIP7
03100          CP      0CH
03110          JR      NC,SKIP7
03120          ADD    A,10H          ;convert to 18H-1BH
03130 DOIT    LD      C,A          ;display the key hit
03140          SVC    @DSP
03150          XOR    A          ;but return empty
03160          RET
03170 ;
03180 SKIP7   BIT    5,(HL)          ;insert mode?
03190          JR      Z,DOIT          ;if not, go ahead and display it
03200          LD      C,A          ;key to display now in C
03210 U4      LD      A,(0000)       ;get char under cursor
03220          LD      D,A
03230          PUSH  DE
03240          PUSH  BC
03250          VDCTL  4          ;get cursor position
03260          LD      E,L          ;save current column
03270          LD      L,78          ;last column
03280 LOOP3   LD      A,E          ;done yet?
03290          CP      L
03300          JR      NC,DONE3
03310          VDCTL  1          ;get char
03320          INC    L          ;next column
03330          LD      C,A
03340          VDCTL  2          ;put it at next pos.
03350          DEC    L
03360          DEC    L          ;go backward
03370          JR      LOOP3
03380 DONE3   POP    BC
03390          SVC    @DSP          ;display key hit
03400          POP    AF
03410 U5      LD      A,(0000),A     ;replace char that was under cursor
03420          XOR    A
03430          RET
03440 ;
03450 FINAL   NOP
03460          END      START

```

End

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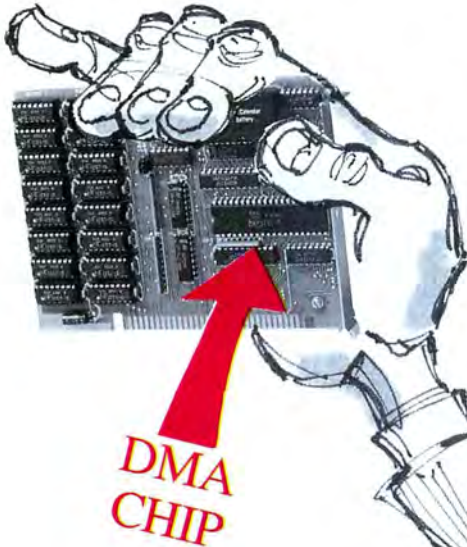
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Writing data to a mass-storage device is a process prone to failure. Scratches and fingerprints on a disk, stray magnetic fields from televisions and electric motors, electrostatic charges, and power line spikes—all can cause widespread bit errors that turn files into unreadable disasters.

A method for detecting and correcting data errors is clearly needed. I've written two Assembly-language programs that identify and fix single-bit errors in each byte; they can also identify multiple-bit errors, but they can't correct them.

Hamming It Up

Several methods are commonly used to detect data errors, including parity checks, longitudinal and cyclic redundancy checks, and checksums. These methods usually won't rectify errors, however, because their designers assume

the errors are transient and will be resolved by rereading the data.

One method providing correction was proposed in 1950 by mathematician Richard W. Hamming. His invention, called Hamming code, employs bit-position-dependent parity checks.

The parity of a data byte refers to the number of bits that are set to 1. In odd parity, the number of set bytes is odd, and the opposite is true in even parity (for example, a byte with the binary value 01101000 has odd parity). Hamming code uses additional bits called check bits to enforce odd parity over specific bit groups.

Figure 1 illustrates the Hamming code for an 8-bit byte. The columns containing bits zero through 7 (labeled b0–b7) refer to bits that hold actual data; in order, they appear in bit positions 3, 5, 6, 7, 9, 10, 11, and 12. (Position 1 represents the rightmost bit.) Positions 1, 2, 4, and 8 contain the check bits, which are labeled x1, x2, x4, and x8. Position 16 contains a bit that

establishes odd parity over the 12 data and check bits.

Letters A through D in Fig. 1 show which bit positions are checked by the check bits. Check bit x1 will be set to a value that establishes odd parity over bit positions 1, 3, 5, 7, 9, and 11, which are designated by A's. Check bit x2 operates similarly for positions 2, 3, 6, and so on, which are designated by B's. Bits marked with the letters C and D are assigned to check bits x3 and x4.

It's important to note several characteristics of Fig. 1. Each group of bits (A, B, C, or D) contains only one check bit in the rightmost position. Further, each bit position has a unique arrangement of group letters in the column below it, and that arrangement has a binary progression.

Figure 2 shows the value of each data bit in a byte with the binary value 10010111. The check bits and overall parity bit have not yet been calculated.

Figure 3 shows the same data byte with

the added check bits and parity bit. Odd parity is computed for each group in turn: since it already exists in group A, check bit x1 is left reset at zero. Since even parity exists in group B, check bit x2 is set to 1 to establish odd parity. The same process is performed on groups C and D.

Finally, the number of 1's in the data and check bits is counted, and odd parity is established over this number by setting the parity bit in position 16 to 1 or zero (here it has been set to zero). Positions 13, 14, and 15 aren't used for an 8-bit data byte.

The final arrangement in Fig. 3 is the one recorded on the storage device.

Finding The Culprit

Let's apply a hypothetical case to Fig. 3 to see how an error is detected and corrected. Assume that data bit b1 in position

Bit position	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
check group	parity				b7	b6	b5	b4	x8	b3	b2	b1	x4	b0	x2	x1
x8					D	D	D	D	D							
x4					C					C	C	C	C			
x2						B	B			B	B			B	B	
x1						A		A		A		A		A		A

Fig. 1. Hamming-code layout.

Data byte = 10010111

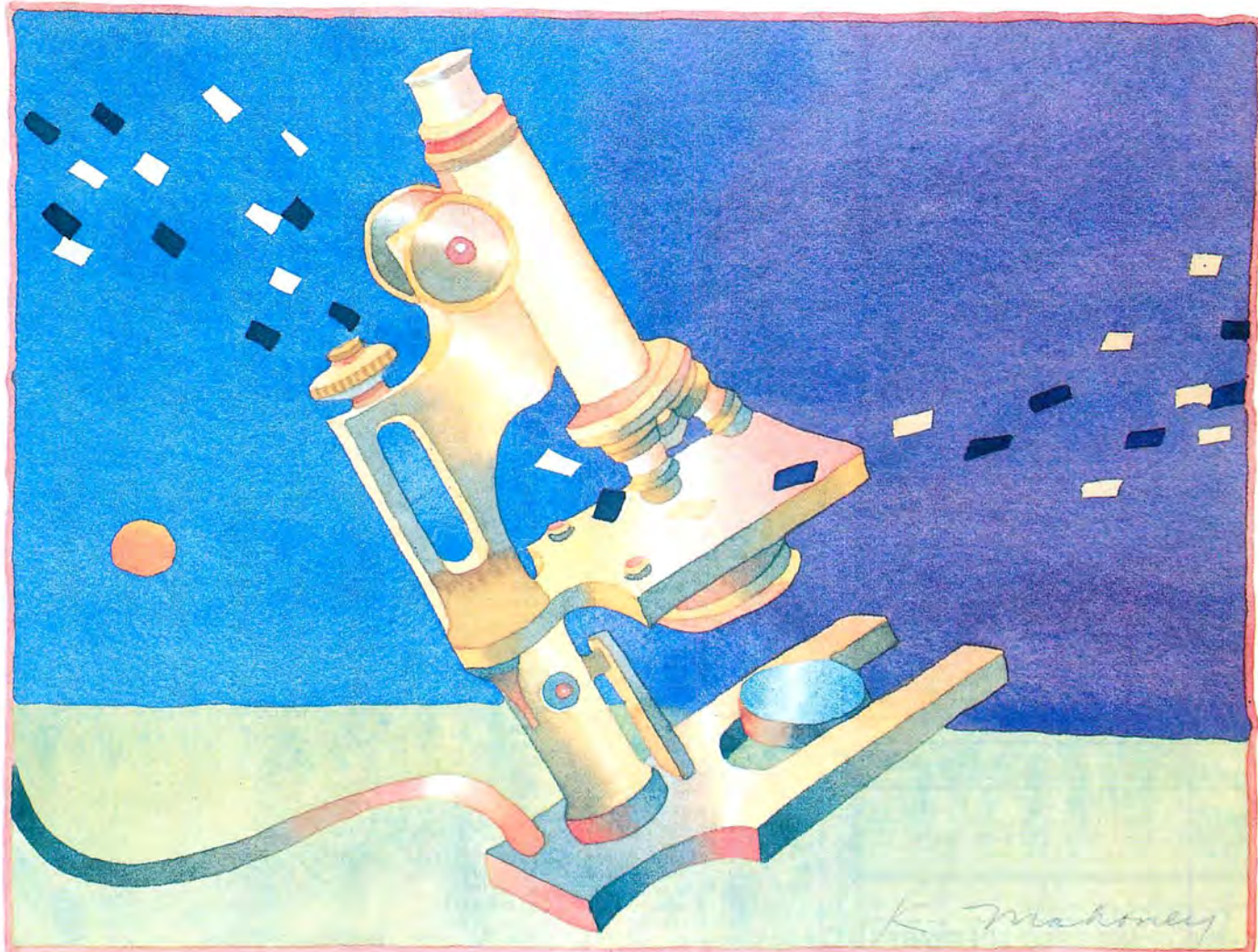
Bit position	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
parity					b7	b6	b5	b4	x8	b3	b2	b1	x4	b0	x2	x1
					1	0	0	1		0	1	1		1		

Fig. 2. Encoded byte without check bits.

Data byte = 10010111

Bit position	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
parity					b7	b6	b5	b4	x8	b3	b2	b1	x4	b0	x2	x1
	0				1	0	0	1	1	0	1	1	0	1	1	0

Fig. 3. Encoded byte from Fig. 2 with added check bits.



5 has been inverted to zero. Check reads the 16 bits from the storage medium and performs parity computations for each bit group. It discovers that even parity now exists in groups A and C, indicating an error in a single bit.

The program constructs a 4-bit binary correction value—each bit corresponding to the four check groups, A–D—to determine which bit is at fault. If a failure did occur in a group, the corresponding bit is set to 1. With groups A and C failing in our hypothetical case, the 4-bit correction value is 0101 (the rightmost bit represents group A).

Since the correction value indicates only the bit position that is in error—not the data bit itself—the check bits (x1–x8) are themselves examined for errors.

To correct the error, the program inverts the indicated bit in the 4-bit correction value.

If the correction value is zero—signifying that all four check groups have the correct odd parity—but the overall parity that includes position 16 is even, then the parity bit in that position must be incorrect.

If the correction value is greater than zero and the overall parity is good, then a multiple error must have occurred. The Hamming code identifies but can't correct errors in more than one bit position.

In one rare situation the Hamming code

falls short. An odd number of errors occurring in positions 3, 5, and 7, for example, will appear to be a single-bit error and the program will attempt a correction. The correction causes all parity checks to pass, but the data byte won't be in its original state.

Write and Check

Model 4 owners must first use Program Listing 1 to establish the macros, definitions, and codes that are common to the two main programs, Write and Check; Tandy 1000 owners must use Program Listing 6 (Hamming.CMN) to perform the same function. Type in (but don't assemble) these programs, making sure to name them exactly as described. The main assembled programs (Write and Check) will later call the command files and incorpo-

rate them into the overall code.

Use Program Listings 2 and 3 for the Model 4, Listings 4 and 5 for the Model III, and Listings 7 and 8 for the Tandy 1000. Write and Check work as separate entities: Write generates Hamming check bits and an overall parity bit for existing disk files, and Check scans for errors.

Write forms the bits in memory using the format in Fig. 1. It opens with the screen prompt "Name of file?", reads data from the file named there, computes Hamming check bits, and writes them to the check file. Before it exits, Write displays the check file name, which will always be the original file name followed by the /CHK extension.

Check opens with a similar prompt and reads the data or program file byte by byte along with the corresponding check bytes in the separate check file. It then performs Hamming checks and corrects any single-bit errors found in the data and check bytes. Multiple-bit errors are displayed at the end.

Try testing Write and Check by using them with a disk file in which you've inserted simulated errors. ■

LOAD
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System Requirements

Models I/III, 4, and Tandy 1000
Assembly language
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4.3a; Tandy 1000 requires
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Program Listing 1. Hamming/ASM. Macros, definitions, and code common to Writer and Check (Model 4 version).

```

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00110 ; TRSDOS 6.2 Version of Hamming Code Programs
00120 ; Assembled with Pro-Create 4.3a
00130 ; Common Macros, Definitions, and Code for both programs
00140 ; (HAMMING/ASM)
00150 ;
00160 ; Program Conversion Written by Hardin Brothers
00170 ;=====
00180 ; SVC Table
00190 ;-----
00200 @DSP EQU 02H
00210 @GET EQU 03H
00220 @PUT EQU 04H
00230 @KEYIN EQU 09H
00240 @DSPLY EQU 0AH
00250 @EXIT EQU 16H
00260 @ERROR EQU 1AH
00270 @INIT EQU 3AH
00280 @OPEN EQU 3BH
00290 @CLOSE EQU 3CH
00300 @CKEOF EQU 3EH
00310 @LOC EQU 3FH
00320 @POSN EQU 42H
00330 @READ EQU 43H
00340 @WRITE EQU 4BH
00350 @FEXT EQU 4FH
00360 @FSPEC EQU 4EH
00370 @HEXDEC EQU 61H
00380 @CLS EQU 69H
00390 ;-----
00400 ; Program Constants
00410 ;-----
00420 B0 EQU 01H ;Definition of data bits
00430 B1 EQU 02H
00440 B2 EQU 04H
00450 B3 EQU 08H
00460 B4 EQU 10H
00470 B5 EQU 20H
00480 B6 EQU 40H
00490 B7 EQU 80H
00500 ;
00510 MASK1 EQU B0!B1!B3!B4!B6 ;Build bit masks
00520 MASK2 EQU B0!B2!B3!B5!B6
00530 MASK3 EQU B1!B2!B3!B7
00540 MASK4 EQU B4!B5!B6!B7
00550 ;
00560 H1 EQU 00H ;Definition of check bits
00570 H2 EQU 01H
00580 H3 EQU 02H
00590 H4 EQU 03H
00600 PARITY EQU 07H
00610 ;
00620 ETX EQU 03H
00630 LP EQU 0AH
00640 CR EQU 0DH
00650 CUROFF EQU 0FH
00660 CURDOWN EQU 1AH
00670 CURUP EQU 1BH
00680 BOL EQU 1DH
00690 ;-----
00700 ; Macro Commands
00710 ;-----
00720 SVC MACRO #NUM,#DUMMY ;;System Supervisory Call
00730 LD A,#NUM ;;Get call number
00740 RST 28H ;; And do it
00750 IFLT %%,2 ;;If not 2 arguments
00760 JP N%,ERROUT ;; go on error return
00770 ENDIF
00780 ENDM
00790 ;
00800 SETBIT MACRO #NUM
00810 LD A,MASK#NUM ;;Get the mask value
00820 AND B ;;Mask off data bits
00830 JP PO,$$?1 ;;Go if parity odd
00840 SET #NUM,C ;;Else set Hamming bit
00850 $$?1 EQU $ ;;Then leave
00860 ENDM
00870 ;
00880 DFIX MACRO #NUM
00890 CP #NUM ;;Is this our error?
00900 JR N%,$$?1 ;;No -- go
00910 IFGT #NUM,8
00920 DFIXL DEFL #NUM-5 ;;For error in B4,B5,B6,B7
00930 ELSE
00940 IFGT #NUM,4
00950 DFIXL DEFL #NUM-4 ;;For error in B1, B2, B3
00960 ELSE
00970 DFIXL DEFL 0 ;;For error in B0
00980 ENDIF
00990 ENDM
01000 LD A,1<DFIXL ;;Get this bit
01010 XOR B ;;Fix the data byte
01020 JP DATERR ;;Report data error.
01030 $$?1 EQU $
01040 ENDM
01050 ;
01060 INCW MACRO #WORD ;;Increment memory word

```

Listing 1 continued

Listing 1 continued

```

01070 LD A, (#WORD) ;;Get LSB
01080 ADD A,1 ;;Add one
01090 LD (#WORD),A ;; And save it
01100 JR NC,$$?1 ;;Leave if no carry
01110 LD A, (#WORD+1) ;;Else get MSB
01120 INC A ;;Add one
01130 LD (#WORD+1),A ;; And save it
01140 $$?1 EQU $
01150 ENDM
01160 ;
01170 BACKUP MACRO #PTR ;;Backup one char and store
01180 PUSH AF ;; character in A
01190 LD DE,#PTR%&FCB ;;DE ==> our file block
01200 SVC @LOC ;;Find current position
01210 DEC BC ;;Decrement to previous position
01220 SVC @POSN ;;Put file pointer there
01230 POP AF ;;Recover byte
01240 LD HL,#PTR%&UREC ;;Point HL at data area
01250 LD (HL),A ;;Store the byte
01260 SVC @WRITE ;;Put it in the buffer
01270 ENDM
01280 ;
01290 PRINT MACRO #ADDR ;;Print a message on screen
01300 PUSH HL ;;Save registers
01310 PUSH DE
01320 LD HL,#ADDR ;;HL==> message
01330 SVC @DSPY ;;Print it
01340 POP DE ;;And recover registers
01350 POP HL
01360 ENDM
01370 ;
01380 DISPCH MACRO #CHAR ;;Display one character
01390 PUSH DE ;;Save registers
01400 PUSH BC
01410 LD C,#CHAR ;;Get character
01420 SVC @DSP ;;Send to video
01430 POP BC
01440 POP DE
01450 ENDM
01460 ;
01470 UP3 MACRO ;;Move cursor up three lines
01480 PUSH DE ;;Save registers
01490 PUSH BC
01500 LD C,CURUP ;;Move up character
01510 SVC @DSP ;;Print it 3 times
01520 SVC @DSP
01530 SVC @DSP
01540 POP BC
01550 POP DE
01560 ENDM
01570 ;
01580 SHOW MACRO #ADDR ;;Display word value at #addr
01590 LD A, (#ADDR)
01600 LD L,A ;;LSB to L
01610 LD A, (#ADDR+1)
01620 LD H,A ;;MSB to H
01630 LD DE,NUMBUF ;;DE ==> Conversion buffer
01640 SVC @HEXDEC,1 ;;Convert the number
01650 DISPCH BOL ;;Cursor to beginning of line
01660 PRINT NUMBUF ;;Print number
01670 ENDM
01680 ;
01690 ;=====
01700 ; Common Program Messages and Data Areas
01710 ;=====
01720 ;
01730 EXTTEXT DB 'CHK',0
01740 PROMPT DB 'Enter data file name ==> ',ETX
01750 SUCCESS DB LF,'Program successfully completed.',LF,CR
01760 ;-----
01770 ; Data areas
01780 ;-----
01790 STAKSAV DW $$-$$ ;;Save system stack
01800 TOTAL DW 0 ;;Total bytes processed
01810 NAMEBUF DS 25 ;;Filespec input buffer
01820 DATFCB DC 32,0 ;;Input File Control Block
01830 CHKFCB DC 32,0 ;;Output File Control Block
01840 NUMBUF DS 5,' ' ;;For number conversions
01850 DB CURDOWN,ETX
01860 DATBUF DS 256 ;;Input file buffer
01870 CHKBUF DS 256 ;;Output file buffer
01880 ;
01890 ;=====
01900 ; Common Program Code
01910 ;=====
01920 ; Exit for all errors
01930 ;-----
01940 ERRROUT PUSH AF ;;Save error code
01950 CALL CLOSE ;;Close files
01960 POP AF ;;Get back error code
01970 SET 6,A ;;Use short error message
01980 LD C,A ;;Move error code to C
01990 LD SP,(STAKSAV) ;;Get back to system stack
02000 SVC @ERROR,1 ;;And leave
02010 ;-----
02020 ; Normal exit
02030 ;-----
02040 DONE CALL CLOSE ;;Close files
02050 PRINT SUCCESS ;;Say we're done
02060 LD HL,0 ;;Send no error back

```

Listing 1 continued on p. 125

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Life is simple if your printer has only one font, or only one that you use regularly. Most modern printers, though, have a variety of useful fonts that you can select by sending the appropriate character strings to the printer. Unfortunately, many users find this inconvenient, and so never take full advantage of their printers' capabilities.

FontPick is a memory-resident program that makes font selection easier than plucking apples from a tree. You call it from an application program by pressing control-F2. FontPick creates a window containing a menu of available fonts (see the Photo), prompts you to select one, and, after you've made your choice, sends the appropriate command to your printer. The program then restores the screen to its original condition.

As written, FontPick executes commands for the Tandy DMP 2100P dot-matrix printer. You can modify FontPick for use with other printers. Substitute the hexadecimal (hex) control codes at the end of Program Listing 1 under label AA with codes from your manual. Remember to convert the decimal code to hex. You also might want to make changes to the menu by changing the DB codes under the MENU label. By substituting the appropriate commands, you can also make it change printer modes, send form feeds, or perform any other function documented in your printer's manual.

FontPick runs on any MS-DOS computer, including the Tandy 1000, 1200, and 3000, and it supports both monochrome and color monitors. You can execute FontPick at any time, except when you're in graphics mode. (The program will send the proper commands to the printer in graphics mode, but it will not display the menu.)

To use FontPick, type in the source listing in Listing 1 using a text editor or word processor of your choice. Name the file FontPick.ASM and store it on disk in

System Requirements

Tandy 1000/1200/3000
Microsoft Macro Assembler
Printer

Program Listing 1. FontPick.ASM.

```

;Memory resident printer utility. David A. Williams
INT_SEG      SEGMENT AT 0H
              ORG          9H*4
KYBD_INT     LABEL WORD          ;Keyboard int vector loc
INT_SEG      ENDS

KYBD_SEG     SEGMENT AT 40H
              ORG          1AH
HEAD         DW              ?          ;Head pointer
TAIL        DW              ?          ;Tail pointer
FST_CHAR    DW          15 DUP (?)    ;Keyboard buffer
LST_CHAR    DW              ?
KYBD_SEG     ENDS

CODE_SEG     SEGMENT
              CS:CODE_SEG,DS:CODE_SEG
              ORG          100H
              KEY          EQU 5F00H    ;Code for Ctrl-F2
              ATTRIB      EQU 70H     ;Attrib byte for rev video
              ROWS        EQU 17      ;Number of rows
              COLS        EQU 26      ;Number of columns
              FIRST:     JMP          LOAD_PROG
              OLD_INT     DD              ?          ;Jump to loading routine
              ;Save old int vector

RES_PROG:    PUSH         AX
              PUSH         BX
              PUSH         CX
              PUSH         DX
              PUSH         DS
              PUSH         ES
              PUSH         DI
              PUSH         SI
              PUSHF
              MOV          AX,CS        ;Match IRET in int routine
              MOV          DS,AX        ;Set DS to data segment
              CALL        OLD_INT
              MOV          AX,KYBD_SEG  ;Get the character
              MOV          ES,AX        ;Set ES to KYBD_SEG
              MOV          DI,ES:TAIL
              SUB          DI,2         ;Location of last char
              CMP          DI,OFFSET ES:FST_CHAR ;Check for
              JAE         NO_WRAP      ; undershoot
              MOV          NO_WRAP:    MOV          DX,ES:[DI]        ;Get character
              CMP          JNE         SKIP        ;Have we been here before?
              JMP          DONE         ;No
              CMP          JE         SKIP        ;Yes
              JE         SKIP          ;Compare char with command
              JMP          START        ;That's it
              MOV          START:     MOV          ES:TAIL,DI        ;Not it, quit
              MOV          FLAG,1      ;Set tail pointer
              MOV          AH,0FH       ;Set flag
              INT         10H          ;Read video mode
              CMP          AL,7        ;Is it mono?
              JE         SAV_SCRN     ;Yes, skip
              MOV          MODE,0B800H ;Set up for color
              MOV          SAV_SCRN:  MOV          AX,MODE
              MOV          ES,AX       ;Buffer address
              MOV          SI,(80-COLS)*2 ;Source segment addr
              MOV          DI,OFFSET STORE ;Source offset address
              MOV          DX,PORT     ;Destination offset addr
              MOV          CX,ROWS     ;Video status port
              MOV          PG_LP:     PUSH        CX
              MOV          CX,ROWS     ;Number of rows
              MOV          ROW_LP:    CALL        CX,COLS
              MOV          TST        CX,COLS ;Character count
              ADD          WORD PTR ES:[SI] ;Test port
              ADD          WORD PTR [DI],AX ;Move
              ADD          DI,2         ;
              ADD          SI,2         ; one
              LOOP        ROW_LP       ; row
              ADD          SI,(80-COLS)*2 ;Index to next row
              POP         CX
              LOOP        PG_LP

DISP_MEN:    MOV          SI,OFFSET MENU ;Source address
              MOV          DI,(80-COLS)*2 ;Destination offset addr
              MOV          DX,PORT     ;Ld video status port addr
              MOV          PG_LP1:    PUSH        CX,ROWS
              MOV          CX,ROWS     ;Number of rows
              MOV          ROW_LP1:   MOV          CX,COLS
              CALL        TST          ;Character count
              MOVSB                    ;Test port
              ;Move one character

```

Listing 1 continued

address onto the stack. An IRET instruction at the end of the interrupt routine retrieves this data from the stack and back to the calling program.

The first time FontPick is executed, it jumps to this routine to exchange the location of EXE2BIN, the starting location, for the existing interrupt vector. EXE2BIN tells DOS to leave all but the LOAD_PROG part of the resident in memory.

From this point on, whenever a key is pressed FontPick examines the keyboard buffer to see which key it was. It does any existing program sees it. The routine labeled H establishes which key FontPick will respond to. As it looks for Shift-F2, but you can change this if you wish first byte of KEY is the scan code and the second byte normal ASCII code for the key. The function keys and other keys and key combinations that cannot be represented by standard ASCII code, use what is called an extended code consisting of the ASCII and (00) and the scan code. When the proper key is recognized, the buffer tail pointer is decremented so that the interrupted program will not be aware that a key was pressed.

Before FontPick can display the menu, it must save the data, including the attribute byte, already displayed in that portion of the screen. This is accomplished by the routine labeled 600 crm

Photo. FontPick's menu.

ASCII format, not the normal format of your word processor. To convert the source code to machine language, you'll need the Microsoft Macro Assembler, which is available from Tandy (Express Order catalog no. 26-5252) and includes an object linker, a symbolic debugger, and other utilities.

Though you needn't have Assembly-language programming experience to create and use FontPick, you'll understand it better with some knowledge of how an editor/assembler works. For that reason, I'll briefly review the operation of the Microsoft Macro Assembler and the procedures required to assemble executable programs.

The Assembly Line

Producing an executable program from a source listing involves several steps. The assembler does the primary job of converting instruction mnemonics, operands, labels, and so forth, to binary, machine-language code. The output, called a relocatable object module, is a disk file with the extension OBJ. It is relocatable—meaning that it can be placed anywhere in memory—because absolute addresses have not been assigned.

Working with large source files is inconvenient when you're writing large programs. Therefore, a linker is provided to combine several object modules, which might cross-reference each other, into one program identified with the extension EXE. Even if you have only one object module, you have to run it through the linker to convert it to the EXE format.

The loader contained in MS-DOS determines the location at which the program will reside in memory and makes the final address assignments. The loader also constructs the program segment prefix (PSP), which consists of 256 bytes of information appended to the beginning of the program.

Some EXE programs can be converted to a second type of MS-DOS executable program called a COM program. MS-DOS contains a utility, EXE2BIN.EXE, for this purpose. COM programs, though subject to some restrictions, are more compact and will load faster than EXE programs. I designed FontPick so that it can be converted to the COM format.

To be convertible, the source file can contain only one segment, but the pro-

Listing 1 continued

```

MOV     ES:BYTE PTR [DI],ATTRIB    ;Attribute byte
INC     DI
LOOP   ROW_LP1
ADD     DI,(80-COLS)*2              ;Index to next row
POP     CX
LOOP   PG_LP1
CMD:    MOV     AH,00H              ;Read kybd input
        INT     16H
        CMP     AL,60H              ;Is it lower case?
        JG      NEXT               ;Yes
        ADD     AL,20H              ;No, add 20H
NEXT:   MOV     CX,6
        CMP     AL,61H              ;Below A?
        JL      CMD                ;Above H?
        CMP     AL,68H              ;Calculate
        JG      CMD                ; offset of
        MOV     AH,0                ; command
        MUL    SIX                  ; string
        MOV     DI,AX               ;Printer ID
        MOV     DX,0                ;Print char
        INT     17H                ;Char to print
        INC     DI
        LOOP   PRINT
RESTORE: MOV    SI,OFFSET STORE     ;Source offset address
        MOV    DI,(80-COLS)*2       ;Destination offset address
        MOV    DX,PORT              ;Video status port address
        MOV    CX,ROWS              ;Number of rows
PG_LP2: PUSH   CX
        MOV    CX,COLS              ;Character count
ROW_LP2: CALL  TST                  ;Move one character
        MOV    SI,ROW_LP2           ;Index to next row
        ADD    DI,(80-COLS)*2
        POP   CX
        LOOP  PG_LP2
DONE:   MOV    FLAG,0              ;Reset flag
        POP   SI
        POP   DI
        POP   ES
        POP   DS
        POP   DX
        POP   CX
        POP   BX
        POP   AX
        IRET

TST:    IN     AL,DX                ;Read port
        TEST   AL,1                 ;Test bit zero
        JNZ   WAIT                  ;Wait until it's reset
WAIT:   IN     AL,DX                ;Read port again
        TEST   AL,1                 ;Test bit zero
        JZ    WAIT                  ;Wait until it's set

FLAG    DB     0
SIX     DB     6
AA      DB     1BH,21H,0DH,00H,00H,00H ;IBM Mode
        DB     1BH,13H,0DH,00H,00H,00H ;Std 10
        DB     1BH,17H,0DH,00H,00H,00H ;Std 12
        DB     1BH,14H,0DH,00H,00H,00H ;Std Condensed
        DB     1BH,3DH,32H,1BH,12H,0DH ;Courier 10
        DB     1BH,3EH,31H,1BH,1DH,0DH ;Elite 12
        DB     1BH,3FH,32H,1BH,11H,0DH ;Courier PS
        DB     1BH,3FH,31H,1BH,11H,0DH ;Elite PS
        DW     0B000H               ;Video buffer
        DW     03BAH                ;Status port
MODE    DB     26 DUP(20H)
PORT    DB     20H,"IBM Mode"       A",20H
        DB     26 DUP(20H)
MENU    DB     20H,"Standard 10 cpi" B",20H
        DB     26 DUP(20H)
        DB     20H,"Standard 12 cpi" C",20H
        DB     26 DUP(20H)
        DB     20H,"Standard Condensed" D",20H
        DB     26 DUP(20H)
        DB     20H,"Courier 10 cpi"   E",20H
        DB     26 DUP(20H)
        DB     20H,"Elite 12 cpi"    F",20H
        DB     26 DUP(20H)
        DB     20H,"Courier PS"      G",20H
        DB     26 DUP(20H)
        DB     20H,"Elite PS"       H",20H
        DB     26 DUP(20H)
STORE   DB     1200 DUP(20H)

LOAD_PROG: MOV    AX,INT_SEG         ;Set ES to INT_SEG
        MOV    ES,AX
        CLI
        MOV    AX,ES:KYBD_INT       ;Get old int vector
        MOV    WORD PTR OLD_INT,AX  ; and save first word
        MOV    AX,ES:KYBD_INT[2]
        MOV    WORD PTR OLD_INT[2],AX ; save second word
        MOV    ES:KYBD_INT,OFFSET RES_PROG ;Replace with new
        MOV    ES:KYBD_INT[2],CS

        MOV    DX,OFFSET LOAD_PROG  ;Last loc to retain
        INT    27H                  ; in memory
        CODE_SEG
        END
        FIRST

```

End

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gram can change the values in the segment registers to address data outside of the program segment. A second requirement is that the program must start at offset 100 hex. It then sets the segment registers to the program-segment address, the instruction pointer to offset 100 hex, and the stack pointer to the top of the segment. When the resident portion of FontPick executes, it uses the stack of whatever program is running.

Program Listing 2 is a simple batch file that automates the assembly of COM files. Create it with your text editor and name it ASM.BAT. Then, when you have written and saved the source file, type ASM FONT-PICK at the DOS prompt. (Do not type the source-file extension.) The batch file will step through the correct sequence of operations and delete the unused files that are generated along the way. Ignore the "No stack segment" warning generated by the linker.

Program Listing 2. A batch file to automate the assembly of COM files.

```
echo off
rem batch file to process .ASM files;
rem enter ASM filename
MASM %1;
LINK %1;
DEL %1.OBJ
EXE2BIN %1 %1.COM
DEL %1.EXE
```

End

Program Notes

Though FontPick is well documented, a few additional comments will help you read between the lines. The program uses several BIOS (basic input/output system) and DOS routines, which are accessed with the INT instruction. The INT instruction executes an indirect jump to an address stored in low memory. This allows DOS and BIOS routines to be relocated without making existing programs obsolete. INT also pushes the flag register and return address onto the stack. An IRET instruction at the end of the interrupt routine retrieves the data from the stack and jumps back to the calling program.

FontPick jumps to the Load Program routine the first time it executes. LOAD_PROG exchanges the location of RES_PROG, FontPick's starting location, for the existing interrupt vector. Interrupt 27 hex tells DOS to leave all but the LOAD_PROG part of the program resident in memory.

Once loaded, FontPick examines the keyboard buffer whenever you press a key and determines if it should display the menu. When it recognizes the proper key or key combination, it decrements the buffer tail pointer so that the interrupted program will not be aware that you pressed a key.

As written, the program responds to control-F2, but you can change this by substituting another key or key combination for the value labeled KEY. The first byte of KEY is the scan code and the sec-

ond byte is the normal ASCII code for the key. The function keys and certain other keys and key combinations cannot be represented by standard ASCII code. These use an extended code that consists of the ASCII null (00) and the scan code.

Before FontPick can display the menu, it must save the data, including the attribute byte, already displayed on screen. This is the purpose of the routine labeled SAV_SCRN. Once the data is saved, the DISP_MEN routine displays the menu.

Both the SAV_SCRN and DISP_MEN routines read from and write to display memory. Though other methods exist for displaying data, this one produces crisp displays that appear almost instantaneously. Both also check the video status port to determine when it is safe to read from or write to the display buffer. This precaution isn't necessary with monochrome monitors, but it doesn't hurt anything either. On color monitors, it prevents snow and noise from interfering with the display.

Each line in the listing starting with the label MENU represents one line on the display—17 lines altogether (including blank lines) with 26 characters to a line. You can change these dimensions, but if you do, be sure to change the values labeled ROWS and COLS near the beginning of the listing.

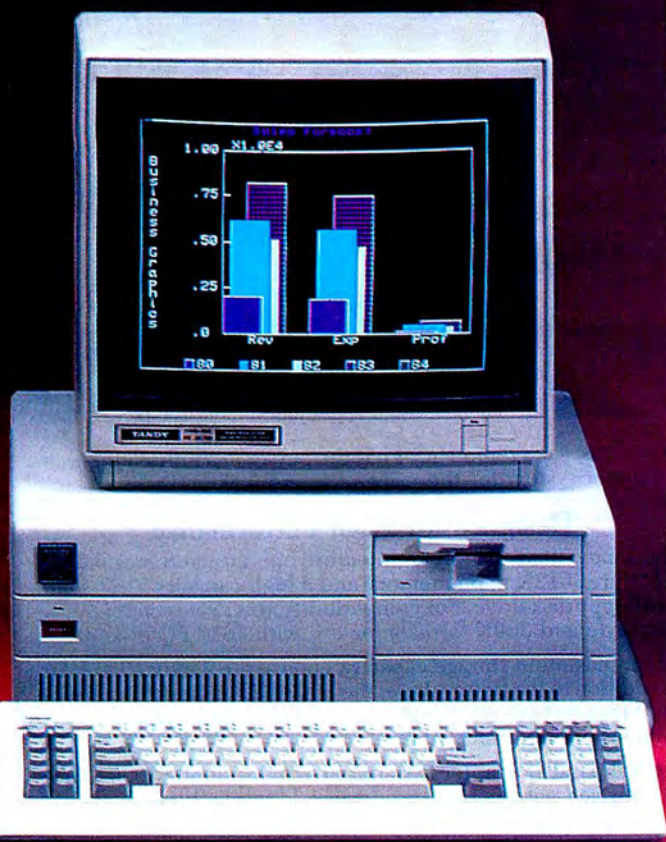
Many standard computers, use separate display buffers located on the display adapter cards. The monochrome buffer begins at location 0B000 hex and the color display buffer begins at 0B800 hex. The Tandy 1000 and some compatibles, however, have only one buffer at location 0B800 hex, which is used by both displays. In either case, 2 memory bytes represent each character. The first contains the code for the character, and the second, the attribute byte, controls the color, underlining, reverse video, and so forth. FontPick uses interrupt 10 hex to find out which type of monitor is in use and sets the values in MODE and PORT accordingly.

Once the menu is displayed, the program waits for further input from the keyboard. When you type a character, it calculates the offset address of the command string and loads it into DI. Interrupt 17 hex sends one character to the printer, and the loop instruction repeats this six times. After sending the appropriate print command, FontPick puts the original screen data back into the display buffer with the Restore routine.

As mentioned previously, the commands in FontPick are for the Tandy DMP 2100P, but you can change them to suit whatever printer you own. Since some commands are longer than others, fill out the short ones with 00 hex. ■

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Monitor and adapter not included

The Tandy 3000 is the affordable alternative to the IBM® PC/AT. Here's the power you need to manage your business or to create a multiuser system for your office.

Our Tandy 3000 is compatible with software designed for the IBM PC/AT and the PC/XT. Choose from advanced word-processing packages to heavy-duty database management to accounting software.

Multitasking, Multiuser Capacity

The Tandy 3000 is designed to use the XENIX 5.0 multiuser operating system. In such a configuration, multiple display terminals will be able to tap the high performance 80286 microprocessor. Thanks to its high processing speed, two to six users throughout an office will be able to use the Tandy 3000 simultaneously. Each user can work independently on such products as accounting, word processing and electronic filing. All of the users can share the Tandy 3000's accessories, eliminating the need for a printer or modem at each worksta-

tion. Thus, each remote user has the power of a fully configured computer system for the price of a terminal.

Designed for High Performance

The Tandy 3000's 16-bit architecture operates at 8 megahertz. It features 512K main memory and a high-capacity 5¹/₄" slim-line floppy disk drive. For compatibility, this drive can read 1.2-megabyte and 360K formats for use with IBM PC diskettes.

Or for maximum storage capacity, choose the Tandy 3000 HD. In addition to the floppy drive, the 3000 HD comes with a built-in 20-megabyte or 40-megabyte hard disk drive for fast access to volumes of important data.

A serial/parallel adapter is standard, making Tandy 3000 ready to interface with peripheral devices like telephone modems, printers and plotters.

The Tandy 3000 is equipped with ten expansion slots, including seven PC/AT-compatible slots, two PC/XT-compatible slots and a PC/XT-compatible half-slot for the serial/parallel adapter.

Tandy 3000. 512K RAM. 25-4001	2199.00
Tandy 3000 HD 20-Meg. 512K RAM. 25-4010	3599.00
Tandy 3000 HD 40-Meg. 640K RAM. 25-4011	4299.00
MS-DOS™ (3.2)/BASIC. Comes with our exclusive DeskMate® II 6-in-1 software. 25-4103	99.95
XENIX Sys. V Operating System. 25-4201	595.00
XENIX Sys. V Development System. 25-4202	595.00
XENIX Sys. V Text Processing System. 25-4203	175.00

SPECIFICATIONS. Microprocessor: Intel 80286 processor with 16-bit data path. Clock speed, 8 MHz. Object code compatible with 8086/8088. Real-time clock with battery backup. **Operating System:** Optional Microsoft MS-DOS 3.2 with BASIC. **Memory:** 512K RAM with parity. 25-4011 standard with 640K RAM. By using the expansion slots, memory is expandable to 12 megabytes under XENIX. Includes power-up diagnostics. Sound included. **Keyboard:** 84-key sculptured, including numeric entry keypad. Special keys include ESCape, Num Lock, Alt, Ctrl, Caps Lock, Prt Sc, Sys Reg, Scroll Lock, Up, Down, Right and Left arrows. Ten programmable Special-Function keys. Retractable legs, 6-ft. coiled cable. **Video Display:** Optional high-resolution, non-glare, non-interlaced 12" monochrome (green) or 14" color monitor. 80 or 40 characters per line by 25 or 50 lines. Optional high-resolution 640 x 200 monochrome graphics and 320 x 200 graphics in 16 colors, or 640 x 200 graphics in 4 colors. **Disk Drives:** Built-in high-density, thin-line 5¹/₄" floppy can read 1.2Mb and 360K formats. Tandy 3000 HD also has built-in 20 or 40-megabyte hard disk drive. Disk storage is expandable to include two floppy disk drives and one hard disk drive, or one floppy disk and two internal hard disk drives. Total internal storage capacity can exceed 80 megabytes. **Internal Expansion:** 10 plug-in card slots, including 7 PC/AT-compatible slots, 2 PC/XT-compatible slots and 1 PC/XT-compatible half-slot for the serial/parallel adapter. Optional 80287 math co-processor can be added. **External Connections:** Standard parallel printer port, RS-232C serial communications port, AC outlet. **Dimensions:** 6¹/₂ x 19 x 18". **Weight:** 47 lbs. **Power Requirements:** 120VAC, 60 Hz. U.L. listed.

IBM/Registered TM International Business Machines Corp. MS-DOS/TM Microsoft Corp.

3000 HL: 4 TIMES AN XT'S POWER



1-Disk Tandy 3000 HL

NEW FOR 87

1699⁰⁰

Monitor and adapter
not included

Commercial Lease Available
For Only \$65 Per Month
(Plus Applicable Use/Sales Tax)

If you've already invested in IBM® XT software and hardware, yet are shopping for a lower-priced compatible, then take a look at our newest computer to join the Tandy line of IBM compatibles, the Tandy 3000 HL.

The Tandy 3000 HL is the basic building block of business systems. It was created to be fully compatible with IBM XT's, and then we made it even better.

First, we made it faster. With an 80286 processor, it's over four times faster than the XT. And that's good news for busy people. Then we made sure the Tandy 3000 HL has plenty of memory to run the software you and your staff have grown accustomed to. The Tandy 3000 HL comes with 512KB standard memory and can be expanded to 4 megabytes using the expansion slots. You can choose from advanced word-processing packages and heavy-duty database management to accounting software. And because the Tandy 3000 HL uses most popular MS-DOS packages that are available off-the-shelf, you can get all the software you need, when you need it.

A Computer That Can Expand—Inexpensively

Because we know how quickly your business can grow, we made sure the Tandy 3000 HL has room for fast, low-cost

expansion. It comes standard with seven expansion slots; four 8-bit/XT compatible slots and three 16-bit data bus slots. And for better office efficiency, the Tandy 3000 HL features a built-in real-time clock with battery backup for automatic date and time-stamping of all jobs, process control and other time-sensitive applications.

We also remember how much time is spent composing memos, calling meetings and writing reports. And because networking is quickly becoming one of the biggest concerns for current computer owners, we made the Tandy 3000 HL network compatible with all MS-DOS computers. Now with the Tandy Vianet local area network, you can connect your existing MS-DOS based computers to the Tandy 3000 HL and continue to communicate with your staff, while spending much less. It will be easier than ever before to pass a document around your company for comments and refinements, producing a finished version that not only costs less but contains better information. You can send memos, figures and other important messages via computers, eliminating lost memos, forgotten meetings or incomplete reports.

For XT compatibility with more power and versatility, at a much lower cost, this is the computer to step up to.

Tandy 3000 HL. 25-4070	1699.00
20 Megabyte Hard Drive. 25-4062	799.00
40 Megabyte Hard Disk. 25-4061	1799.00
Hard Drive Controller. 25-4060	399.95
MS-DOS 3.2/BASIC/DeskMate II. 25-4103	99.95

SPECIFICATIONS. Microprocessor: Intel 80286 processor with 16-bit data path. Switchable clock speed, 4/8 MHz. Object code compatible with 8086/8088. Real-time clock with battery backup. **Operating System:** Optional Microsoft MS-DOS 3.2 with BASIC. Memory: 512K RAM with parity. By using the expansion slots, memory is expandable to 4 megabytes. Includes power-up diagnostics. Sound included. **Keyboard:** 84-key sculptured, including numeric entry keypad. Special keys include ESCape, Num Lock, Alt, Ctrl, Caps Lock, Prt Sc, Sys Reg, Scroll Lock, Up, Down, Right and Left arrows. Ten programmable Special-Function Keys. Retractable legs, 6-ft. coiled cable. **Video Display:** Optional high-resolution, non-glare, non-interlaced 12" monochrome (green) or 14" color monitor. 80 or 40 characters per line by 25 lines. Optional high-resolution 80 characters by 50 lines, 640 x 200 graphics and 320 x 200 graphics in 16 colors, or 640 x 200 graphics in 4 colors. **Disk Drives:** Built-in thin line 5 1/4" floppy can read 360K formats. Disk storage is expandable to include two floppy disk drives and one hard disk drive, or one floppy disk and two internal hard disk drives. Total internal storage capacity can exceed 80 megabytes. **Internal Expansion:** Seven plug-in card slots, including three 16-bit slots, four PC/XT-compatible slots. Optional 80287 math co-processor can be added. **External Connections:** Standard parallel printer port. **Dimensions:** 6 1/8" x 17 x 15 1/2". **Weight:** 32lbs. **Power Requirements:** 120VAC, 60 HZ. U.L. listed.

IBM/Registered TM International Business Machines Corp.

SAVE \$299⁹⁵! BUY EITHER TANDY 1000



NEW FOR 87

1199⁰⁰

Reg. separate items 1498.95. Software not included.

Get Down to Business with DeskMate II

- Fifty-Percent Faster Than the IBM® PC
- Ready-to-Run—Includes DeskMate II Six-Function Software
- Software Compatible with the IBM PC—Choose From the Most Popular Programs on the Market
- Two Built-In 5 1/4" 360,000-Character Disk Drives
- Five PC Compatible Card Slots for Easy Expansion

This year, we're offering your business a Christmas bonus! Buy the Tandy 1000 SX, and we'll include the CM-5 Color Monitor at no extra charge. The CM-5 features a 13" screen, 80 x 25 text and 320 x 200 graphics.

High Speed Performance

The 1000 SX is centered around the 8088 microprocessor, ensuring compatibility with industry-standard MS-DOS software. But unlike other "industry-standard" computers, you can run virtually all of your programs one and one-half times as fast with a 1000 SX. This software-switchable speed control lets you finish spreadsheets, sort data bases and display intricate charts and graphs faster than ever.

To complement this new level of sophisticated performance, the 1000 SX comes with 384K RAM, expandable to 640K on the main board, and two built-in disk drives. And with five card slots, it's easy to expand your system. Expansion boards are user-installable, and you can choose from memory expansions, internal modems—even a 20-megabyte hard disk card!

We've improved our popular DeskMate 6-in-1 applications software to take advantage of the Tandy 1000 SX's power. DeskMate II* for the Tandy 1000 SX features six applications on one disk. And with the special task-switching feature, you can exit DeskMate II, enter an applications program, then return to DeskMate II—all with just a few keystrokes. Start computing the first day with Text Processing, Spreadsheet Analysis, Electronic Filing, Calendar/Alarm, Telecommunications and Electronic Mail. Every day you'll be greeted by a menu that displays a calendar, appointment schedule and a list of files stored for every function. Plus, when you use your Tandy 1000 in a local area network, DeskMate II is ready, because it's compatible with ViaNet.

And since the Tandy 1000 SX is PC compatible, you can choose from an astounding collection of MS-DOS programs. Select from popular spreadsheet, word processing, integrated applications, business graphics, education or entertainment programs.

Packed with Deluxe Features

With the Tandy 1000 SX, most of the "options" you expect to pay more for are included. Adapters are built in for easy hookup to your color monitor. Adapters for a printer, joysticks, or light pen are all standard, as are MS-DOS 3.20 and GW-BASIC. Whatever your needs, the Tandy 1000 SX is the most powerful computer for the money.

25-1051/1023 1199.00

SPECIFICATIONS: Microprocessor: Intel 8088, Clock Speed: 7.16/4.77 Mhz, software selectable. **Operating System:** Includes Microsoft's MS-DOS 3.2 with GW-BASIC. (Reference Manuals extra). **Memory:** 384K RAM, expandable on main board to 640K. Includes power-up diagnostics. **Keyboard:** 90-key sculptured, including numeric-entry keypad. Special keys include HOLD, ESCape, BREAK, CTRL, CAPS, INSERT, DELETE, and HOME. Twelve programmable Function keys. Retractable legs. 6-ft. coil cable. **Video Display:** Optional high-resolution, non-glare 12" monochrome (green) or 13" RGB Color Monitor. 80 or 40 characters per line by 25 lines. 256 characters. Reverse video, blank, blink. 16 foreground and 8 background colors. High-resolution monochrome and color graphics (640 x 200 pixels). Displays 8 of 16 colors—black, blue, green, cyan, red, magenta, brown, white, gray, light blue, light green, light cyan, light red, light magenta, yellow, high-intensity white. Higher resolution video support available with optional expansion boards. **Disk Drives:** Two double-sided, double-density, 360K (formatted) thin-line 5 1/4" mini-floppies. 48 tracks per inch. **Internal Expansion:** Five user-accessible IBM PC-compatible card slots (10" maximum length), 8087 Math-Coprocessor. **External Connections:** Standard parallel port, composite video out, line level audio out, light pen port, two joysticks, RGB Color Monitor. AC outlet. Power: 120 VAC, 50/60 Hz.

*DeskMate II requires 80 column monitor. Telecommunications and E-Mail require optional modem.

& GET A COLOR MONITOR BONUS!



NEW FOR 87

799⁰⁰

Less platform, external disk drive and software. Reg. separate items 1098.95

- The Lowest-Priced MS-DOS Based Personal Computer
- Get PC Compatibility at a Fraction of the Price
- Fifty-Percent Faster Than the IBM® PC
- Incredibly Easy-to-Use Personal DeskMate Software
- Choose from Thousands of Popular Programs
- Built-In 360,000-Character Floppy Disk Drive
- Ideal for the Home, A Natural for Schools

The new Tandy 1000 EX is a true PC-compatible computer, ready to use the MS-DOS software you bring home from the office, as well as software designed for the home or classroom. And for Christmas, we're including a CM-5 Color Monitor at no charge. Inside the sleek one-piece design resides a 5 1/4" disk drive and 256,000-character RAM. The integral 90-key keyboard has the same layout as the Tandy 1000 SX, ideal for business programs. You'll find an advanced three-voice sound circuit for sophisticated sound and music generation through the built-in speaker. There's also a headphone jack with volume control for quiet listening—perfect for the classroom.

The Advantages of Personal DeskMate

Every Tandy 1000 EX comes with a new graphics-oriented version of our DeskMate productivity software. Personal DeskMate* is amazingly easy to use, with handy pull-down menus and pop-up boxes for selecting functions. Add an optional Digi-Mouse® or joystick and you'll have the ultimate in convenience.

SPECIFICATIONS: Microprocessor: Intel 8088, Clock Speed: 7.16/4.77 Mhz, software selectable. **Operating System:** Includes Microsoft's MS-DOS 2.11 with GW-BASIC. (Reference Manuals extra.) **Memory:** 256K RAM, expandable to 640K. Includes power-up diagnostics. **Keyboard:** Integral 90-key sculptured, including numeric-entry keypad. Special keys include HOLD, ESCape, BREAK, CTRL, CAPS, INSERT, DELETE and HOME. Twelve programmable Function keys. **Video Display:** Optional high-resolution, non-glare 12" monochrome (green) or 13" RGBI Color Monitor. 80 or 40 characters per line by 25 lines. 256 characters. Reverse video, blank, blink. 16 foreground and 8 background colors. High-resolution monochrome and color graphics (640 x 200 pixels). Displays 8 of 16 colors—black, blue, green, cyan, red, magenta, brown, white, gray, light blue, light green, light cyan, light red, light magenta, yellow, high-intensity white. **Disk Drives:** One double-sided, double-density, 360K (formatted) thin-line 5 1/4" mini-floppy. 48 tracks per inch. **Internal Expansion:** One "PLUS" style expansion board or two "PLUS" style expansion boards when used with Memory PLUS Expansion Adapter (25-1062). **External Connections:** 5 1/4" 360K or 3 1/2" 720K External Disk Drive, standard parallel port, composite video out, 1/8" headphone jack with volume control, two joysticks, RGBI Color Monitor. AC outlet. **Power:** 120 VAC, 50/60 Hz.

*Personal DeskMate requires 80 column monitor. Telecom requires optional modem.

With TEXT you'll see a simple text entry and editing system that includes cut/copy/paste functions, search and replace, and underlining and boldface. WORKSHEET gives you a simple in-memory spreadsheet application with 99 rows and 99 columns of numeric, text, or calculated cells. It will support selectable column widths, as well as numeric and text cell format options. DESKTOP helps you visually organize and manage program and data files. You can install any combination of applications onto the screen, including CALCULATOR, NOTEPAD, CALENDAR and PHONE DIRECTORY. You can use FILER to keep track of your recipes. With PAINT you'll have a simple graphic picture editor that includes functions for drawing basic shapes (solid or outline), lines, points, fonts, and pattern fills. And of course we've included TELECOM, our basic telecommunications package for communicating with information services as well as for uploading and downloading files.

Ready to Use, Ready to Expand

The one-piece Tandy 1000 EX offers affordable versatility—your new monitor hooks up right away—start computing immediately. Plug in joysticks, printer or a second disk drive without buying extra-cost adapters. Add the Memory PLUS Expansion Adapter for two additional connectors for more memory, modem telecommunications, Digi-Mouse and classroom networking options.

With MS-DOS/GW-Basic 2.11. 25-1050/1023 799.00
Tandy 1000 EX Monitor Platform. 26-210 29.95
MS-DOS 3.20 Upgrade. 25-1170 29.95

MONITORS, ADD-ONS AND BOOKS

Complete Your System with the Tandy Display Monitor That's Right for You

Monitor Pedestal
sold separately



We offer monitors for every need and budget. Our monochrome monitors have non-glare, green phosphor screens. Or pick a color monitor for brilliant graphics.

VM-1 Monochrome Monitor. 12" screen displays 80 x 25 text, 640 x 400 graphics. Tilts 5 or 10 degrees for best viewing angle. 26-5111 199.95

VM-3 Monochrome Monitor. 12" screen displays 80 x 25 text, 720 x 348 graphics. 25-3010 219.00

New! VM-4 Monochrome Monitor. 12" screen displays 80 x 25 text, 640 x 200 graphics. 25-1020 129.95

New Low Price! CM-1 Color Monitor. 14" screen displays 80 x 25 text, 640 x 400 graphics. Tilts 5 or 10 degrees for best viewing. Was \$599.00 in Cat. RSC-16. 26-5112 529.95

New! CM-5 RGBI Color Monitor. 13" screen displays 80 x 25 text, 320 x 200 graphics. 25-1023 299.95

New! CM-10 RGBI Color Monitor. 13" screen displays 80 x 25 text, 640 x 200 graphics. 25-1022 459.95

Quick-Reference Chart for Tandy Display Monitors

	Video Adapters for Tandy 1200/3000			Tandy 1000	CoCo	100/102/200 Disk Video	Tandy 2000	CoCo 3
	25-3045	25-3046	25-3047					
VM-1		640 x 400 Text Only	640 x 400 Text and Graphics(3)				640 x 400 Text and Graphics(4)	
VM-3	720 x 348 Text and Graphics(1)							
VM-4	640 x 200 Text and Graphics			640 x 200 Text and Graphics		640 x 200 Text Only		
CM-1		640 x 400 Text Only	640 x 400 Text and Graphics(3)				640 x 400 Text and Graphics(5)	
CM-5	320 x 200 Text and Graphics			320 x 200 Text and Graphics				
CM-8								640 x 192 80-Column Text and Graphics
CM-10	640 x 200 Text and Graphics			640 x 200 Text and Graphics				
Composite Color	320 x 200 40-ColumnText			320 x 192 40-Column Text		320 x 200 40-Column Text		320 x 192 32/40-Column Text and Graphics
TV	320 x 200 40-Column Text(2)			320 x 200 40-Column Text(2)	256 x 192 32-Column Text	320 x 200 40-Column Text(2)		320 x 192 32/40-Column Text and Graphics

Two-Button Digi-Mouse



99⁹⁵

Ideal for Use with
Graphics Programs

Deluxe Joystick



29⁹⁵

Get Quicker and
Easier Cursor Control

Plugs in for easy cursor movement in graphics programs, as well as other applications. Requires Digi-Mouse/Clock Controller Board (26-5144, 25-1010 or 25-1015). 26-1197 99.95

You can feel the difference. Patented stick mechanism for more accurate cursor control and quicker response. Select "spring-centering" or "free-floating" operation. 25-1080 29.95

Instructional and Reference Books

New! MS-DOS/GW-BASIC Reference Guides. Includes reference materials for MS-DOS and GW-BASIC 2.11 and 3.20. 25-1508 29.95

MS-DOS: The Basics. Explains the basics of the MS-DOS system, its functions and possibilities. 25-1506 7.95

MS-DOS: Advanced Applications. Discusses working with files and devices, organizing your files, simplifying your work, controlling the flow of data, personalizing your system, keeping your system healthy and "looking behind the scenes". 25-1507 14.95

Learning BASIC for Tandy Computers. An excellent tutorial

for BASIC programming by Dr. David Lien, author of our famous Model I Owner's Manual. 25-1500 19.95

The Complete Guide to the Tandy 1000. An extremely thorough examination of the power of our most popular computer. Covers basic operations, software options, compatibility issues, mastering MS-DOS, hardware, expansions and more. 25-1505 14.95

Tandy 1000 Programmer's Reference Manual. Documents all BIOS subroutines and entry points for use in low-level languages. 25-1503 14.95

Tandy 1000 Technical Reference Manual. Includes schematic diagrams and theory of operation on the Tandy 1000 and option boards. 25-1504 29.95

(1) Requires special software. (2) Requires RF modulator. (3) 640 x 200 with standard software. Hi-res modes require special software. (4) Graphics require 26-5140. (5) Requires 26-5140//5141.

POWERFUL EXPANSION OPTIONS

TCS-100 Tape Cartridge System

Backup Your Data on Tape

1999⁰⁰



Now you can get reliable hard-disk backup on tape (backup 10 megabytes in as little as 6 minutes). Uses standard 1/4" cartridges (one included) for over 48 megabytes of archival storage. Powerful file-by-file backup/restore function. Select single files, groups of files or all files. Select files based on globals, wild cards, files modified since last backup, file creation data, directory structure and more. Features three heads—read, write and erase—for one-pass backup with immediate read-after-write verification. Requires Interface Kit (below) U.L. listed AC.

25-3020 1999.00

Tandy 1000/1200/3000 Interface Kit. Includes software and cables for file-by-file or mirror-image backup. Kit also supports IBM PC and PC-compatible computers. 25-3021 ... 149.95

1/4" Data Tape Cartridge. 26-1391 34.95

20 + 20-Megabyte Disk Cartridge System

3499⁰⁰



Depend on a Disk Cartridge System instead of a hard disk for speed, reliability, expandability, security and transportability. The DCS consists of one or two drives and high-performance cartridges. Because cartridges are removable, you can store an unlimited amount of data. You can easily back up your conventional hard-disk system. Requires Interface Kit (below).

New! 20 + 20-Megabyte DCS. 25-4066 3499.00

New! 20-Megabyte 5 1/4" Internal DCS. (Available 9/30/86.) 25-4064 1799.00

10-Megabyte DCS. 26-1245 2195.00

Secondary DCS. Add a 10-megabyte disk kit* to create a 10 + 10-megabyte system. 26-1246 999.00*

New! 8" 20-Megabyte Cartridge. 26-220 119.95

New! 5 1/4" 20-Megabyte Cartridge. 26-221 84.95

New Low Price! 10-Megabyte Cartridge. Was \$89.95 in Cat. RSC-16. 26-1372 79.95

20-Megabyte Hard Disk Card

NEW FOR 87

799⁰⁰

- An Efficient New Way to Get Hard-Disk Storage
- User-Installable Card Saves on Desk Space

Get 20 megabytes of hard-disk storage on a user-installable card. Mounts in a 10" card slot on the Tandy 1000 or a 13" slot on the Tandy 1200, Tandy 3000 HL, IBM PC or PC compatible. Operates as either first or second hard disk and can run a second hard disk drive. Comes with a thorough installation manual and a diskette with special installation software. It's the easiest way yet to get hard-disk storage power! 25-1029 799.00

Sale! 10-Megabyte Hard Disk Drive

Save \$499 Reg. Separate items 998.95

499⁹⁵



Expand your Tandy 1000's storage affordably. Add two to the Tandy 1000 or one to the Tandy 1000 HD for 20 megabytes of total system storage (Cable Kit and installation required for secondary unit). Includes Hard Disk Controller Board. 25-1025/1007 Sale, 499.95

User-Installable Tandy 3000 Expansion Boards and Options

1.2-Meg. Floppy Disk Kit. High-performance, high-capacity floppy disk drive. Store 1.2 megabytes of data. Can also read and write 360K disks. 25-4050 299.95

360K Floppy Disk Kit. 25-4051 199.95

New Low Price! Hard Disk Controller. Lets you add an internal 20-megabyte hard disk. Was \$499 in Cat. RSC-16. 25-4060 399.95*

20-Megabyte Hard Disk Kit. Use with Tandy 3000 HD to increase internal storage by 20 meg. Or combine with Controller above to convert a 3000 to a 3000 HD. 25-4062 799.00*

External Hard Disk Cable Kit. 25-4063 59.95*

New! Memory Expansion Board. Add up to 2 megabytes of memory to your Tandy 3000. Comes with 1MB of memory. In MS-DOS, use VDISK to set aside portions of your computer's RAM memory that simulate disk storage. Use board for more efficient operations using XENIX System V operating system. 25-4030 499.95

New! 4-User Board. Adding this multiuser board to your Tandy 3000 computer enables it to support up to four serial devices

operating at 9600 baud. For use with the XENIX System V operating system. The board uses a Z80 controller for greater speed. 25-4031 299.95

80287 Math Co-Processor. Add to your Tandy 3000 to perform one set of functions while the co-processor simultaneously performs highly accurate mathematical calculations (arithmetic, trigonometric operations and logarithmic functions) at high speed. Programs must be specifically written for this option. 25-4033 399.95

Tandy 1000/1200/3000 Serial Parallel Adapter. Add a second serial/parallel adapter to connect a second printer or increase your communications capability with an additional modem. 25-4034 169.95

10-Megabyte Disk Cartridge System Interface Kit. For Tandy 1000/1200/3000. 25-3022 199.95*

New! 20-Megabyte Disk Cartridge Interface Kit. For Tandy 1000/1200/3000. 25-4081 149.95*

New! Universal Disk Cartridge System Interface Kit for Tandy 2000. 26-5147 199.95*

*Installation Recommended. Not Included.

UPGRADE & EXPANSION OPTIONS



Add a Disk Drive to Your System

NEW FOR 87

279⁹⁵

3 1/2" 720K External Disk Drive. Gives twice the storage of a 5 1/4" disk drive and uses smaller, more durable diskettes. Special features in the Tandy 1000 EX allow you to store programs on this disk drive and load them directly. 25-1061, 279.95★

5 1/4" 360K External Disk Drive. Makes backing up diskettes much easier! Also very useful for personal productivity applications. 25-1060 249.95

Tandy 1000 Disk Drive Kit. Provides an additional 360K of disk storage. Mounts internally. Installation recommended (not included). 25-1005 199.95

Tandy 1000/1200/3000 Expansion

Digi-Mouse

Plugs in for easy cursor movement in graphics programs, as well as other applications. 26-1197 99.95

New! Memory PLUS Expansion Adapter

Expands your Tandy 1000 EX to 384K and adds DMA circuit to speed up computer operations. Sockets allow you to expand another 256K. Also provides connectors for addition of two PLUS Upgrade Boards. 25-1062 129.95★

New Low Price! Memory PLUS Expansion Board

Provides DMA and an additional 256K of memory—bringing your 128K Tandy 1000 to 384K. Add the 256K RAM Kit for a full 640K. PLUS Expansion Board (RS-232 or Mouse) can be plugged into a special connector, saving a slot for other applications. Was \$319.95 in RSC-16. 25-1011 179.95

New Low Price! 256K Parity Memory Kit

Add 256K of memory to your Tandy 1000, 1200 or 3000. Was \$219.95 in RSC-16. 25-3062 129.95

New Low Price! Memory Expansion Board

Uses an expansion slot to upgrade a 256K Tandy 1200 to 384K or a 384K Tandy 1000 to 512K. Also provides sockets for an additional 128K. For Tandy 1000/1200/PC/Compatibles. Was \$199.95 in RSC-16. 25-1009 129.95

New Low Price! 128K RAM Upgrade Kit

Use to upgrade your Tandy 1000 from 256K to 384K or from 512K to 640K. Was \$129.95 in RSC-16. 26-5162 99.95

New! 8087 Math Co-Processor

For Tandy 1000 (25-1000A or 25-1001A only), and 1200. Increase throughput up to 10 times with software that supports a co-processor. Supported by many CAD and spreadsheet programs and many more. 25-1012 229.95

Digi-Mouse Controller/Calendar Board

Dual-purpose board includes controller for Digi-Mouse™ and perpetual time/date. Never have to enter time and date again. For Tandy 1000/1200 only. 25-1010 99.95

New Low Price! 1200-Baud PC Modem

An auto-dial/auto-answer modem for the Tandy 1000/1200/3000, the IBM PC and PC compatibles. Features powerful automatic dialer commands that are compatible with virtually all communications software. Hayes® compatible. Switchable 1200/300-baud operation. FCC registered. Was \$299.95 in RSC-16. 25-1013 199.95

New! Dual Display Graphics Adapter

Combines the function of 3 boards in one. Uses VM-3 and CM-10 monitors. Displays up to 640 × 200 in 16 colors with special software. Features Hercules-compatible graphics mode for use with VM-3 monitor. 25-3045 249.95★

Deluxe Text Display Adapter

Allows your Tandy 1000, 1200 or 3000 to display text on the VM-1 Monochrome Monitor or CM-1 Color Monitor. 25-3046 249.95★

New Low Price! Deluxe Graphics Display Adapter

Allows your Tandy 1200 or 3000 to display high-resolution graphics (640 × 400) on the CM-1 or VM-1. Was \$499.95 in RSC-16. 25-3047 399.95

Hard Disk Controller Board

Allows you to add hard disk drives for up to 70 million characters of storage for data and programs. Compatible with most Tandy 1000 software—most programs transfer directly to hard disk. Includes cable for use with our 10, 15 or 35-Megabyte Hard Disks. 25-1007 299.95★

PLUS Upgrade Boards

These boards are specially designed for use with the Tandy 1000 EX or our Memory PLUS Expansion Board. You can also use them with the Tandy 1000 SX or any other PC compatible with the PLUS Upgrade Adapter Board. All PLUS Upgrade Boards are user installable with just a few simple tools.

New Low Price! PLUS RS-232C Option Card

Lets your computer talk with other computers and access national information services, when combined with communications software and external modem. Use with high-speed modems or serial plotters and printers. Was \$99.95 in RSC-16. 25-1014 79.95

PLUS Digi-Mouse Controller/Calendar Board

Dual purpose—includes controller for Digi-Mouse™ and a perpetual time/date clock. You'll never have to enter time and date again! 25-1015 99.95★

New! PLUS 300 Baud PC Modem

Great for use with the DeskMate and on-line services such as Comuserve, Dow-Jones and more! Switchable Tandy/Hayes® compatible modes. Connects directly to modular phone jack. FCC registered. Cable included. 25-1017 (Avail. 12/30/86) 99.95★

New! PLUS 1200 Baud PC Modem

Hayes™ compatibility lets you run the most popular communications software at higher speeds—reducing the cost of on-line time. FCC registered. 25-1018 199.95★

New! PLUS Network 4 Interface

Use the Tandy 1000 EX as a low cost system in an educational network. 25-1019 299.95★

PLUS Upgrade Adapter Board

Allows you to use PLUS Upgrade Boards in a standard PC card slot. 25-1016 14.95

* At press time, certain accessories had not been certified by the FCC. These devices may not be offered for sale until certified. Check with your local store about current status.

1000/1200/2000/3000 SOFTWARE

The *pfs* Series

Choose from this family of software for extremely user-friendly programs. Programs interact with each other so you only need to enter data once.

pfs:file

A very simple way to create and organize your own business or personal filing system. Store, retrieve and review information in a fraction of the time conventional filing takes.

Tandy 1000/1200. 25-1140 140.00

Sale! *pfs:report*

A powerful analysis tool that creates presentation-quality tabular reports from sales, inventory and other data stored in *pfs:file*. Sort from any data category and calculate averages, totals, subtotals and more.

Tandy 1000. Reg. \$125.00. 25-1141 Sale, 69.00

Tandy 1200. 25-3162 125.00

pfs:write

Easily create reports, letters and memos with advanced editing features and page headings and footers, centered text, right or left justification and more.

Tandy 1000/1200. 25-1142 140.00

pfs:graph

Turn complex numerical data into easy-to-read graphs. Accepts data from *pfs:file* or from the keyboard. Displays and prints data in bar, line or pie charts. Each chart can contain one to four graphs. Requires monochrome or color graphics.

Tandy 1000/1200. 25-1143 140.00

pfs:plan

Lets you organize a spreadsheet for planning, tracking, analyzing and reporting numerical data. You can even print a copy of your worksheet in a document produced with *pfs:write*.

Tandy 1000/1200. 25-1144 140.00

Database Management

Cornerstone

A full-featured relational database system designed specifically for non-programmers. Simply select menu options or complete forms to build complex databases, enter data and produce reports. The flexibility lets you change virtually any aspect of your database at any time. Add, delete or change files, fields, indexes, relationships or reports in seconds. Fields are variable-length, so you never need to determine field lengths in advance. Requires 256K and two disk drives.

Tandy 1000/1200/2000/3000. 26-5354 99.95

dBASE II

Powerful relational database management for easy manipulation of data using English-like commands. You can add, delete, edit, display and print your information. And you can change the file format at any time without re-entering data. Provides a maximum of 65,535 records per database file and 1000 characters per record. Requires 256K.

Tandy 1000/1200/2000/3000. 26-5352 495.00

dBASE III Plus

An ideal data management system for people who don't want to program, or a programming tool for those who prefer to create their own system. With our built-in Assistant, you'll be provided with new easy-to-use pull-down menus for creating, using and modifying databases. Our new Screen Painter lets you create custom screens as your business dictates. The Advanced Query System lets you build complex query requests just by selecting from pull-down menus. Finally, there's a new Applications Generator that creates entire applications programs without programming! A new Data Catalog and more than 50 new commands and functions help streamline applications development. Requires 384K, 2 floppy drives or one floppy and one hard drive. LAN mode requires 384K and 3.1 DOS.

Tandy 1200/3000. 25-3191 695.00

OFFIX

Create "file folders" that can be stored and retrieved from "file cabinet drawers", create documents and forms for folders, and produce reports and form letters based on the contents of the folder. Requires 256K.

Tandy 1000/1200 HD/2000. 26-5325 99.95

Spreadsheet Analysis

Microsoft Multiplan

This popular "second-generation" spreadsheet lets you transfer information between worksheets automatically. You can assign plain English names to any column, cell or area, vary individual column widths, center numbers and text within a column or align decimals. Sorting can be performed in alphabetical or numerical order. Cells can be set up individually, by row, column, block—or globally. Displays up to eight windows on the screen. Includes on-line help.

Tandy 1000/1200/2000/3000. 25-1163 195.00

Integrated Software

Sale! DeskMate

DeskMate is an easy-to-use, multifunctional software program that uses the same self-prompting commands throughout. Daily menu displays a calendar, appointment schedule and a list of files stored for every function. Choose from word processing, spreadsheet analysis, electronic filing, telecommunications, electronic mail and calendar/alarm. Telecom and Mail require modem.

Tandy 1200 HD/IBM PC Compatibles. Reg. \$199.95
25-3166 Sale, 99.95

DeskMate II

Includes all the features of DeskMate with the addition of a task-switching feature that allows the user to alternate between DeskMate II and another program with a few keystrokes.

Tandy 1000 SX. Included with CPU

Tandy 1000/2000. 25-1164 (Avail. 10/15/86) 199.95

Tandy 1200/PC Compatibles.
25-3167 (Avail. 10/15/86) 199.95

Tandy 3000. ... Included with MS-DOS (25-4103, \$99.95)

Personal DeskMate

An easy-to-use, graphics-oriented program with pull-down menus and "dialogue boxes" for selecting functions. Includes Text, Worksheet, Filer, Calendar, Telecom and Paint, a graphic picture editor. A Phone Directory, Calculator and Notepad may be accessed any time. TELCOM requires a modem.

Tandy 1000 EX. Included with CPU

Tandy 1000/1000 SX. 25-1165 (Avail. 10/15/86) 199.95

Lotus 1-2-3

An easy way to go from spreadsheet to graphics to information management—instantly! Change your spreadsheet data; then graph it in seconds. Search and sort data in your spreadsheet. "Macro" keys let you substitute a single keystroke for a long sequence. One keystroke brings you on-screen help. Features 256 columns and 2048 rows in spreadsheet and 2000 records in database. Requires 256K.

Tandy 1000/1200/3000. 25-1145 495.00

Tandy 2000. 26-5300 495.00

Framework II

This program doesn't just process numbers—it processes ideas. Each operation is placed in a "frame" that separates it from the rest of the program. Each frame is in an outline form, which you can rearrange or modify at any time. Just jot down notes or ideas in one frame, then create sub-frames for databases, spreadsheets, graphics and reports which relate to these ideas. Framework also utilizes a "desktop" format to view several operations at once on the screen. A special "zoom" function lets you instantly expand any frame to fill the entire screen. Requires 384K.

Tandy 1200/3000. 25-3192 695.00

TANDY 1000/1200/2000 SOFTWARE

MS-DOS Languages and Communication

Macro Assembler

Assembles symbolic instructions into machine code. Supports an expanded set of conditional directives. 26-5252 . . . 99.95

Lattice "C"

Lattice C compiler is a fast, two-phase compiler. 26-5254 . . . 499.00

FORTRAN Compiler

From Microsoft. A subset of FORTRAN-77 for scientific and engineering applications. 26-5255 . . . 349.95

PASCAL Compiler

From Microsoft. Compatible with the ISO proposed standard. Generates machine code. 26-5256 . . . 299.95

COBOL Compiler

Includes an editor, interactive debugger, CRT control and a single-pass compiler. 26-5257 . . . 595.00

OmniTerm 2

Communicate with a mainframe or Tandy XENIX host as a VT100 terminal, access information services, communicate with other micros or auto-answer and file transfer in the unattended mode. 25-1160 . . . 129.95

Softerm 2000

A communications and terminal-emulation program to access bulletin boards, information services and mainframes. Emulates over 20 character and block-mode terminals. Requires 256K. 26-5261 . . . 149.00

T-1000 Protocol Converter

Lets your computer or terminal access IBM host computers using BSC, SNA/SDLC or Channel Attachment Operations. Emulates an IBM 3278-2 via direct type A coax connection. Requires terminal emulation software, such as Softerm 2000 (26-5261). UL listed. 26-1169 . . . 995.00

Tandy 2000 Communications

BIS 3780

Allows a Tandy 2000 to communicate with an IBM bisynchronous protocol host with any IBM S/360, S/370, 30XX and 43XX host or non-IBM hosts using standard IBM SNA/SDLC or IBM bisynchronous protocol. Your computer functions as a remote terminal on a Remote Job Entry (RJE) terminal. MS-Assembler (26-5252) may be required if mode reconfiguration is needed. 26-5258 . . . 695.00

BIS 3270

Allows a Tandy 2000 to communicate with a mainframe over point-to-point or multi-point telephone lines (via a synchronous modem or modem eliminator) with any IBM S/360, S/370, 30XX and 43XX host or non-IBM hosts using standard IBM SNA/SDLC or IBM bisynchronous protocol. Emulate an IBM 3271/3274/3275/3276 display station and a 3284/3286 printer. 26-5259 . . . 695.00

CLEO-3270 Cluster Controller

Emulate a remote IBM 3276-2 cluster controller with an IBM 3287 printer attached (via a synchronous modem or modem eliminator). Your cluster can consist of up to four other computers emulating IBM 3278 display stations. Requires 256K system and serial Expansion Board (26-5164). 26-5262 . . . 980.00

Tandy 2000 Serial Expansion Board

Connect your Tandy 2000 to a mainframe computer, or hook terminals or additional serial devices to the Tandy 2000. Includes four serial channels with connectors. 26-5164 . . . 325.00

Tandy 2000 Programmer's Reference Manual

Contains information for assembly language programmers, including entry conditions for MS-DOS. 26-5403 . . . 19.95

Tandy 2000 Hardware Reference Manual

Introduces schematics and theory of operation for troubleshooting, designing interfaces and more. 26-5404 . . . 24.95

Tandy 1000 Learning Programs

Educational

New! Robot Odyssey

A science adventure for sharp teens and adults. Robotropolis is an underground city populated by robots that you must escape from. To unlock the secret exit you must design friendly robots, navigate invisible mazes, solve puzzles and sneak past sentries. 25-1135 . . . 34.95

New! Rocky's Boots

Hailed as a software classic by the New York Times, the award winning Rocky's Boots helps develop skills in logical problem solving, abstract reasoning, and creative thinking. The concepts of electronic circuitry, circuit design and logic are explored in a motivating environment where players invent machines to solve puzzles and win over 30 different games, including games they design themselves. By experimenting with simulated real-world electronic parts and "electricity," players as young as 9 years old can learn basic computer logic. 25-1139 . . . 34.95

New! Below The Root

Based on Zilph Snyder's recently published Green-Sky Trilogy, Below The Root combines the story-building aspects of a text adventure with hundreds of colorful graphics. It also combines fast-paced excitement with a unique text menu—a first in the field of adventure games. 25-1136 . . . 29.95

Wiz Type

Your children learn to type words, sentences and paragraphs in

a game with the characters from the comic strip "The Wizard of Id". Twenty typing levels to choose from. 25-1114 . . . 34.95

Typing Tutor III

The fastest, most effective way to learn how to type on your computer. Features Letter Invaders™, the arcade game that sharpens your typing skills. Also runs on the Tandy 1200 HD, the IBM PC and PC compatible computers. 25-1126 . . . 49.95

Mastering the SAT

Comprehensive and self-paced, the program places emphasis on the principles involved in each question and its solution, as well as test-taking strategies. 25-1127 . . . 99.95

The FUNDamentals

A self-paced teaching program and manual designed to teach the new user the basics of operating computers in general, and the Tandy 1000.

Tandy 1000. 25-1124 . . . 29.95

Tandy 1000 SX. 25-1166 . . . 29.95

Tandy 1000 EX. 25-1167 . . . 29.95

Millionaire

A remarkable simulation of the real world of stock market investing. 26-5384 . . . 49.95

The FUNDamentals/TM Digital Learning System. Mastering the SAT/TM CBS Software. Robot Odyssey and Rocky's Boots/TM The Learning Co. Typing Tutor III/TM Simon & Schuster. Wiz Type/TM Sierra On-Line. BIS 3270 and BIS 3780/TM Micro Integration. CLEO-3270 Cluster Controller/TM Phone I Inc. Fortran Compiler, PASCAL Compiler and Macro Assembler/TM Microsoft Corp. Softerm 2000/TM Softronics. T-1000 Protocol Converter/TM Avatar Tech. Millionaire/TM Blue Chip Software. Below the Root/TM Windham Classics.

1000/1200/2000/3000 SOFTWARE

Accounting

Quartet

A Tandy exclusive! Quartet includes four integrated accounting programs to give you the most up-to-date information on your company's financial health. Track your business records with programs for General Ledger, Accounts Receivable, Accounts Payable and Payroll. Quartet was designed for ease of use, fast data entry and on-line updating of ledger accounts. Features a convenient search function and automatic look-up of records. Quartet provides easy access to invoices, bills, paychecks, expense checks and ledger transactions and can create user-defined reports for customers, vendors, employees and items. Entries are made only once. Any related data is automatically updated to the General Ledger. Since all Quartet functions are integrated, there is no constant disk swapping as on many systems. Best of all, easy-to-read formatted screens look much like the invoices, check registers and payroll registers you're already using. Quartet can be used to print user-formatted financial statements with or without comparisons to previous years. Also prints invoices, monthly statements, payroll checks and expense checks. Includes well-defined audit trail. Uniformity of functions throughout the program makes Quartet especially easy to learn. Comes with sample data. Requires 256K and two disk drives or hard disk.

Tandy 1000/1200/2000/3000. 25-1146 399.95

Tandy 3000 XENIX Multiuser Software

Powerful, fully integrated multiuser software. See page 25 for full descriptions.

General Ledger. 25-4301 599.00

Payroll. 25-4303 (Avail. 12/30/86) 699.00

Accounts Receivable. 25-4304 599.00

Accounts Payable. 25-4305 599.00

Order Entry. 25-4307 599.00

Sales Analysis. 25-4308 399.00

Personal Accounting Software

Finance Manager

Helps you gain a better understanding and control over your personal and business financial needs. Create net worth statement and budgets, determine net profit, print checks, account for taxes, monitor your income and expenses and analyze investment opportunities. Automatic check printing and checkbook reconciliation are both included. A search capability can be used to recall any recorded transaction. All income and expense activities can be entered into a budget that is automatically updated and represented graphically. All taxable transactions can be recorded and retrieved later for tax preparation. Includes a program that will turn your personal computer into a sophisticated financial calculator. Calculates net present value, future values and loan amortization schedules.

Tandy 1000/1200/3000. 25-1148 99.95

Managing Your Money

Andrew Tobias' Managing Your Money is seven programs in one integrated, personal financial management package. Managing Your Money serves as a reminder pad and a complete budget and checkbook program. It helps with tax estimation and can even print out your schedule D. The program evaluates your family's present life insurance needs and suggests how you can improve your coverage. It is a financial calculator which can perform rental property analysis and financial planning. The sophisticated portfolio manager handles as many real or hypothetical stocks, bonds and options as you like, and can also manage collections such as wines, coins or paintings. And it's easy to use. Wherever you are in the program, just press the ESCape key for a HELP message. The HELP messages tell you how to work with the program and, where appropriate, also provide financial guidance.

Tandy 1000/1200/3000. 25-1159 199.95

Finance Manager/TM Interactive Software. HomeWord Plus/TM Sierra On-Line. Managing Your Money/TM Meca. Micro Illustrator/TM Island Graphics. Microsoft Word/TM Microsoft Corp. Quartet and SCRIPSIT/TM Tandy Corporation. VersaCAD /TM T & W Systems.

Word Processing

SCRIPSIT®

Includes features of a dedicated word processor. Control-key functions can be displayed on the screen for quick and easy reference. And the built-in spelling corrector and verifier from Houghton-Mifflin not only finds misspellings, but corrects them automatically. Allows merging with dBASE files. And of course you get the features you've come to expect with the name SCRIPSIT: global search function, easy editing features, on-screen format reference and more. Extremely easy to learn and use. Requires 256K and two disk drives.

Tandy 1200/3000. 25-3171 299.95

Tandy 1000/2000. 25-1155 299.95

Tandy 3000 XENIX. Requires 640K.

25-4213 (Avail. 9/30/86) 499.00

Microsoft Word 3.0

Add our optional Digi-Mouse and move text and select commands without even using the keyboard! Word displays up to eight windows at once, so you can move text from one document to the other with ease. Text is displayed in boldface, italics, underlines, super and subscripts, small caps—all without any confusing symbols. More information on the various commands are displayed by pressing a single "help" key. Use with our color monitor and enjoy color-coded text. Requires 256K.

Tandy 1000/1200/3000. 25-1162 450.00

Microsoft Word

Tandy 2000. Ver. 1.0. Requires graphics. 26-5314 ... 375.00

HomeWord Plus

No complicated commands to memorize, no hefty manuals to flip through! HomeWord is so easy to use, adults or children can start word processing almost immediately! Instructions on cassette tape and an easy-to-follow instruction manual take you through basic word processing functions. And the program's identifiable icons make it a snap to print, edit, delete or move copy. Using the built-in spelling dictionary, HomeWord Plus automatically searches for misspelled or unknown words. Correct a misspelled word once and HomeWord Plus corrects it throughout the remainder of your text. HomeWord Plus includes 45,000 words, and you can add up to 5000 more.

Tandy 1000. 25-1161 69.95

Graphics

Micro Illustrator

Draw beautiful pictures and designs on your computer. No programming experience needed—all commands are on the icon-driven menu. Just point to choose shapes, colors, patterns, special effects and brushes. Save your pictures on disk and create your own picture show.

Tandy 1000. 25-1120 29.95

VersaCAD Entry-Level

A general-purpose design and drafting program that contains much of the power found in software five times the cost. Menu-driven operation and plain-English prompts guide you through the program as you work. Productivity features include 10 built-in primitive objects; ability to quickly group objects for collective manipulation; interactive editing (the object being worked on blinks on the screen and visually changes); total flexibility of object attributes (color, linestyle, etc.) on any drawing level (attributes may be changed at any time with a function key); unlimited zoom; auto-dimensioning; inquiry about object locations, area, perimeter totals, etc.; drawing aids, such as center marker and template lines; snap at any time to an object; grid intersection or user-defined spacing increments; output to pen plotter or graphics printer with user-defined plot specifications; and automatic drawing recovery from error or power failure. Includes written tutorial and introductory audio tape. Requires 256K, two disk drives, graphics monitor and Tandy GT-2000 digitizer.

Tandy 1000/1200/2000. 26-5282 399.95

TANDY 1000 HOME SOFTWARE

Games

New! Star Flight

Explore strange new worlds and new civilizations. Boldly go where no man has gone before—then figure out how to communicate with the aliens you find there. A state-of-the-art role-playing adventure set in outer space. Develop and play six characters: Captain, Science Officer, Navigator, Medical Officer, Communications Officer, and Chief Engineer. Explore over 20 unique star systems, each displayed in stunning graphic detail. 25-1137 (Avail. 10/30/86) 49.95

New! Rogue

A college classic, Rogue is so full of unpredictable monsters, ever-changing magic and hidden dangers that it's never the same game twice. 25-1134 29.95

New! Black Cauldron

A Walt Disney 3-D animated adventure game. You must find the Black Cauldron and defeat the forces of the wicked Horned King by destroying the cauldron's magical powers. 25-1133 (Avail. 9/30/86) 34.95

New! Winnie The Pooh

Walt Disney's Winnie The Pooh and his friends will capture your child's imagination while developing necessary skills and building knowledge. 25-1132 (Avail. 10/30/86) 34.95

Demon Attack

Waves of winged demons are invading. Armed with laser cannons and missiles, you must defend your home from the interplanetary warriors. 25-1110 29.95

One-on-One

Basketball superstars Larry Bird and Julius "Dr. J." Erving helped design this exciting simulation game. Try 360-degree slam dunks, turn-around jump shots, rebounding for tip-ins and more. For one or two players. 25-1111 34.95

Pinball Construction Set

Comes with five built-in pinball machines, or choose from 32 game parts to build your own. 25-1112 34.95

Lode Runner

To find the stolen treasure, you, the Galactic Commando, must run, jump, drill special passages and outsmart the Bungeling guards if you're to succeed. More than 150 game screens! 25-1113 29.95

BC's Quest for Tires

An exciting action game featuring characters from the comic strip "BC". Follow Thor as he zips around aboard his prehistoric unicycle trying to rescue the Cute Chick from the hungry dinosaur. 25-1115 34.95

King's Quest

Enter an adventurous world of three-dimensional graphics, sound and animated characters. Guide brave Sir Graham on his quest and return the king's treasures! Different mysteries and obstacles await you each time. 25-1117 39.95

Cutthroats

By Infocom, the makers of Zork I. You're the chief diver at a backwater island, working for some shady characters. Can you recover the treasure? Also runs on the Tandy 2000, Tandy 1200 HD, the IBM PC and PC compatibles. 25-1121 39.95

Touchdown Football

This is grid-iron action at its toughest and most exciting. Challenge the computer opponent with your own run, pass, punt and kick strategies. Program your offense and defense as you like. 25-1123 29.95

Flight Simulator

A real-time flight simulation program. The simulation considers 35 important aircraft characteristics and includes an out-the-window three-dimensional dynamic flight display and extensive flight controls. 26-5379 49.95

New! F-15 Strike Eagle

A challenging and exciting air combat from the modern electronic cockpit! You'll fly combat missions, engage enemy aircraft, and destroy enemy ground targets in the skies of Southeast Asia, Europe, and the Middle East. 25-1125 34.95

New! Ghostbusters

Based on the hit movie. Program features the bouncy theme song from the hit movie, voice synthesis and the ever-present danger of The Marshmallow Man. 25-1138 34.95

Infocom Sampler

The Sampler is the perfect way to introduce yourself to the addictive pleasures of Infocom. It contains portions of four different types of stories: Zork I, The Witness, Planetfall and Infidel. 25-1129 7.95

King's Quest II—Romancing the Throne

Enter a strange and wonderful adventure world as you guide King Graham on his quest to free his queen-to-be from a jealous enchantress. Different mysteries and obstacles await you each time you play. Also runs on the Tandy 1200 HD, the IBM PC and PC compatibles. 25-1128 39.95

Pipes

Arlo the Plumber needs your help to bring water to the people of Gilroy. Help him choose pipe from the factory, connect them to the houses and tie your new system to the water supply. Be frugal and plan your systems well, or you'll both end up all wet. Levels of difficulty increase with the number of houses in Gilroy. 25-1108 29.95

Learning with Leeper

Leeper will lead your children through four award-winning preschool games and help prepare them for reading, writing and math. Features shape matching, counting, eye-hand coordination and creativity skills. 25-1118 34.95

Spinnaker Software

Facemaker

Helps children become comfortable with computer fundamentals by playing fun, simple games. Build an animated face by choosing eyes, noses, ears and more. Helps improve concentration. 25-1100 29.95

Kids on Keys

Children learn with the computer keyboard as they identify numbers, letters and words. A "picture editor" lets kids change or create new pictures. 25-1101 29.95

Kindercomp

A series of games for pre-schoolers. Kids create colorful drawings, identify number sequences, create repeating word patterns, match letters and numbers and more. 25-1102 29.95

Fraction Fever

Helps children develop an understanding of fractions. Kids hop an animated "pogo stick" to match the correct picture with the fraction shown on the screen. 25-1103 29.95

Alphabet Zoo

Children learn to associate letters of the alphabet with the sounds they represent in two exciting maze games. Colorful pictures and music accompany the program. 25-1104 34.95

Kidwriter

Your children create their very own storybook with colorful scenes, text and music. The picture-stories can be saved on disk and loaded again at a later time. 25-1105 29.95

Trains

An economic simulation program. You're in charge of a railroad empire. It's up to you whether your business succeeds or fails. Make deliveries, stay on schedule and clear enough money to keep rolling. 25-1107 29.95

Alphabet Zoo, Facemaker, Fraction Fever, Kids on Keys, Kindercomp, Kidwriter and Trains/TM Spinnaker. B.C.'s Quest for Tires, King's Quest I and II and Learning With Leeper/TM Sierra On-Line. Cutthroats and Infocom Sampler/TM Infocom. Demon Attack and Touchdown Football/TM Imagic. Flight Simulator/TM Microsoft Corp. Lode Runner/TM Broderbund. Star Flight, One-on-One and Pinball Construction Set/TM Electronic Arts. Pipes/TM Activision. Rogue/TM Epyx. Ghostbusters/TM Columbia Pictures. F-15 Strike Eagle/TM Microprose.

MODEMS & VIDEOTEX SOFTWARE



Communications Modems

Use with any RS-232C-equipped computer. Full duplex, originate/answer, 300 bps. Bell 103 compatible. FCC registered. U.L. listed.

Acoustic Coupler

A AC-4. Accommodates round or square handsets—ideal for use in hotel rooms where direct connection may not be possible. Also half duplex.
26-1179 119.95

New! Intelligent Modem

B DCM 7. Switch selectable between Hayes® and Tandy command sets. Easy-to-use auto-dial/auto-answer. Connects directly to modular phone jack.
26-1394 99.95

Sale! Direct-Connect Modem

C DCM 3. Plugs directly into modular phone jack. Works with either DB25 or 4-pin connector (Color Computer type). Includes a modular phone cable. Reg. \$59.95. 26-1178 Sale, 39.95



NEW FOR 87

High-Speed Intelligent Modem

199⁹⁵

DCM 212. This auto-dial/auto-answer modem is switch selectable between Hayes® and Tandy command sets. Easy-to-use menu-driven operation automatically selects 300 or 1200 bps rate. Bell 212A compatible. Avail. 10/30/86.
26-1385 199.95



Integrated Phone and Modem Gives You 2 Devices in 1

Modemfone™ 100. Get the extraordinary convenience of a telephone and modem in one affordable unit. Telephone features switchable Touch-Tone/pulse dialing, adjustable ringer volume and one-button touch redial. Hearing aid compatible. Modem features full duplex, originate/answer, 300 bps. Standard RS-232C computer connection. Bell 103 compatible. FCC registered. U.L. listed AC adapter.
26-1386 99.95



RS-232C Selector Switch

149⁹⁵

SW-303. Connect three RS-232C devices to your computer. One configurable port for communications. U.L. listed. Cables not included. 26-1499 149.95

Access Information by Phone

CompuServe Information Service

Get "on line" with this exciting information service—and the first hour is free! CompuServe offers local, national and international news (read headlines before they've gone to press!), weather and sports from major newspapers like *The New York Times* and *The Washington Post*, plus the full newswire service of the Associated Press. Get historical information and updates on over 32,000 stocks, bonds and securities. There's also a home and educational reference service and computer games. Send and receive "electronic mail". Get 16K of RAM workspace and 128K of disk storage. All this available at CompuServe's low hourly rate (additional charges for some services).

Dow Jones News/Retrieval

A "direct line" to Wall Street—and the first hour is free! Dow Jones News/Retrieval gives you current market quotes (subject only to the mandatory 15-minute delay) on all stocks, bonds and options traded on the major exchanges—plus selected U.S. Treasury issues. Detailed financial statistics compiled by Media General Financial Services are available for all NYSE and AMEX traded companies. There's also "electronic editions" of *The Wall Street Journal*, *Barron's* and the Dow Jones "Broadtape"—as recent as 90 seconds and as far back as 90 days.

Low-Cost Videotex Packages

Videotex software packages allow access to national information networks and data bases using your computer and an optional-extra telephone interface. Simply dial a phone number (usually local), press a few keys and the desired information appears on your screen. Each easy-to-use package includes a Videotex software manual, CompuServe manual, ID number and password, and a Dow Jones manual and password. You also get one FREE hour on both the CompuServe and Dow Jones! After that, you'll be billed at their low hourly rates.

Color Computer Package. 26-2222 29.95

Universal Sign-Up Kit. Includes information kit for CompuServe and Dow Jones. Requires software or terminal emulation.
26-2224 19.95

Videotex Plus

A powerful and sophisticated communications package for your disk system. Videotex Plus lets you communicate with any computer information service (with the same communications protocol as Videotex), such as CompuServe and Dow Jones News/Retrieval. It's simple to use, yet loaded with features to help you minimize connection time. Requires modem.

Model I/III Package. 26-1588 49.95

Model 4 Package. Same as above. 26-1598 49.95

Tandy 2000 Package. Same as above. 26-5260 49.95

Use Modems only with Bell-compatible equipment. Direct-connect modems are not for multi-line use without optional-extra controller. Hayes/TM Hayes Microcomputer Products, Inc. Modemfone/TM Tandy Corp. CompuServe/TM CompuServe, Inc. Dow Jones News/Retrieval/TM Dow Jones & Co., Inc.

CHRISTMAS SAVINGS ON OUR



A True Family Computer

SALE!

Save \$60 **99⁹⁵** Reg. 159.95

Less TV and Program Paks

- Write Sophisticated Programs and Create Color Graphics
- Access 32,000 Characters of Memory With Built-In Extended BASIC Language
- Add a Color Disk Drive and OS-9 Operating System to Access the Full 64K

64K Extended BASIC Color Computer 2. Learn to program or use ready-to-run software. Ideal for a variety of small business and professional uses, too. Simple, one-line commands make detailed color graphics easy to create. Perfect for drawings, designs, charts, engineering applications—even animation! Features 256 × 192 screen resolution (49,152 pixels); multi-character variable names; string arrays up to 255 characters; full-featured editing; tracing; floating point 9-digit accuracy; trigonometric functions; user-definable keys; specific error messages; and more. Software is available for personal and household tasks, education and entertainment. Easy to expand. Attaches to any TV. Includes tutorial manuals. UL listed. 26-3127 Sale, 99.95



Increase Data Storage

Save \$100 **199⁹⁵** Reg. 299.95 156,672 Characters of User Storage Per Diskette

FD-501 Color Thinline Disk #0. Turn any Color Computer with Extended BASIC into a complete disk system and store over 156,000 characters of data. Write your own programs or use ready-to-run software. Includes 5 1/4" double-density, 35-track floppy disk drive; Program Pak cartridge containing the Disk Operating System; cable; blank diskette; manual and operator's instructions. UL listed. 26-3131 Sale, 199.95

Second Drive for FD-501. Adds 156K of storage. Requires installation (not included). 26-3132 179.95

Save \$69⁹⁵ When You Buy DeskMate™ and a Disk Drive

Complete package includes the FD-501 Floppy Disk Drive and DeskMate 6-in-1 Program. Reg. separate items \$399.90.

For the Color Computer 2.
26-3131/26-3259 329.95

For the Color Computer 3.
26-3131/26-3262 329.95

Color Computer Upgrade Kits

16K RAM Upgrade Kit. Converts a 4K Color Computer to 16K to use larger, more sophisticated programs. 26-3015 29.95*

Low-Profile Keyboard Kit. Upgrades any Color Computer with the old keyboard to our newer version. 26-3016 24.95*

64K RAM Upgrade Kit. Converts a 4K, 16K or 32K Color Computer to the same memory used in 26-3127. 26-3017 59.95*

Extended BASIC ROM Kit. Allows advanced graphics or disk drive capability. Requires 16K RAM. 26-3018 39.95*

*Installation required (not included). Some installations may require additional-cost hardware.

POPULAR COLOR COMPUTERS



Superb Graphics Resolution and Uncompromising Performance at An Incredible Price

SALE! Save **\$20** **199⁹⁵** Reg. **219.95**

- Choose From a Palette of 64 Brilliant Colors
- Produce Sharp, Crisp Graphs and Illustrations
- Display 32 × 16, 40 × 24 or 80 × 24 Text
- 160 × 192, 320 × 192 or 640 × 192 Resolution
- Use With a High-Resolution Monitor or Your Own TV
- Expands Easily As Skills and Needs Grow

128K Extended BASIC Color Computer 3. Introducing Radio Shack's newest version of our famous Color Computer. The Color Computer 3 can be used in a variety of applications such as graphics, programming, budgets, word processing, database management, spreadsheet analysis and many others. The Color Computer 3 comes with 128K memory (expandable to 512K), and gives you the advantage of greater programming and data processing power, as well as higher resolution graphics. Simply connect the Color Computer 3 to a high-resolution monitor—

like the new CM-8 monitor (sold separately, at right)—and you can create incredibly detailed charts, graphs and engineering drawings in vivid colors. The special higher graphics mode lets you paint 160 × 192 or 320 × 192-resolution graphics using 16 out of the 64 total colors. Or produce razor-sharp 640 × 192-resolution in 4 colors. The 21 new commands featured in the Color Computer 3's Extended BASIC language allow you to switch between screens, colors and backgrounds at a higher resolution and in a greater variety of colors than any previous Color Computer. When connected to a TV, the Color Computer 3 will display text in a 32-character by 16-line format. Get a 40-character by 24-line or 80-character by 24-line display with a monitor. Best of all, the new Color Computer 3 is compatible with software and accessories designed for the Color Computer 2 (in the Color Computer 2 mode). Expands easily with disk drives, printer, telephone modem and more. UL listed AC. 26-3334 Sale, 199.95

New! High-Resolution Color Monitor

CM-8 RGB Analog Color Monitor. Designed for use with the Color Computer 3. Displays up to 80 × 24 text and 640 × 192 graphics. It is the perfect complement to the superb graphics capabilities of the Color Computer 3. The CM-8 features a 13" diagonal screen and a built-in speaker with volume control. Includes cable. UL listed AC. 26-3215 299.95

SPECIFICATIONS FOR COLOR COMPUTER 3. Microprocessor: 6809E 8-bit. Clock Speed: 0.894 MHz or 1.788 MHz. Keyboard: 57 keys, including Function, Alternate, F1 and F2. Video Display: 16 lines of 32 characters (uppercase only) to 24 lines of 80 characters (uppercase/lowercase). Color graphics capabilities range from 64 × 32 (8 colors) to 640 × 192 (4 colors and background color) with 6 intermediate display formats. High-resolution graphics in the same range available through machine language, Extended BASIC or Program Paks. Memory: 128K RAM—internally expandable to 512K. Twenty-one commands in enhanced Extended BASIC. Input/Output: 1500-baud cassette (recorder optional). Two joystick ports. RS-232C serial port (4-pin only). Standard TV (300 ohms), composite monitor and RGB Analog Monitor outputs. Dimensions: 3 × 10³/₈ × 14³/₄". Power: 120VAC, 60 Hz.

SPECIFICATIONS FOR COLOR COMPUTER 2. Microprocessor: 6809E, 8-bit. Clock Speed: 0.894 MegaHertz. Keyboard: 53 keys. Video Display: 16 lines of 32 characters (upper case only). Color graphics capabilities range from 64 × 32 (8 colors) to 256 × 192 (1 color and background color) with three intermediate formats. Memory: 16K ROM and 64K RAM. Input/Output: 1500-baud cassette (recorder optional). Two joystick ports. RS-232C serial port (4-pin only). Standard TV (300 ohms) output. Dimensions: 3 × 10³/₈ × 14³/₄". Power: 120VAC, 60 Hz.

COLOR COMPUTER ACCESSORIES



A Color Mouse. Adds speed and ease to games and graphics creation. Simply "roll" the mouse across tabletop (or any flat surface) to accurately position cursor. You can use it alone or with a joystick.
26-3025 49.95

B Joysticks. Our lowest-priced joystick. Now two players can experience the fun and excitement of games at the same time. Fast 360° movement! Single-shot button.
26-3008 Pair/19.95

C Deluxe Joystick. Our best! Patented stick mechanism gives you more accurate cursor control and quicker response. Dual-axis trim controls adjust to your touch—allowing you to "fine tune" joystick to your game, business and graphics software. Select "spring-centering" or "free-floating" operation.
26-3012 Each 29.95



A Multi-Pak Interface. Connects up to four Program Pak™ cartridges to your Color Computer at once! No more plugging in and unplugging cartridges. Connect disk drives and other accessories, too. Change between slots with selector switch or under program control. U.L. listed.
26-3124 99.95

B DC Modem Program Pak. RS-232 interface and 300-baud, originate/answer modem. Transfer/receive ASCII files or access information services by phone.
26-2228 89.95

C Deluxe RS-232 Program Pak. Frees serial port for optional printer while you communicate with major information services and with other computers over telephone lines. Software is built in. Requires modem.
26-2226 79.95



A Sound/Speech Cartridge. Adds sound, three voices and noise to your BASIC programs. 26-3144 79.95

B Hard Disk Interface. Use your Color Computer with Primary Drives. Requires 64K, Multi-Pak Interface, floppy disk with controller and OS-9 (2.0 or later). 26-3145 129.95

C Orchestra-90 CC. Create highly sophisticated electronic music and sound effects with your computer and listen to it on your home stereo. Both musicians and non-musicians can compose in six octave ranges in up to five voices. Simulate various instruments and percussion. 26-3143 79.95

D Appliance/Light Controller. Connect lights and appliances to Plug 'n Power™ remote control modules (sold separately), attach the controller to your Color Computer, then program times and events. U.L. listed. 26-3142 99.95



Electronic Book Makes Learning Fun

24⁹⁵

Four Fun Programs Available Separately

Electronic Book. Your kids will spend hours learning the fun way! Each of the software packages (sold separately, below) contains "pages" which compose the Electronic Book. Different areas of the book's touch-sensitive surface are pressed to make selections. Interactive routines make learning a game. Safe for kids to use, too—plugs into joystick port. Requires 16K Color Computer and cassette recorder. 26-3141 24.95

Maze Master. 26-2541 19.95

Shape Maker. 26-2542 19.95

The Number Factory. 26-2543 19.95

Word Wizard. 26-2544 19.95

Orchestra-90/TM Software Affair.

COLOR DISK SOFTWARE

Childpace

Track your child's early development from 3 months to 5 years old. Evaluates dexterity, language, personal and social skills. 26-3248 39.95

D.L. LOGO

Programming language designed to run under OS-9. Includes "MUSIC" to play songs with up to 4 voices, "SAY" for support of Speech/Sound cartridge, and joystick support. 26-3033 99.95

OS-9 Disk Operating System

Accesses the entire memory of our 64K Extended BASIC Color Computer. 26-3030 69.95

New! OS-9 Level II

Same as OS-9 (above), but with enhancements for Level II to support 512K RAM and dual speed. 26-3031 (Avail. 9/30/86) 79.95

PASCAL-09

A complete implementation of this structured programming language. Requires OS-9 DOS. 26-3034 99.95

BASIC-09

An enhanced version of standard BASIC written for the 6809 microprocessor. Includes advanced features derived from PASCAL. Requires OS-9 DOS. 26-3036 99.95

C Compiler

A high-level language that produces assembly language source code for the 6809 microprocessor. Requires OS-9 DOS. 26-3038 99.95

OS-9 Screen Print

Print high-res Color Computer graphics. Requires CGP-220 for four-color printouts or dot-matrix printer with bit-image mode for B&W. Requires OS-9 DOS. 26-3221 14.95

OS-9 Profile

A personalized electronic filing system. Requires 64K and OS-9 operating system. 26-3274 49.95

New! Phantomgraph

Create graphical depictions of data from either database or user input. Incorporate graphs and text, too. 26-3276 (Avail. 12/30/86) 49.95

TRSCOPY

Allows transfer of text files between "OS-9" disks and "Color Computer Disk Basic" disks. 26-3263 24.95

COOKBOOK

Two programs in one—an all-purpose menu planner and recipe index file. 26-3257 39.95

TSEDIT

A high-resolution screen editor that allows upper and lower case in lines from 32-80 columns. 26-3264 34.95

TSWORD

A format program that forms a powerful OS-9 word processing package when combined with TSEDIT. Illustrated menus. Requires 64K. 26-3267 34.95

New! TSSpell

A spelling checker/corrector designed to run under OS-9 in conjunction with TSWORD. 26-3266 (Avail. 11/30/86) 39.95

Investograph

Charts stocks and trends. Features high-resolution graphics. 26-3258 49.95

Cash Budget Management

A sophisticated personal or small business bookkeeping program. Features ready-to-use income, expense and cash

categories—and you can define your own.

26-3261 49.95

New! DeskMate 3

We've made the popular DeskMate even better. DeskMate 3 is an integrated package of seven commonly used personal productivity applications on one disk.

26-3259 (Avail. 9/30/86) 99.95

DYNACALC

A powerful electronic spreadsheet. Features up to 256 columns or 256 rows of cells. Requires 64K and OS-9 DOS.

26-3275 99.95

New! Mickey's Space Adventure

Children will learn problem-solving skills while operating a spacecraft. 26-3247 (Avail. 10/30/86) 29.95

Biosphere

An ecological simulation game that teaches children to create a workable ecology. Requires 64K. 26-3280 29.95

Robot Odyssey I

Helps develop skills in logical problem solving, abstract reasoning and creative thinking. Requires 64K. 26-3284 34.95

Rocky's Boots

Players invent machines to solve puzzles and win over 30 different games, including games they design themselves. Requires 64K. 26-3283 34.95

PAN

Write your own songs! Includes everything you need to compose music in three-part harmony. 26-3279 29.95

New! Zone Runner

Transport various items between the outposts of the galaxy while avoiding the patrols, pirates, escorts and mines.

26-3286 (Avail. 12/30/86) 29.95

Pegasus and the Phantom Riders

Destroy waves of attackers. Requires joystick or Color Mouse. 26-3281 29.95

Pitfall II

Help Pitfall Harry on a treacherous journey to recover the magnificent Raj diamond. Requires 64K RAM and joystick. 26-3287 29.95

One-on-One

Dr. J (Julius Erving) and Larry Bird play basketball, one on one style. Control either player and try to win. 26-3288 34.95

Flight Simulator

Learn the basics in manual control of ailerons (pitch and roll), compass readings, take-off and landing and more. Requires 64K and joystick. 26-3108 24.95

Varloc

Chess pieces must wage a battle for victory of each square. You control one side, the computer the other. 26-3291 29.95

Desert Rider

How long do you think you can survive this treacherous, grueling motorcross track? Joystick required. 26-3292 29.95

Ghana Bwana

You're in an outrigger trying to reach an island. Obtain the treasure and win. Joystick required. 26-3293 29.95

New! Rogue

Rogue is so full of unpredictable monsters, ever-changing magic and hidden dangers that it's never the same game twice. 26-3297 (Avail. 10/30/86) 29.95

New! The Interbank Incident

You try to find the thieves who have stolen a code book from the Interbank Corporation. 26-3296 29.95

OS-9 and BASIC-09/TM Microware and Motorola. UNIX/TM AT&T. DeskMate/TM Tandy Corp. DYNACALC/TM Computer Systems Center. Mickey's Space Adventure/TM Walt Disney. Robot Odyssey I and Rocky's Boots/TM The Learning Co. Pitfall II/TM Activision. One-on-One/TM Electronic Arts. Flight Simulator/TM Microsoft. Rogue/TM Epyx, Inc.

COLOR COMPUTER SOFTWARE

DeskMate

Now our popular DeskMate software is available for the Color Computer! Color Computer DeskMate is an integrated package of seven commonly used personal productivity applications on one disk: Text, Ledger, Index Cards, Paint, Telecom, Calendar and Calculator. DeskMate is very user friendly. You can easily select an application (identified by name and icon) with your mouse, joystick or keyboard arrow keys.

TEXT—A general-purpose text entry and editing program that performs search and replace; file merge; and block select, copy and delete. It's ideal for writing correction-free letters, memos and short reports.

LEDGER—A simple spreadsheet which includes an easy-to-use menu and automatic column formatting. You can use Ledger to do budgeting, sales forecasting, profit and loss projections and other "What if...?" calculations.

INDEX CARDS—A personal filing system. You can enter and edit data and perform simple sorts and searches. It's ideal for keeping track of names and addresses.

PAINT—A four-color picture editor to create graphics screens. You can easily create lines, shapes, patterns, fill in areas with color and enter text. Using Paint, you can create colorful charts, graphs, designs, even "doodles" on your screen, then print a copy on a dot-matrix or ink-jet printer.

TELECOM—A communications program to access national information services, plus transmit and receive ASCII files from other computers by phone (requires modem). Telecom makes it easy to access computer bulletin boards.

CALENDAR—A simple monthly calendar that displays "to do's" for any date. Calendar is an easy way to organize your day.

CALCULATOR—A four-function calculator available within any application. This program is similar to a printing calculator. Figures and calculations scroll up the screen. Includes printer support.

DeskMate for the Color Computer. Comes complete with an easy-to-understand manual. 26-3259 99.95

New! Color File II

Our new, improved version of Color File! With Color File II you can easily and quickly store, retrieve and use various types of important data, such as addresses, warranties and personal records. You can easily alphabetize, select, examine, print, change and save your information.

26-3110 (Avail. 11/30/86) 26.95

Spectaculator

Do your planning, forecasting and problem-solving with this "electronic spreadsheet." Just enter numbers and formulas, and Spectaculator will calculate and display the results on command, saving you time and effort. Up to 99 rows and columns. Cassette recorder recommended. 26-3104 29.95

Personal Finance II

This easy to use household budget program features 26 major expense categories. Review your expenditures on a year-to-date or category basis. 26-3106 29.95

New! Color SCRIPSIT II

Color SCRIPSIT II is a word processing system that includes an editor to enter and edit text and text formatting commands. The view mode allows the user the ability to change the format control information while viewing the page.

26-3109 (Avail. 11/30/86) 29.95

Color Screen Print Utility

Provides multi-color printouts of color graphics scenes produced from any graphics program. For use with color ink-jet printer (26-1268) or any dot-matrix printer with bit-image capabilities for black and white printouts. Requires 16K Extended BASIC and cassette recorder. 26-3121 9.95

Editor/Assembler

Develop 6809 software programs or subroutines. You get trial assembly of object code and execution of your program in-

memory before final assembly to tape, an editor that enables you to change your program and reassemble, and Z-Bug for quick and easy testing. Requires 16K. 26-3250 39.95

Atom

① Teaches the names of elements, their atomic numbers, configurations and main properties. Includes beautiful wall poster. 26-3149 19.95

Vocabulary Tutor

Match words with their definitions and place words in the appropriate sentences. For grades 3-5.

Vocabulary Tutor 1. ② 26-2568 8.95

Vocabulary Tutor 2. ② 26-2569 8.95

Color Computer Learning Lab

② Self-teaching course in standard Color BASIC.

26-3153 49.95

Color Math

Math skills for ages 6-14. Includes problems in addition and subtraction. 26-3201 19.95

Electronic Book Software

Your kids will spend hours learning the fun way! Each software package contains "pages" which compose the Electronic Book (sold separately). Different areas of the book's touch-sensitive surface are pressed to make selections. Interactive routines make learning a game.

Maze Master

Helps teach some of the basic principles involved in computer programming. 26-2541 19.95

Shape Maker

Challenges children to identify geometrical shapes and make designs. 26-2542 19.95

The Number Factory

Children will enjoy practice in basic arithmetic skills.

26-2543 19.95

Word Wizard

Help your children improve spelling skills the fun way.

26-2544 19.95

Program Pak™ Games

Dragonfire

① You must dodge fireballs tossed by the dragon to get to the treasure room. 26-3098 29.95

Downland

① Alone in a secret cave, you jump and climb from chamber to chamber, collecting keys, gold and diamonds. Each chamber is different—so watch out! 26-3046 19.95

Dungeons of Daggorath

You're pitted against a succession of awesome beasts. Each victory brings you closer to your ultimate opponent—the evil wizard. 26-3093 29.95

Baseball

① Plays just like the real game! You control pitching, running and defense.

26-3095 19.95

Androne

① Your computer has been invaded by Data Bugs. Call on Androne, a user-controlled robot to hunt through your memory banks and "de-bug" them. 26-3096 19.95

Cassette Tape Game

Pyramid

② Perilous adventure game! Explore the ancient pyramid's unknown passages for treasures! 26-3310 14.95

① Joysticks required. ② Cassette recorder required. ③ Joysticks and cassette recorder required.

HANDY POCKET COMPUTERS

PC-6 Pocket Scientific Computer

119⁹⁵

- 65 Built-In Scientific Functions
- Programs in BASIC and Assembly Language

Pocket Scientific Computer PC-6. An ideal tool for engineers and students, the PC-6 combines the best features of a powerful scientific calculator and a pocket computer. Performs up to 65 scientific calculations—or write your own programs in BASIC or assembly language. Retains programs and data even when power is off. A built-in Note and Address File keeps important telephone numbers or engineering data and formulas handy. Features an easy-to-read, 24-character LCD. Uses PC-4 Cassette Interface and Printer with PC-5/6 Cable (all sold separately). 8K RAM. Folds up to only $\frac{3}{4} \times 1\frac{13}{16} \times 5\frac{5}{8}$ ". Includes battery. 26-3672 119.95
8K RAM Module. 26-3674 19.95
PC-5/6 Cable. Use PC-5 or PC-6 with PC-4 Cassette Interface and PC-4 Printer. 26-3671 14.95



PC-7 Pocket Scientific Computer

69⁹⁵

- With 72 Scientific and 17 Statistical Calculations
- Features 2K RAM
- Programs in BASIC

Pocket Scientific Computer PC-7. Keep track of important data and calculations wherever you go with our new PC-7 Pocket Computer. This incredible, compact unit performs up to 72 scientific calculations and 17 statistical calculations. This makes it perfect for engineers, students and professionals who need exact mathematical data rapidly. Mathematical functions include trigonometric, logarithmic/exponential, absolute value, permutations, standard deviation, linear regression and many others. The PC-7 features 2K random access memory and 35 commands in BASIC including: CLEAR, END, INPUT, DATA, READ AND STAT. You can even write your own programs in BASIC! Keyboard composed of 72 keys. Measures $1\frac{13}{32} \times 5\frac{1}{2} \times 7\frac{3}{32}$ ". 26-3673 69.95



Sale! PC-4 Pocket Computer

Save \$20 **39⁹⁵** Reg. 59.95

Pocket Computer Model PC-4. Lets you keep up to 10 short programs in memory or combine the programming area for longer programs. BASIC language includes 23 commands, 15 functions and 10-digit numeric accuracy. Use just two key-strokes to enter up to 16 common commands. Edit and Debug modes make the PC-4 easier to program than a programmable calculator. Typewriter-style keyboard includes 53 alphabetic keys and a 10-key numeric datapad. A big 12-character LCD scrolls to 62 characters. With batteries and manual. 26-3650 Sale, 39.95

[A] PC-4/5 Cassette Interface. Store and load programs on cassette tapes using an optional cassette recorder. Requires two "AA" alkaline batteries. 26-3651 39.95

[B] PC-4/5 Printer. Prints at 20 characters per line (60 lpm) in an electro-thermal 5 x 7 dot matrix. Includes rechargeable batteries and U.L. listed AC adapter/charger. 26-3652 79.95

PC-4 Thermal Paper. 65-711 Pkg. of 5/1.99



TANDY PORTABLE COMPUTERS

Sale! Our Popular Tandy 200

Save \$200 **599⁰⁰** Reg. 799.00 ■ Multiplan Built In
 ■ 24,000-Character Memory

Tandy 200. A powerful problem solver. For complex spreadsheet analysis and calculations, we put popular Multiplan software into the Tandy 200's permanent memory. Do sales forecasts, profit-and-loss projections, budgeting, pricing, engineering calculations and more. An improved version of the Model 100's easy-to-use word processing program makes Tandy 200 especially useful for memos, reports and correspondence. Four other "instant-on" programs are a personal appointment calendar, address and phone directory, and telephone auto-dialer. You can even create your own programs in BASIC. The Tandy 200's high-contrast flip-up liquid crystal display has 240 x 128 resolution for big, clear graphics, or 16-line by 40-character text. Includes parallel printer, RS-232C, cassette and bar code reader interfaces. 26-3860 Sale, 599.00



SPECIFICATIONS. Microprocessor: 8-bit 80C85 CMOS. Clock Speed: 2.4 MHz. Memory: 72K ROM, expandable to 104K; 24K RAM, expandable to 72K in banks of 24K. Keyboard: Full-sized 56-key typewriter style with embedded data pad, plus 8 programmable function keys, 4 command keys and 4 cursor control keys. Display: 16 x 40 liquid crystal display, upper and lower case ASCII characters, 240 x 128 dot-matrix graphics. Modem: Built-in 300-baud direct-connect modem with auto-dialer. FCC registered. Originate and answer modes. Tone dialing signals. Input/Output: Parallel printer interface. RS-232C serial communications interface programmable up to 19,200 baud. Cassette tape interface loads at 1500 baud. Standard bar-code reader interface. Dimensions: 2³/₁₆ x 11³/₄ x 8¹/₂". Weight: 4.5 lbs. Power Supply: Operations—Up to 16 hours on 4 "AA" alkaline batteries, and can use nickel-cadmium rechargeable batteries with minor additional-cost modification. Optional U.L. listed AC/DC charger/adaptor available. Memory—Internal rechargeable nickel-cadmium batteries.

Sale! Slimmer, Lighter Tandy 102

Save \$100 **399⁰⁰** ■ 24K Memory ■ 40 x 8 Display
 Reg. 499.00 ■ Five Built-In Management Programs
 ■ Direct-Connect Telephone Modem

Tandy 102. We've redesigned our best-selling portable—the famous Model 100—into an even smaller package. But we've retained the same remarkable features, including five instant-on programs, an 8 x 40 display and a modem—all built in. Use the Tandy 102 as a personal word processor, address/phone directory, appointment calendar and telephone auto-dialer. Access other computers or national information services by phone with the built-in modem and communications program. You can even write your own programs in BASIC. Includes parallel, RS-232C, cassette and bar code reader interfaces. Only 3 lbs. Requires four "AA" batteries. 26-3803 Sale, 399.00



SPECIFICATIONS. Microprocessor: 8-bit 80C85 CMOS. Clock Speed: 2.4 MHz. Memory: 32K ROM; 24K RAM, expandable to 32K. Keyboard: Full-size 56-key typewriter style with embedded 10-key datapad, plus 8 programmable function keys, 4 command keys and 4 cursor control keys. Display: 8 x 40 Liquid Crystal Display, upper and lower case ASCII characters, 240 x 64 dot-matrix graphics. Modem: Built-in FCC-registered direct-connect modem with auto-dialer. 300 baud. Originate and answer. Input/Output: Parallel printer interface. RS-232C serial communications interface programmable up to 19,200 baud. Cassette tape interface loads at 1500 baud. Standard bar-code reader interface. Dimensions: 1¹/₂ x 11⁷/₈ x 8¹/₂". Weight: 3 lbs. Power Supply: Operations—Up to 20 hours on 4 "AA" alkaline batteries or optional U.L. listed AC power supply. Memory—Internal rechargeable nickel-cadmium batteries will maintain memory intact for up to 30 days with power off (depending on the amount of RAM installed) and are automatically recharged from "AA" batteries or AC power.

Portable 100/102/200/600 Accessories



- A Disk/Video Interface*.** 184K disk drive and TV/monitor interface. 26-3806 499.00
- Sale! Second Disk Drive.** For 26-3806. Installation not incl. Reg. \$199.95. 26-3807 Sale, 99.95
- B Portable Disk Drive*.** 100K of data on 3¹/₂" floppies. Requires four "AA" batteries or AC Adapter (not included). 26-3808 199.95
- C Carrying Case*.** 26-3811 39.95
- Portable Disk Drive Carry Case.** 26-3815 24.95
- D Tandy 600 Carrying Case.** 26-3905 59.95
- E Bar Code Wand*.** 26-1183 99.95
- Acoustic Coupler.** 26-3805 39.95
- Printer Cable.** 26-1409 14.95
- Modem Cable.** 26-1410 19.95
- AC Adapter.** 26-3804 . . 5.95
- Legs.** 26-3812 3.99
- Model 100 8K RAM Upgrade.** Req. installation (not incl.). 26-3816 49.95
- New! Tandy 102 8K RAM Upgrade.** 26-3817 14.95
- Tandy 200 24K RAM Upgrade.** Req. installation (not incl.). Reg. \$199.95. 26-3866 Sale, 99.95
- New Low Price! Tandy 600 96K RAM Upgrade.** Install. rec. Was \$399.95 in RSC-16. 26-3910 299.95

*For Models 100/102/200 only. A Shown with computer and monitor (not included).

TANDY 600 WITH DISK DRIVE

Sale! Our Most Powerful Portable Computer!

Save \$600 **999.00** Reg. 1599.00

- Self-Contained 3 1/2" 360K Disk Drive
- Five Full-Featured, Built-In Applications
- Internal 300-bps Direct Connect Modem
- Typewriter-Style Keyboard

Tandy 600. Features five resident applications. Multiplan, the popular "second-generation" spreadsheet, can do and show more because of the Tandy 600's larger display and expanded memory. Word processing is easy using a subset of Microsoft® Word. File is an electronic database for names and addresses, expenses, client billing, inventory and more. With Telecom and the Tandy 600's built-in modem, you're able to communicate with other computers over phone lines and access national information networks. Telecom will even dial the phone number of anyone listed in File. Calendar helps you keep track of daily tasks and activities. Weighs 9 1/2 pounds and measures 12 x 13 x 2 3/4".

26-3901 Sale, 999.00



SPECIFICATIONS: **Microprocessor:** 16 bit 80C88 CMOS. **Clock Speed:** 3.07 MHz. **Memory:** 160K ROM; 32K RAM, expandable to 224K RAM. **Keyboard:** Full-size 73-key typewriter style with embedded 10-key datapad. **Display:** 80 x 16 Liquid Crystal Display, upper and lower case ASCII characters. 480 x 128 dot-matrix graphics. **Modem:** Built-in FCC-registered direct-connect modem with auto-dialer. 300 baud. Originate and answer. **Input/Output:** Parallel printer interface. RS-232C serial communications interface programmable up to 19,200 baud. Cassette tape interface loads at 1500 baud. Standard bar-code interface. **Dimensions:** 23/4 x 12 x 13" **Weight:** 9.5 lbs. unit, 11 lbs. with AC adapter. **Power Supply:** Operations—Up to 8 hours with 1 hour disk access on built-in rechargeable batteries. Optional U.L. listed AC adapter.

Tandy 600 Programs

BASIC ROM. Write your own programs.
26-3904 129.95

Tandy 200 Programs

Bar Code Writer. Takes input from Model 100 TEXT files and produces bar codes in six forms. Requires 24K, cassette recorder, printer and cables. 26-3895 34.95

Bar Code Drivers. Allows bar code wand to read Interleaved Two of Five, Codabar and UPC-E bar codes. Requires 16K, cassette recorder and bar code wand. 26-3896 19.95

Data Manager. Lets you store, examine, update and list a variety of information—from personal records to appointment schedules. Requires cassette recorder. Reg. \$39.95.
26-3886 Sale, 24.95

MultiSolutions. Plugs into ROM socket. Includes three applications: a word processor, a Time Minder and Data Manager. Requires 24K. Reg. \$149.95. 26-3894 Sale, 99.95

Project Scheduler. Divide a large job into individual tasks. Requires 24K and cassette recorder. 26-3893 39.95

Romulus Chess. Choose from seven playing levels. Requires cassette recorder. 26-3890 19.95

Tandy Code Read/Write. Generates and reads modified NATI code. Requires 24K, cassette recorder, printer, cable and bar code wand. 26-3897 24.95

Text Power 200. Turns your Tandy 200 into a true word processor—much more powerful than the built-in word processing program. Requires cassette recorder. Reg. \$39.95.
26-3881 Sale, 24.95

Time Minder. Manage your appointments and expenses effectively or just display a calendar for any month of any year. Requires cassette recorder. 26-3883 39.95

*RAM Upgrades Are in Banks of 96K Each—Installation Recommended.

Tandy 100/102 Programs

Remote Disk. Allows you to use your Model I/III/4/II/12/2000/Color Computer disk drive as a storage area for your Model 100 files. Includes cassette and diskette. 26-3839 59.95

Assembler/Debugger. Debug, write and assemble machine language code. Requires cassette recorder.
26-3823 49.95

Model 100 Spectaculator®. A mini-spreadsheet. Requires 16K memory and cassette recorder.
26-3828 49.95

Data Manager (Cassette). Requires 24K memory and cassette recorder. 26-3836 39.95

SCRIPSIT® 100. Features advanced formatting capabilities. Requires printer and cassette recorder. Reg. \$39.95.
26-3830 Sale, 24.95

Calculator. Powerful math "scratchpad" for finance and regular math functions. Requires cassette recorder.
26-3827 19.95

Statistics. Generate reports for descriptive statistics, frequency distribution, histogram, correlation, regression, time series analysis and much more. Requires 32K and cassette recorder.
26-3825 29.95

Executive Calendar. Schedule appointments or display a calendar for any month. Requires cassette recorder.
26-3833 19.95

Interactive Solutions. Contains three programs: Data Manager, Spreadsheet and Text Formatter. Uses optional ROM socket. Reg. \$149.95. 26-3844 Sale, 99.95

Multiplan. This ROM program is a portable version of the popular spreadsheet analysis program—does not occupy Model 100 RAM. Reg. \$149.95. 26-3829 Sale, 99.95

COMPUTER ACCESSORIES

Standby Power System for Home and Office



NEW LOW PRICE!

595⁰⁰

Was \$695.00 in Cat. RSC-16

BPS 400. Guards against data loss in case of a brownout or electrical failure. Provides more than 10 minutes of full power operation (400 VA) to allow you to shut down your system safely. During normal operation, the BPS 400 also protects your equipment against harmful electrical spikes and transients. Easily handles power requirements of Tandy 6000 or 3000—even when supporting extra drives. Four outlets. 6 × 10³/₄ × 12¹/₂". U.L. recognized. 26-1189 595.00

Power Switching System



NEW FOR 87

79⁹⁵

Adds Versatility to Any Computer System

Computer and monitor not included

Turn up to five individual accessories on and off from the front panel. Holds all Tandy monitors and swivels for best viewing angle. Provides full power line noise filtration, plus full common and differential mode transient protection. Features status lamp and six outlets (five are switch controlled). Rated 15A. Includes circuit breaker and 10-ft. line cord. U.L. listed. Available Sept. 30, 1986. 26-203 79.95

Twin Outlet Power Protector



NEW FOR 87

16⁹⁵

- Our Lowest Priced Power Protector—A "Must" for Any Home System
- Protects Computer and Peripheral Against Harmful Power Surges and Line Noise
- Plugs Into Any 120-Volt AC Outlet

Provides common and differential mode transient protection (50 joules per mode, 25 nanoseconds, 340-volt clamping at 50 amps), plus full power line noise filtration. Includes MOV status lamp. Rated 10A. Includes push-to-reset circuit breaker. U.L. listed. Available Oct. 30, 1986. 26-1395 16.95

Deluxe Power Center



NEW FOR 87

69⁹⁵

Protect Your Computer System

Provides full common and differential mode transient protection with MOV status lamp (80 joules per mode, 25 nanoseconds, 340-volt clamping at 100 amps). Full external and internal noise filtration in four isolated segments. Auto-sense power switch with adjustable sensitivity. "Once-off, stays off" power dropout protection with indicator lamp, reset button. Rated 15A. Push-to-reset circuit breaker. 6-ft. power cord. U.L. listed. Available Oct. 30, 1986. 26-1396 69.95

Computer Cassette Recorders



CCR-81 Recorder

59⁹⁵

Sale!

CCR-82 Recorder

Save **29⁹⁵**
\$20

Reg. 49.95

A CCR-81. Ideal for loading and saving your own programs and data on cassette tapes. Battery/Record LED indicator. 10¹/₂ × 5³/₄ × 11³/₁₆". Includes cable. U.L. listed AC operation or four "C" batteries (not included). 26-1208 59.95

B CCR-82. Features volume control with preset marker. 7¹/₈ × 4¹/₁₆ × 1⁵/₁₆". Includes cable. Requires four "AA" batteries or AC adapter (not included). 26-1209 Sale, 29.95
AC Adapter for CCR-82. U.L. listed. 273-1454 5.95

Computer Cassette Tapes



Low **189**
As **1** Each

- Ideal for Program and Data Storage
- Certified Free of Drop Outs and Defects

Deluxe C-20 Cassette Tape. "Reel-to-reel" design in a clear shell.

26-308 3.79

C-20 Tape. 26-301 ... 2.79

C-10 Tape. 26-302 ... 1.89

Quantity	Deluxe C-20 (Each)	C-20 (Each)	C-10 (Each)
1-11	3.79	2.79	1.89
12-23	3.39	2.49	1.69
24-47	2.99	2.19	1.49
48-Up	2.69	1.99	1.39

COMPUTER ACCESSORIES

Universal Computer Floor Stand



NEW FOR 87

29⁹⁵

Holds CPU in Vertical Position

Computer not included

Save desk space. Place our Universal Computer Floor Stand next to your workstation. Securely holds Tandy and other PCs. Width adjusts to 6". Steel construction. Non-skid rubber feet. Easy to assemble. 26-201 29.95

Universal Monitor Pedestal



16⁹⁵ ■ Adjusts for Better Viewing
■ Works with Most Monitors

Adjustable platform rotates and tilts for best viewing angle. Holds all Tandy monitors and many others. Color and finish of platform matches Tandy monitors. Base measures: 11 x 10 1/4"

26-1369 16.95
Computer and monitor not included.

Monitor Platform



NEW FOR 87

29⁹⁵

Perfect for Tandy 1000 EX

Designed to hold a monitor and disk drive for the Tandy 1000 EX. Also suitable for the Color Computer. Sturdy steel legs, wood top. 5 3/8 x 20 3/4 x 11 7/8". Easy to assemble. 26-210 29.95
Computer system not included.

Deluxe Printer Platform



49⁹⁵

Printer not included.
Stack Paper Under Printer

Saves desk space. The Deluxe Printer Platform elevates your wide-bed (132-column) printer so paper feeds from below (3" clearance). Smoked acrylic. Platform measures 3 1/2 x 22 x 16". A "must" if you want a well-organized computer work area.

26-1383 49.95

Universal Printer Supports



16⁹⁵ Ideal for Home Systems

New Low Price! Elevates your printer so fanfold paper can be placed underneath to save desk space. Use with 80-column printers. Durable crystal polystyrene construction. Easy to assemble. Was \$19.95 in RSC-16.

26-1367 16.95
Printer not included.

Anti-Glare Mesh Screen



NEW FOR 87

24⁹⁵

Cuts Glare and Reflections

For Tandy color monitors (CM-1, 2, 4, 5 and 10). Also fits VM-2 monochrome monitor. Specially woven diagonal nylon mesh provides high viewing resolution. Easy to install. 26-202 24.95

Anti-Glare Mask (not shown). For Model I/II/III/4/12/16 monochrome screens.

26-511 16.95
Monitor not included

Universal Keyboard Cover



NEW FOR 87

7⁹⁵

Computer and keyboard not included

Protects keyboard when not in use from dust and spills. Fits all detachable Tandy keyboards. Sturdy textured polystyrene. 2 5/8 x 18 3/4 x 8". 26-200 7.95

Model III/4 Keyboard Cover (not shown). 26-1342 12.95

Computer Security System



24⁹⁵

■ Low-Cost Theft Deterrent
■ Easy to Install

Mounting plates attach to tabletop and side of computer and peripheral by special acrylic adhesive. No modification required, no holes to drill. Includes user-resettable combination lock, 3-ft. vinyl-coated steel cable, 3 mounting plates and instructions.

26-1376 24.95

Expansion Set. Two plates and surface preparation kit. 26-1377 11.95
Computer and monitor not included.

Anti-Static Mat



NEW FOR 87

89⁹⁵

Chair not included

Drains static charges that can damage your computer. Carbon fibers remove charges instantly (rated less than 2 x 10⁹ ohms, less than 0.05 second decay time). Clear textured vinyl. Cleats on bottom prevent slipping on carpet. With 10-ft. grounding cord. 45 x 53"

26-214 89.95

PRINTER/COMPUTER SUPPLIES

Stock Up Now on Fanfold Printer Paper



- Buy Fanfold Paper in Small Quantities and Save
- Available in Mini-Paks, Totes and Full Cartons
- Store Your Printouts in the Reusable Cartons

Feed paper directly into the printer from the reusable cartons. Letter-size sheets (9 1/2 x 11") have "invisible" detachable, perforated margins. Single-part sheets are high-quality, 15-pound bond, unless a heavier weight is specified. No ground wood or recycled paper. Multi-part sets are clean, carbonless, no-mess paper.

Fanfold Printer Paper						
Size	Parts	Design	Vertical Perf.	Qty.	Cat. No.	Price
9 1/2 x 11"	1	Greenbar	Yes	1500	72-304	24.95
9 1/2 x 11"	1	Greenbar	Yes	3500	26-1403	49.95
9 1/2 x 11"	1	White	Yes	500	26-1423	8.95
9 1/2 x 11"	1	20# White	Yes	500	26-1387	10.95
9 1/2 x 11"	1	20# White	Yes	1250	26-1427	24.95
9 1/2 x 11"	1	20# White	Yes	2500	72-311	44.95
9 1/2 x 11"	2	White	Yes	750	72-305	34.95
14 7/8 x 11"	1	Greenbar	No	500	26-1330	11.95
14 7/8 x 11"	1	Greenbar	No	1500	72-300	34.95
14 7/8 x 11"	1	Greenbar	No	3500	26-1417	69.95
14 7/8 x 11"	1	White	No	1500	72-303	34.95

Fanfold Mailing Labels

Low As **6⁹⁵** Pkg./1000



1-Wide. 4 1/2" carrier. Pkg. of 1000.
26-1328, 6.95

1-Wide. 4 1/2" carrier. Pkg./5000.
72-402 24.95
2-Wide. Pkg./2000. 72-401 15.95
3-Wide. Pkg./3000. 72-400 16.95
2-Wide. Dry gum. Pkg./2400.
26-1456 9.95

Roll Printer Paper



Printer	Paper	Cat. No.	Qty./Price
CGP 115	4 1/2" x 150"	26-1428	3/4.95
CGP 220	8 1/2" x 75"	26-1333	3/9.95
CGP 220	8 1/2 x 11" sheets	26-1341	250/6.95
TP-10	Thermal 4 1/8" x 80"	26-1332	2/3.95
PT-210/TRP 100	Thermal 8 1/2" x 100"	76-1003	6/24.95
PC-1	1 3/4" x 18"	26-3506	6/1.75
PC-2	2 1/4" x 30"	26-3606	6/2.49
PC-3	Thermal 2 1/4" x 7"	26-3592	5/2.49
PC-4	Thermal 1 1/2" x 8 1/2"	65-711	5/1.99
LP I/II/IV/VIII/200	8 1/2" x 500"	26-1402	2/19.95
Plotter/Printer (26-1190)	9" x 90", 8 1/2" pin-to-pin	26-1407	4.95
Quick Printer (26-1153)	Electrostatic 4 3/4" x 130"	26-1405	3/19.95
Quick Printer II (26-1155)	Electrostatic 2 3/8" x 75"	26-1412	2/4.95

Order Your Own Custom Forms from Any Radio Shack Computer Center

Radio Shack provides a complete selection of custom-designed business forms, envelopes and labels that are guaranteed compatible with our computer systems and accounting software. Visit your nearest Radio Shack Computer Center today to place your order for professional forms.

Get a Protective Dust Cover for Your System



- Protects Against Dust and Dirt
- Durable Vinyl With Reinforced Stitching on All Seams

System Dust Covers	Cat. No.	Each
Model 12/16/6000	26-526	7.95
Model III/4 or DT-1 Terminal	26-506	5.95
Color Computer 2/3	26-532	3.95
Tandy 1000/1200/2000/3000	26-541	9.95
Tandy 1000 EX	26-543	4.95
Printer Dust Covers		
DMP 105	26-530	3.95
DMP 130	26-536	3.95
DMP 430	26-535	4.95
DMP 2100/2110	26-525	4.95
DMP 2200	26-539	4.95
DW II & DWP 510/520	26-508	5.95
DW Printer w/ Tractor (except DWP 520)	26-538	5.95
DWP 220/230	26-537	4.95
Peripheral Dust Covers		
CCR 81 Recorder	26-517	2.95
DT-100 Monitor	26-540	4.95
Color Computer Disk Drive	26-542	3.95
Tandy 1000 EX Disk Drive or Hard Disk	26-544	3.95



Anti-Static Spray



5⁹⁵ Use on Equipment, Screen or Carpet
Helps eliminate problem-causing static. Safe. 16 fl. oz.
26-515 5.95



Disk Cartridge

NEW LOW PRICE!

79⁹⁵

Use with our 10-Megabyte Disk Cartridge System. Was \$89.95 in RSC-16.
26-1372 79.95



Printwheel Cleaning Kit

16⁹⁵

Clean clogged, recessed areas. 26-1320 16.95
Refill Fluid and Pad.
26-1322 5.95



Typing Easel

17⁹⁵ Keeps Pages in Place

Adjustable T-bar (8 3/4" to 13 7/8") and friction pads keep books open and in place. Cushioned base. 73-2003 .. 17.95

1/4" Data Tape Cartridge

34⁹⁵



Use with our TCS-100 Tape Cartridge System for 48 megabytes of archival storage. 450 ft. 26-1391 34.95



Printwheel Binder

9⁹⁵

Protects printwheels from loss or damage. Holds nine wheels. For DW II, DWP 410/510. 73-2004 9.95

DISKETTES AND DISK STORAGE



Certified 3 1/2", 5 1/4" and 8" Unformatted Diskettes

Single-Sided Diskettes

Size	Tracks	Diskettes Per Pkg.	Cat. No.	Quantity Price Per Package		
				1-4 (Each)	5-9 (Each)	10-Up (Each)
3 1/2"	80	3	26-415	15.95	14.49	13.49
	80	10	26-416	44.95	39.95	37.95
5 1/4"	40	1	26-305	2.19	1.99	1.89
	40	3	26-405	5.95	5.29	4.99
	40	10	26-406	15.95	14.49	13.49
8"	77	3	26-4904	10.95	9.95	9.29
	77	10	26-4906	34.95	31.95	29.95

Double-Sided Diskettes

Size	Tracks	Diskettes Per Pkg.	Cat. No.	Quantity Price Per Package		
				1-4 (Each)	5-9 (Each)	10-Up (Each)
3 1/2"	80	3	26-417	16.95	15.29	14.49
	80	10	26-418	49.95	44.95	42.95
5 1/4"	40	3	26-411	6.95	6.29	5.95
	40	10	26-412	16.95	15.29	14.49
	80	3	26-409	8.95	7.95	7.49
	80	10	26-410	24.95	22.95	20.95
	80 (1.6Mb) High-Density	3	26-421	15.95	14.49	13.49
	80 (1.6Mb) High-Density	10	26-422	44.95	39.95	37.95
8"	77	3	26-4961	12.95	11.95	10.95
	77	10	26-4960	39.95	35.95	33.95

- Fully Certified for Highest Reliability
- State-of-the-Art Formulation and Lubrication
- All Diskettes Are Unformatted, Double-Density, Soft-Sector

Our diskettes are double coated with an advanced ferric oxide blend to provide maximum lubrication and resistance to diffusion. All diskettes are unformatted, double-density and soft-sectored. Always keep plenty of diskettes on hand. Stock up today.

- 5 1/4" Replacement Labels.
26-307 Pkg. of 54/1.95
- 8" Replacement Labels.
26-4955 Pkg. of 54/1.95

Radio Shack COMPUTER CENTER
DISKETTE CLUB Certified TSI-82 Diskettes
Valid at Radio Shack Computer Centers and participating Stores and Dealers
40% Savings
Issued to: _____
By: _____
Get 40% off any 3-pack of diskettes each month for a year!

Get Your FREE Diskette Discount Card

An incredible offer! Stop by and pick up your free Diskette Discount Card at any Radio Shack Computer Center, participating Radio Shack store or dealer. The Card enables you to save 40% on any 3-Pack of Diskettes each month for a whole year. Get your Card today and start saving!

Diskette Storage Boxes



Low As **12⁹⁵**

Available in 3 Sizes

Disks not included

Organize your floppy disks with five adjustable dividers. High-impact styrene.
3 1/2". Holds 30. 26-1381 12.95
5 1/4". Holds 50. 26-1362 14.95
8". Holds 50. 26-4953 24.95

Protect Your Diskettes



Disks not included

5 1/4" **Wallet File**. Rugged binder for long-term use. Anti-static vinyl pages. Holds 10 diskettes. 26-1366 7.95

Universal 3-Ring Data Binder. 26-1310 5.95

5 1/4" **Disk Envelopes**. Holds 2. Package of 10. 26-510 7.95

8" **Disk Envelopes**. Holds 1. Pkg. of 10. 26-4907 7.95

Disk Library Boxes

Low As **2⁹⁵**

Available in 3 Sizes

Disks not included



Store like a book when closed, flip through disks when opened.

3 1/2". Holds 5. 26-1380 . . . Pkg. 2/2.95

5 1/4". Holds 10. 26-1452 4.95

5 1/4" **Tote**. Holds 5. 26-1348 2.95

8". Holds 10. 26-4952 5.95

Helpful Programming Aids



- Produce Professional Worksheets
- Create Easy-to-Follow Flowcharts

- Ⓐ **Model I/III Graphics Worksheets**. 26-2105 100 Sheets/4.95
- Ⓑ **Printview Ruler**. 26-1313 3.50
- Ⓒ **Flowchart Template**. 26-1312 3.95

Disk Drive Verifier Diskette

NEW FOR **87**

29⁹⁵

For Tandy 1000 EX and SX, and 1200



Analyzes alignment, rotational speed index sensor position, clamping ability and write/read accuracy. Tandy 1000 requires 256K, Tandy 1000 EX requires 384K. 26-1370 29.95

Disk Drive Head Cleaning Kits

Low As

7⁹⁵ Each

Kits for 3 1/2", 5" and 8" Drives



3 1/2" **Kit**. Single-sided. 26-419 . . . 9.95

NEW! 3 1/2" Kit. Double-sided. 26-420 9.95

5 1/4" **Drive Kit**. 26-408 7.95

8" **Drive Kit**. 26-4957 8.95

DELUXE BUSINESS PRINTERS

Dot-Matrix Power for Business



1695⁰⁰

Lease for
Only \$65
Per Month*

- IBM PC Compatible
- Prints 380 cps

DMP 2200. A versatile business printer. Efficient, fast printing means no long delays for reports—and that saves your business money. Supports elongated, double-high, bold, underline, super/subscripts, italics and double-strike. Features bit-image graphics. Prints up to 380 characters per second. Uses 3" to 16" fanfold paper only (bottom or rear paper feed). Built-in tractor—not sprocket. Prints original, plus up to six copies. Parallel interface only. U.L. listed.

26-1279 1695.00

SPECIFICATIONS. Print Density: 10, 12, 17.1 (standard); 10 and 12 (correspondence); proportional and compressed proportional. Print Speed: Standard 10 cpi—380 cps. Correspondence 10 cpi—90 cps. Proportional—77-180 cps. Character Set: 95 ASCII, 31 graphics and special characters. IBM Character Set 1 and 2. Horizontal Dot Resolution: 60-240 dots/inch, 1632-3916 dot columns/line. Dimensions: 4³/₄ x 22¹/₂ x 16⁷/₈". Weight: 39³/₄ lbs. Power: 120VAC, 60 Hz, 200W.

Print Customized Type Styles



1295⁰⁰

Lease for
Only \$50
Per Month*

- IBM PC Compatible
- Prints 240 cps

DMP 2110. Use the Font Editing Packages (sold separately) to load different type styles for print quality that rivals a daisy wheel printer! Includes data processing, word processing and graphics modes. Prints up to 240 characters per second. Precision 24-wire print head. Parallel interface. Includes bi-directional tractor. U.L. listed.

26-2810 1295.00

SPECIFICATIONS. Print Density: 10, 12 and 16.7 cpi, plus proportionally spaced and elongated. Print Speed: Standard 10 cpi—121 lpm/80 column, 84 lpm/132 column. Correspondence 10 cpi—33 lpm/132 column. Character Set: 96 ASCII, 31 international and 31 graphics characters. Font Matrix: DP mode—10 cpi and 16.7 cpi: 24 x (13 + 5), 12 cpi: 24 x (13 + 2). WP mode—10 cpi: 24 x 36, 12 cpi: 24 x 30, Proportional: 24 x n. Horizontal Dot Resolution: 360 dots/inch, 4896 dots/line. Paper: Up to 15" wide. Friction feed. Prints original, plus two copies. Dimensions: 5⁷/₈ x 21¹/₁₆ x 15". Weight: 42 lbs. Power: 120VAC, 60 Hz.

NEW
FOR 87

Turn Complex Numerical Data Into Charts and Graphs with Our 8-Color Digital Plotter



799⁰⁰

Create Pie Charts,
Bar Graphs, Maps,
Tables and More

PC-695. Create incredible graphics—in up to eight colors—and turn rows of numerical data into easy-to-understand graphics. Plot pie charts, tables, maps, bar graphs and more. Ideal for business information such as financial trends, production data and market forecasts. Prints on any high-quality bond paper. Features "self-test" mode. Includes standard hard nib pens in black, red, blue, green, lime green, brown, orange and magenta. Asynchronous RS-232C serial interface. U.L. listed.

26-2830 799.00

SPECIFICATIONS. Print Speed: 3 inches per second axial, 4⁷/₃₂ inches per second diagonal. Interface: Asynchronous serial RS-232-C. Buffer: 256 bytes. Baud Rate: 300, 1200, 2400, 9600. Dimensions: 3³/₁₆ x 17¹/₂ x 7³/₁₆". Weight: 6¹/₂ pounds. Power: 120 VAC, 60 Hz, 5 watts.

AFFORDABLE TANDY PRINTERS

Produce Correspondence-Quality Text Using This 132-Column Printer with 18-Wire Print Head

699⁰⁰

IBM PC Compatible
Was \$899.00 in Cat. RSC-16

DMP 430. The 18-wire print head gives you superior-quality correspondence fonts in a single pass. Prints 10, 12 or 16.7 cpi, plus elongated standard, elite and condensed. Get micro, italic and double-high fonts, too. Produces bit-image graphics at 7 or 16-bit columns. True pin-driven tractor—not sprocket. Prints original, plus two copies, at up to 180 characters per second. Parallel and Color Computer-compatible serial interfaces. U.L. listed.

26-1277 699.00

SPECIFICATIONS. Print Density: 10, 12, 16.7 cpi, plus elongated. Print Speed: 10 cpi—43 lpm/80 col. Character Set: 96 ASCII, 64 special and 30 block graphics characters. Horizontal Dot Resolution: 480-800 dots per line. Vertical Spacing: 12, 6, 8 lines per inch. Line Feed: 1/6, 1/8, 1/12, 1/72". Dimensions: 3 1/16 x 15 3/8 x 9 7/16". Weight: 8 3/4 lbs. Power: 120VAC, 60 Hz.



Sale! Triple-Mode "Personal Printer"

Save **\$100** **249⁹⁵** Reg. 349.95 ■ IBM PC Compatible ■ Prints Up to 100 cps

DMP 130. Features word processing, data processing and dot-addressable graphics modes. Prints in four character styles: Standard or italic cursive in draft or correspondence modes. Supports super/subscripts, double-width, bold, double-strike and microfonts. Bi-directional, logic-seeking print head (uni-directional in correspondence and graphics modes). Prints original, plus two copies on 4" to 10" fanfold paper or single sheets. Built-in tractor. Parallel and Color Computer-compatible serial interfaces. U.L. listed.

26-1280 Sale, 249.95

SPECIFICATIONS: Print Density: Draft Quality—10, 12 and 17 cpi (standard and italic cursive). Correspondence Quality—10 and 12 cpi (standard and italic cursive). Speed: 50 to 100 cps (draft), 20 to 24 cps (correspondence). Character Set: 96 ASCII, plus Tandy or IBM special characters. Bit Image: 480 to 1920 dot columns/line. Dimensions: 4 3/4 x 15 3/8 x 10 1/2". Weight: 10 3/4 lbs. Power: 120VAC, 60 Hz, 33W.



Budget-Priced High-Performer

199⁹⁵ ■ Bit-Image Graphics ■ Prints 80 cps

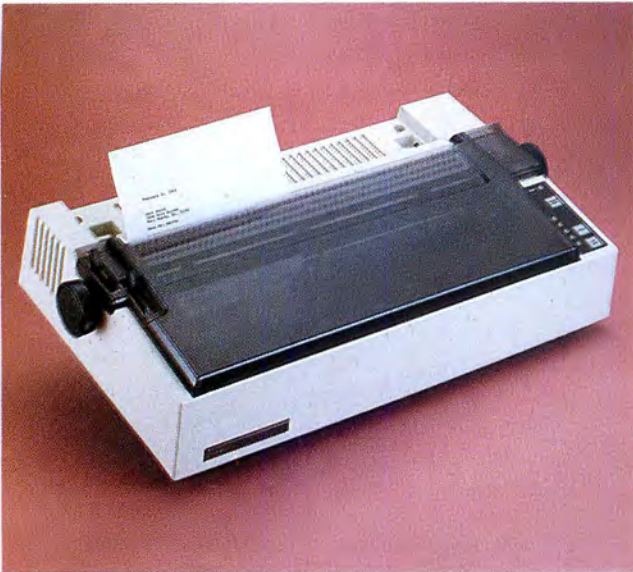
DMP 105. Another Radio Shack price breakthrough! Ideal for data processing and general-purpose use. Bi-directional—prints 80 upper and lower case characters per line (8 x 9 matrix) at 43 lines per minute at 10 characters per inch. Elongated and condensed modes. Prints up to 80 characters per second. Removable adjustable tractor uses 4" to 9 1/2" fanfold paper, friction platen for single sheets. Prints original, plus one copy. Parallel and Color Computer-compatible serial interfaces. U.L. listed.

26-1276 199.95

SPECIFICATIONS. Print Density: 10, 12, 16.7 cpi, plus elongated. Print Speed: 10 cpi—43 lpm/80 col. Character Set: 96 ASCII, 64 special and 30 block graphics characters. Horizontal Dot Resolution: 480-800 dots per line. Vertical Spacing: 12, 6, 8 lines per inch. Line Feed: 1/6, 1/8, 1/12, 1/72". Dimensions: 3 1/16 x 15 3/8 x 9 7/16". Weight: 8 3/4 lbs. Power: 120VAC, 60 Hz.



LETTER-QUALITY DAISY WHEELS



Our Best Daisy Wheel Printer

995⁰⁰

- IBM Compatible
- Prints 500 wpm

DWP 520. Give your correspondence, reports and memos that clean, crisp "electric typewriter" look. You can print fixed 10 or 12 characters per inch or choose proportional spacing (using appropriate optional 96-character print wheels). Prints up to 43 characters per second. Features forward and reverse paper feed and 1/2-line feed, backspace and underline. Supports boldface, strike-through, double-underline, super and subscripts. "External Program Mode" allows you to use print wheels with different pitch or special characters. Parallel interface only. Includes Courier 10 print wheel and carbon ribbon. U.L. listed. 26-2800 995.00

DWP 520 Bi-Directional Tractor. 26-2801 149.95

SPECIFICATIONS. Print Speed: 19.5 lpm at 10 cpi, 132 column. Carriage Motion: Unidirectional, optimal motion seeking. Character Set: 96 ASCII, plus special and international, 21 control codes. Paper: Up to 16" wide. Original, plus 5 copies. Friction feed. Interface: Parallel. Dimensions: 8 x 24 1/2 x 15 1/2". Weight: 28 lbs. Power: 120VAC, 60 Hz, 141 Watts.

Our Lowest-Priced Daisy Wheel

399⁹⁵

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Tandy Tunes

Make beautiful music together with your Tandy 1000.

The Tandy 1000 can play three musical voices simultaneously through its music chip, using the GW-Basic Play statement. The IBM PC can't do that (except for the PCjr), nor can any of the numerous PC clones.

Both the Sound and Play statements produce tones, but only the Play statement conforms to standard musical notation. I'll lead you step by step through the special commands and their musical equivalents, describe a few shortcomings and pitfalls, and take you through a program that uses all three voices to play a Bach sonata.

In the process, you'll learn about music and perhaps get a few ideas on spicing up games and other programs with sound. Don't expect much help from the GW-Basic manual: The instructions it contains are skimpy at best and even wrong in a few places.

Tuning Up

Why not follow along on your 1000? Load Basic and get ready to do some typing after the Ok prompt (you must first insert a Beep Off command on the 1000A). It makes no difference to Basic whether you use upper- or lowercase characters; I'll be using lowercase for note names and rests, uppercase for all other commands. (Adding spaces can improve the readability of your command strings—Basic ignores them anyway.)

Now, type in and enter:

```
PLAY "c","e","g"
```

to play a three-note C-major chord. It sounds high and shrill because Basic defaults to the fourth of the seven octaves available. Adding O3 to each voice's command (the capital letter O and 3) brings you down to octave 3. The command line should now look like this:

```
PLAY "O3 c","O3 e","O3 g"
```

All About Octaves

It's important to understand octaves and how they're translated in Basic. A

System Requirements

Tandy 1000
Basic

Figure 1 consists of seven musical staves, labeled a through g, illustrating various musical concepts. Staff a shows a C-major chord (C4, E4, G4). Staff b shows an octave jump from C4 to C5. Staff c shows a melodic phrase of eighth notes: C4, D4, E4, F4, G4, A4, B4, C5. Staff d shows the same phrase as c, but with a dotted quarter note for the final C5. Staff e shows a quarter rest. Staff f shows two sets of repeated notes: C4, C4, C4, C4 and E4, E4, E4, E4. Staff g shows repeated notes played with rests: C4, [rest], C4, [rest], C4, [rest], C4, [rest].

Figure 1. Musical examples. a) C-major chord. b) C to C octave jump. c) Phrase with eighth notes. d) Same phrase as c) but with a dotted quarter note. e) A quarter rest. f) Two sets of repeated notes. g) Repeated notes played with rests.

piano's white keys are divided into groups of seven pitches: C, D, E, F, G, A, and B. The next, or eighth, key is the C an octave higher than the first C (the Latin root *oct* means "eight"). Between the white keys are black keys (not including B-C and E-F) that represent approximate mid-points in pitch. The black keys are called sharps if they're a half-step higher than a white key, flats if they're lower. Each octave thus contains 12 notes.

Basic can play in seven octaves numbered zero to 6, each starting in C and working up to B. The bottom octave (zero) really has only three notes: A, A# or B*, and B. Other notes in this octave are sounded as the low A. In octave 6, I can't hear anything but a click above F, but your ears might be better than mine.

The Basic manual incorrectly states that the C in octave 3 is the same pitch as middle C on the piano keyboard; it should say octave 2. But since the octave 3 C is in the midrange of notes available in Basic,

it's easier to treat that as middle C, as the examples in Fig. 1 do. Figure 1a shows the C-major chord played earlier.

The greater-than (>) and less-than (<) symbols let you go up and down one octave. They provide the easiest way to change octaves within a melodic line after using the O command to establish a starting octave. Here's a command line that uses them to produce the one-voice melody in Fig. 1b:

```
PLAY "O3 c>c<bagfedc"
```

This line plays middle C in octave 3, jumps up an octave to the C of octave 4, comes back to octave 3, and goes down the scale.

Flats and Sharps

To indicate flats, add a minus sign (-) after the note name. For sharps, you can use either the number sign (#) or the plus sign (+). Change the C-major chord to C minor by adding a minus sign after the E

to make it an E-flat:

PLAY "O3 c","O3 e-","O3 g"

Volume Control

To my ears, the sound starts out too loud, and here again the manual steers you wrong. You can set the volume between zero and 15; my manual says the default is 8, but that was true only in the first GW-Basic release. The latest, version 2.02, defaults by turning the volume all the way up to 15. (The manual also says the volume command won't work without the Sound On statement. Wrong again.)

Try turning down each voice by adding a volume instruction:

PLAY "V8 O3 c","V8 O3 e-","V8 O3 g"

You can also vary the volume of each voice:

PLAY "V12 O3 c","V8 O3 e-","V4 O3 g"

You'll probably want equal volume most of the time, but varying the volume does let you emphasize melodic lines in individual voices.

Legato, Staccato, and Normal

Try adding more notes to each voice so the chord repeats four times. While you're at it, turn the volume levels back to 8 and change the E-flats back to E-natural:

PLAY "V8 O3 cccc","V8 O3 eeee","V8 O3 gggg"

The line produces four distinct chords

because Basic defaults to the music normal (MN) setting and plays each note at 7/8 its regular duration. You can further shorten the duration by adding the music staccato (MS) command to make each note 3/4 its normal length:

PLAY "MS V8 cccc","MS V8 O3 eeee","MS V8 O3 gggg"

Basic's music legato (ML) command plays each note at full value:

PLAY "ML V8 O3 cccc","ML V8 O3 eeee","ML V8 O3 gggg"

The problem with music legato is it lacks separation between notes and sounds like one long chord. It works fine, though, if all the notes are changing:

PLAY "ML V8 O3 ccde","ML V8 O3 effe","ML V8 O3 gagg"

Music normal (MN) and music staccato (MS) present even bigger problems. You'd think music normal would play 7/8 of a note followed by a silent period equalling 1/8 the value. Similarly, with music staccato you'd expect the sound/silence ratio to be 3/4:1/4, but it isn't so. The code was apparently written by programmers and not by musicians. The silent period is an inflexible, short value having no apparent relationship to the length of the note.

When you use equal notes in each voice, MN and MS sound fine; but when you put eighth notes in one voice, quarter

notes in another, and 16th notes in the third, the silences gang up differently and produce horrible fragmentation and separation of lines. I'll discuss how to handle that later.

Note Lengths

The most common time signature in Western music has four pulses, or beats, per measure. Thus, a whole note lasts a whole measure (four beats) and a half note lasts half a measure (two beats). Four quarter notes fill a measure and get one beat each; halving each quarter note produces eight eighth notes of one-half beat each, and so on. Figure 2 illustrates this principle.

The command for specifying note length (L) holds for each note in a voice until Basic encounters the next L. Try putting a whole note in the first voice, two half notes in the second, and eight eighth notes in the third (and go back to MN mode):

PLAY "L1 MN V8 O3 c","L2 MN V8 O3 ee","L8 MN V8 O3 gggggggg"

You can also place a number after a note name to change the duration for that note only. In Basic, Fig. 1c looks like this:

PLAY "L4 cdee8f8g"

You can designate dotted notes by putting a period after the note name. (A dotted note's value is lengthened by half.) Here's the Basic statement for Fig. 1d:

PLAY "L4 cde.f8g"

Basic recognizes any note length from 1 to 64. It will play 57th notes, but don't tell your musician friends that. They'll only want to hear the standard note values I've talked about, with maybe some occasional 32nd or 64th notes.

Rests and Tempo

Rests are handled by a pause command (P) followed by the same numbers used for length. The musical example in Fig. 1e looks like this in Basic:

PLAY "cdp4e"

The tempo command (T) sets the speed of the music by quarter notes per minute; the default value is 120 and the allowable range is 32-255. With two or three voices, make sure to indicate a tempo for each if you aren't using the default value. Try four quarter notes at tempo 230:

PLAY "T230 MN cccc"

and then slow it down to tempo 50:

PLAY "T50 MN cccc"

You might have noticed that changes to any of the dynamic commands mentioned so far (L, O, T, MN, ML, MS, and V) become the new default value until they are reset.

Background and Foreground

Two other commands, MB and MF, produce music in the background and in the foreground. With music background (MB), the program goes ahead with the next state-








Whole note	L1		four beats	
Half note	L2		two beats	
Quarter note	L4		one beat	
Eighth note	L8		half a quarter—two together	
Sixteenth note	L16		half an eighth—four together	

Fig. 2. Note lengths and designations. Second column gives GW-Basic equivalent.



Fig. 3. Excerpt from Bach's E-flat Trio Sonata, Allegro.

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ment as soon as it sets up the Play statement and can do other things while the music is playing. The manual is wrong in saying that no more than 32 notes can be in the background at a time. I can get 48 to play, which means only that the interpreter won't set up the next line until it is down to the last 48 notes. You can write much longer phrases in MB with no problem.

Try this short program that plays music in the foreground:

```
10 CLS
20 PLAY "MF cdefg"
30 PRINT "Hello"
```

You didn't see "Hello" until the tune was finished. Now replace MF in line 20 with MB and run the program again. "Hello" was right there waiting for you. (The manual is wrong again in saying Basic assumes MB if you don't specify MB or MF. In fact, it assumes MF.)

A Bach Trio

The Program Listing is a transcription of part of a Bach organ trio sonata for the Tandy 1000. It is written in three voices, and the computer produces sustained notes without volume decay like an organ.

Thus far, we've given the Play statement its commands in strings within quotation marks, but it can also take them in string variables. The program sets up three arrays: S\$() for the soprano (first) voice, A\$() for the alto (middle) voice, and B\$() for the bass (third) voice.

Look at the first few measures of the Bach score and see how they're translated in the Basic listing. Each array element is set up to handle four measures; thus, the first four measures of the soprano line are in S\$(1).

S\$(1) starts by declaring octave 3 (O3) and eighth notes (L8). Then it plays an E-flat, jumps up to the next octave for another E-flat, comes down to the original octave for an F, then back up an octave for E-flat, and so on. There's a 16th-note command later in the same line.

The alto voice part in A\$(1) is all rests for the first four measures. The time signature is 3/4, so each measure contains three quarter-note beats. P2 creates a rest equal to a half note (two beats), and P4 creates a quarter rest (one beat). The two rests are repeated four times.

The bass voice in B\$(1) starts off by declaring quarter-note lengths (L4) in the second octave (O2). Then there's a two-beat E-flat followed by a quarter rest, and so on.

The entire group of array assignments is a note-by-note transcription from the organ score. For simplicity, I've split it up so that each array element represents four measures.

The array elements are then played from within a For...Next loop. Just before the loop begins, however, there's another Play statement in line 380 that initializes tempo at 120, volume at 8, music in background, and music legato for each voice.

Program Listing. Program to play excerpt from Bach's Trio Sonata using Basic Play command. (See p. 164 for information on using the checksums in this listing.)

```
30 SCREEN 0:KEY OFF 'Give the ** 1201
40 COLOR 14,1,1:CLS 'audience ** 1118
50 LOCATE 7,35:PRINT "J. S. Bach" 'something to ** 2042
60 LOCATE 9,27:PRINT "Trio Sonata No.1 in E flat" 'look at while ** 3546
70 LOCATE 10,37:PRINT "Allegro" 'the music plays ** 2119
80 REM ** 364
90 REM Now assign the notes to the S$( ), A$( ), and B$( ) arrays ** 4742
100 REM ** 405
110 S$(1)="O3 L8 e->e-<f>e-<g>e-<a>e-<b>e-ce- L16 <b>e-dc<b>e- ** 6713
    gfe-dc<b-a-ga-b-ge-gb>e-<fa>ce-" ** 1843
120 A$(1)="p2p4p2p4p2p4p2p4" ** 2499
130 B$(1)="O2 L4 e-2p4c2p4O1g.a-8b-e-ga"
140 S$(2)="O4 L16 dcdfe-de-gfe-fa-gf-gb-dcdb-e-de-b- L8 dfb-dcab- ** 5397
    dFd<b>d"
150 A$(2)="O2 L8 b->b-cb-db-e-b-fb-gb- L16 fb-agf>dc<b-agfe-de-f ** 5728
    d<b>dFb-dfa-b-" ** 2343
160 B$(2)="O1 L4 b-2p4b-2p4b->dfb-2p4"
170 S$(3)="O4 L8 e-p8e-p8e-p8e-p8e-p8e-p8 L16 p16e-fga-b->c<b-a-g- ** 5803
    fa- L8 g<b>c<a>f4"
180 A$(3)="O3 L16 gfgb-a-ga->c<b-a-b>d<c<b>ce-<gfg>e-<a-ga>e- ** 7519
    L8 <gb>e-<gfb>p16 L16 e-fga-b->c<b-a-gfa-"
190 B$(3)="O1 L8 e->e-<f>e-<g>e-<a>e-<b>e-ce-<b-p8>cp8dp8e-2d4 ** 4350
    "
200 S$(4)="O4 L16 p16a-gfe-dc<b-a-ga>f<g>fe-dc<b-a-gf4p16a-gfe- ** 6169
    4p16de-f< L8 b>dbg>cd"
210 A$(4)="O3 L8 g<b>c<a>f4 L16 p16a-gfe-dc<b-a-ga>f<g>fe-dc< ** 6133
    b-a-gf4p16a-gf L8 e-gab" ** 3559
220 B$(4)="O2 L4 e-a-p4<b>cd<e-a-2g L16 p16>gfgf-fde-"
230 S$(5)="O4 L16 e-c<b><g>c<b>ce-c<b>c L8 <a-p8>e-p8e-p8 L16 ** 7290
    p16<b-a-b-fb-a-b>d<b-a-b- L8 gp8>d-p8d-p8"
240 A$(5)="O3 L16 c8p8p4p4p16fe-fcfe-fa-fe-fd8p8a-8p8a-8p8p16e-d ** 6026
    -e-<b>e-d-e-g-e-d-e-"
250 B$(5)="O2 L8 ce-ce-ce-<f>a-<f>a-<b>d<b>d<b>d<e>g<e- ** 4852
    >g<e-g"
260 S$(6)="O3 L16 p16a-ga-fa-ga->c<a-ga-fb-a-b>d<b-a-b>fdcdb-8 ** 6402
    g8e-2p16dc<b-ab-agf>e-dc"
270 A$(6)="O3 L16 cfefcfefa-fe-fd8f8b-2p16<b-a-b>e-<b-a-b>ge-d ** 6140
    e-ab-agf>dc<b-agfe-"
280 B$(6)="O1 L8 a->c<a>c<a>c<a>d<a>d<a>d<g>e-<g>e-<f4 ** 4652
    p4p4"
290 S$(7)="O3 L16 b-2.p16ab->e-<b-ab>dc4p16gfe-db-agfe-dc" ** 4058
300 A$(7)="O3 L16 dcdfe-de-gfe-fa-gf-gb-dcdb-e-de-b-d4p16>dc<b-ag ** 5013
    fe-" ** 3217
310 B$(7)="O1 L8 b->b-cb-db-e-b-fb-gb-fb-e-b-fa"
320 S$(8)="O3 L8 b->fgfgf L16 fb-ab-e-b-db-e-b-cb-d4p16<b>cde-f ** 5970
    gab-8<b-8>c8p8<a4b-2,"
330 A$(8)="O3 L16 db-ab-e-b-db-e-b-cb- L8 dfgfgf- L16 f<b>cde-4 ** 5918
    p16de-cf8d8e-8p8c4d2."
340 B$(8)="O1 L8 b-4p4p4b-4p4p4p8>fgfgf-dge-p8f4<b-2." ** 3677
350 REM ** 412
360 REM Initialize tempo, volume, background mode, and legato in ** 6690
    each voice ** 414
370 REM ** 3116
380 PLAY "T120 V8 MB ML", "T120 V8 MB ML", "T120 V8 MB ML" ** 416
390 REM ** 4646
400 REM Use a FOR-TO-NEXT loop to play the array strings ** 409
410 REM ** 913
420 FOR K=1 TO 8 ** 1403
430 PLAY S$(K), A$(K), B$(K) ** 503
440 NEXT
```

End

Be sure to set each command for individual voices.

Avoiding Problems

What happens to the Bach piece if you specify music foreground instead of music background? To find out, change the MB initialization commands in line 380 to MFs and rerun the program.

The gaps between four-measure groups are now too great, and there is some separation between voices. The rhythm is lost and the flow has become awkward. Because of this limitation, you'll likely have to specify MB in serious musical applications.

What happens if you don't use the ML (legato) setting? The Bach sonata clearly demonstrates how fragmented the voices will become. Change the MLs in line 380 to MNs and run the program. The notes are out of sync.

The normal and staccato modes (MN and MS) are so flawed by their lack of rhythmic integrity that you should never

use them, unless you're working with three voices that have identical rhythmic patterns. Songs like that are usually boring, though. Plan always to use legato (ML) and background (MB).

Keeping the Band Together

Some complex rhythmic passages fragment if the command strings are too long—even if you've used ML and MB. To fix this, use shorter command strings: Put only two measures, one measure, or even half a measure in each line of the array. The lines will be synchronized each time the For...Next loop starts.

Even this solution won't work if there's a marked difference in rhythmic complexity among voices. If you can't get 16th notes in one voice to match up with half notes in another, try writing the half notes as a series of four eighth notes. When the eighth notes are all the same pitch and you're in legato mode (ML), the sound produced will be the same as a half note.

Sometimes your ear will tell you the Basic interpreter is producing a voice sluggishly; making all the voices about equally complex should fix the problem.

If you always use legato (ML), which puts no silences between notes, how do you handle repeated notes in the same voice? Organists deal with this problem all the time, and they have a standard rule: Replace a note that is to be repeated with a note exactly half its value and a corresponding rest.

Figures 1f and 1g illustrate the principle. (Figure 1f is the phrase before it's broken down.) Here's the Basic code:

```
PLAY "ML c8p8cd8p8d"
```

Enharmonic Code

You can specify notes by number (N) instead of by their letter names (PLAY "N61" for example). The range is zero to 84; zero is silent, and 1-10 produce the identical low A (note 10) of the bottom octave. With my speaker and to my ears, notes 79-84 sound like clicks. Consult the manual for instructions on producing sound effects with this command.

You can use a numeric variable after O, P, T, and V (the manual shows the wrong syntax and says incorrectly that you can't use V). You must put an equals sign (=) between the command letter and the nu-

meric variable, followed by a semicolon before continuing or completing the command string. The following short program demonstrates the proper syntax:

```
10 SOFT = 5:LOUD = 15 'define V settings
   (volume)
20 SLOW = 60:FAST = 240 'define T settings
   (tempo)
30 PLAY "V = soft:T = slow:cdefg V = loud:T =
   fast:gfedc"
```

Use the Sound statement instead of Play when you want to create sound effects that are controlled by numeric variables—it's more appropriate for that. The Play statement is designed to emulate a key-

board and does a super job of it.

You can also call a previously defined string variable that contains a Play statement followed immediately by the variable name and a semicolon (there's no equals sign). This is handy for repetitive phrases.

The GW-Basic Play statement opens up a world of musical programming. Enjoy it. ■

Don Phillip Gibson is a physician and church organist. You may write to him at 910 E. 11th, Winfield, KS 67156. For \$6, Don will send you a disk of all three movements of the Bach E-flat Trio Sonata.

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MONTEZUMA MICRO

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MONTE'S TOOLKIT

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REQUIRES: Montezuma Micro CP/M® 2.2 version 2.21+

Monte's Toolkit is a collection of utilities that will prove useful to every owner of Montezuma Micro CP/M (you all are owners, aren't you?). It's a disk full of programs that perform functions that are difficult, cumbersome or expensive to do any other way. Monte has tried, in his own way, to briefly explain each function for you below. Read on and be saved.

DOUBLECROSS™ allows unlimited file transfers between CP/M™, IBM-DOS and Model 3/4 LDOS™ /TRSDOS™ with unsurpassed ease and speed. In fact, you can move just about anything from any disk to any other disk but you might have to make changes for program operation. Lotus 123™ just flat won't run on your Model 3 and I doubt that you could ever modify Scripsit™ enough to run on the IBM. Simple menus guide you through the operation with minimal keystrokes. Just tag the files you want in the directory display and go. You won't get doublecrossed with **DBLCROSS**.

FREEFORM™ formats and backs up Model 3/4 LDOS/TRSDOS and IBM MS & PC-DOS (versions 1.x, 2.x and 3.x), both single side and double side plus there is a special "clone" copy when you just don't know or care what you have. Just insert a disk and copy away. All you have to know about the disk is how to get it into the drive. The Analysis feature lets you look at and print the actual structure of a disk - even the ones with "funny" formats.

WSPR lets you print to almost any printer using almost any control code. It's nearly magic and does a whole lot more than I can talk about here including letting you print *anything* your printer can print.

FILEFIX™ gives you the ability to "fix" your "files" by adding line-feeds when your files are going from CP/M or IBM-DOS to LDOS/TRSDOS or take them away if you are transferring the other way. You can remove the control codes from a WordStar™ document thereby converting it to a non-document file. The fix will also fix up Scripsit files so they can be used by CP/M and IBM-DOS based wordprocessors (you know - the real ones). All this is accomplished with the use of simple menus and boy, it is fast.

SYS2M requires 128K and our CP/M. The CCP and the BDOS are moved to drive M and the BIOS is modified to allow a Warm Boot from Drive M. So what you say. Well, you still have to have a disk in drive A but it no longer has to have the CP/M system resident. It can be anything. This little jewel copies frequently used programs to drive M and searches there first for all program requests resulting in much faster program loading. Slick isn't it?

AUTO is a little goodie that lets you issue multiple commands from the command line. Eliminates the *pain* of Submit. As in all the other parts of **MONTE'S TOOLBOX**, complete and comprehensive instructions are included and it's available right now.

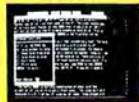


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Once Upon A Time,

Monte Zuma, our Founder, President and King, has always had trouble keeping his desk organized. The Sidekick™ from Borland International would solve the problem, but alas, it was not available for CP/M™. So Monte asked his favorite nephew, the legendary LaMont E. Zuma (distant cousin to Rondo Talbot, a direct descendant of Monte Zuma himself) to work on the problem as best he could during recess at the home. LaMont, a true legend in his own time, really outdid himself this time. A touch of both shift keys halts your application program in its tracks and up pops Monte's Window™ ready to use. What could be simpler? Put an end to the fumbling and pawing around the pile of papers on your desk. You will find Monte's Window™ indispensable. When you are finished, break back to your application program and it resumes without error. Monte's Window™ is truly a breakthrough. See for yourself - Look through Monte's Window™ on your Model 4. How did you ever get along without it? See the page opposite for order information. Monte's Window™ is available right now.



MONTEZUMA MICRO

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MONTE'S BASIC

Your TRSDOS BASIC (01.01.00) will work the same, for the most part, under CP/M as it does under TRSDOS. However, for the most part isn't good enough. But, with some changes provided by our **BASCON**™ program, you can be 100% compatible with the standard BASIC used with CP/M. True, you lose some of the TRSDOS BASIC features while gaining new features such as FILES, NULL, RESET, etc. **BASCON** alters your TRSDOS BASIC, which was included with your Model 4 when you bought it, so that it will function under CP/M. You must have the unaltered original TRSDOS BASIC as above in order to convert with **BASCON**. The program operation is fully automatic and quick. The resulting BASIC runs any CP/M 2.2 BASIC program that previously required MBASIC™. Programs written for TRSDOS BASIC may require modification to run correctly under the converted BASIC. Fully compatible with MBASIC. We even provide for additional documentation that is keyed by page number to your TRSDOS BASIC manual. **MONTE'S BASIC** is available right now.

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Can we talk? CP/M vs TRSDOS

By moving to CP/M on your Model 4 you achieve two things. First you open the door to a wealth of existing software. More 8-bit software runs under CP/M than any other operating system. This includes virtually all of the "big name" programs which have set the standards by which all others are measured. Programs like **WordStar**, **dBASE II**, and **Turbo Pascal** are available for CP/M, but not TRSDOS. Public domain software, almost unknown under TRSDOS, fills hundreds of megabytes of disk space. Valuable public domain programs like the **Small C Compiler** are just a toll-free phone call away. Most importantly, hundreds of applications programs are available from a multitude of vendors. Many include the source code. Wouldn't you like to be able to choose from scores of Accounts Receivable or General Ledger programs, instead of the meager selection you now have? Circle our special Reader Service number 600 on the Reader Service Card to receive our comprehensive free listing of suppliers of application programs that run under CP/M.

What about the future?

When the time comes to move up to another computer it will almost certainly use MS-DOS. That's when CP/M users get a pleasant surprise. Since MS-DOS was a derivative of CP/M it operates in almost the same manner. Even better, most of the same software packages are available in 16-bit form and they operate in virtually the same way that they did under CP/M.

Is it easy to use?

Montezuma Micro's CP/M has been carefully crafted to present a maximum of features while taking a minimum of memory. It supports all of the standard features of the Model 4/4P/4D computers, as well as most of the optional ones. Our CP/M has been consistently been awarded the highest ratings in industry magazines. It is version 2.2, the most popular and reliable of all the versions of CP/M produced. Our CP/M has been made as easy to use as possible. All customer-selected features are chosen from simple menus in our CONFIG utility. This includes the ability to configure a disk drive to run like that of scores of other CP/M com-

puters for maximum ease of software portability. Using the unique DBLCROSS program in our Monte's Toolkit utility package you can move files back and forth between CP/M, TRSDOS (1.3 and 6.x), and MS-DOS.

Why use Montezuma CP/M?

We have already told you why our CP/M is the best for the Radio Shack Model 4 computer. The only question left to answer is "Why buy CP/M at all?" Radio Shack has abandoned TRSDOS — all of their new machines use MS-DOS. Most of the software producers have followed, leaving no new software development and saddling the TRSDOS user with whatever software "left-overs" he can find. Which DOS do you want to head into the future with: the one originally written for the Model I or the one that served as the basis for MS-DOS? Make the right choice right now for just \$169.

If I need support?

We don't forget you after the sale. If you have a problem you will find our phones are answered by people, not answering machines or hold buttons. Our philosophy is very simple — we want you to be happy and satisfied with your purchase. If you have a problem then we have a problem, and we'll do whatever we can to resolve it.

Cost to update?

Our owners are protected against instant obsolescence by our lifetime upgrade policy. At any time you can return your original CP/M disk to be upgraded to the latest version free of charge, except for a small shipping and handling fee. Periodically we publish **NEW STUFF**, a newsletter for registered users of Montezuma Micro CP/M. This publication carries news about new products, tips for getting more out of CP/M, and other valuable information for our users. It is sent free of charge to registered owners.

Can I use a hard disk drive?

CP/M hard disk drivers are available for Radio Shack, Aerocomp, and most other popular brands of hard disk drives. These drivers allow the hard drive to be partitioned into one to four logical drives of varying sizes.

These drives may all be used by CP/M, or may be divided between CP/M and TRSDOS. A head-parking utility is included on the driver disk to minimize the risk of damage when the hard disk drive is not in use. Also included at no charge is a utility which will copy, compress, list, print, and delete files with ease. There isn't much you can say about a driver. It either works or it doesn't. Ours works supremely and it only costs \$30.

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Size of Transient Program Area (TPA): 56,070 bytes in a 64k system. 55,046 bytes in a 63k system (with optional hard disk driver). **CP/M IOBYTE:** Fully implemented. **Device Drivers:** Disk (35, 40, 77, & 80 track, single/double density single/double sided, 3, 5, or 8 inch. (More than 85 disk formats supported) **Maximum Disk Capacity:** 40T SS=220k, 40T DS=440k, 80T DS=880k **RS-232:** All word lengths, parity, & baud rates. **Parallel Printer:** With or without line-feed and/or formfeed. **Video:** 24 by 80 with reverse video. **Keyboard:** Full ASCII with 9 function keys. **RAM Disk:** 64k, automatic on 128k systems. **Hard Disk:** Optional drivers available at extra cost for most popular models. Standard CP/M programs included: **ASM, DDT, DUMP, ED, LOAD, MOVCPM, PIP, STAT, SUBMIT, SYSGEN, and XSUB.**

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HARDBACK \$ 49



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Spooling Around

Use the Model 4's extra memory as a printer buffer in Model III mode.

Running a Model 4 in Model III mode is a bit like driving a Porsche in first gear—it does the job, but it could do more if you'd let it.

By using utilities that employ Model 4 features from Model III mode, however, you can enjoy the Model 4's enhancements and run a wide variety of software designed for the Model III. I've written a print spooler employing random-access memory (RAM) that is normally inaccessible from Model III mode.

Spool School

Spool intercepts data intended for a line printer and stores it in a buffer. An interrupt-driven background routine outputs a stream of data to the printer until the printer indicates it is no longer ready, while the foreground routine runs seemingly uninterrupted. To use Spool, just type it into your editor/ assembler, assemble it, and execute it.

Spool is unlike most spoolers because it needs no user RAM or disk space to store its buffer. Instead it uses the 16K of bank zero, which is mapped out in Model III mode in 64K Model 4's, or the 32K of bank 2 in 128K Model 4's and 4Ps. The only memory overhead is the 100 or so bytes dedicated to the two required drivers.

The program is configured for 64K Model 4's, not 4Ps. You must change a couple of constants to configure it for 128K machines. I describe the changes in the Constants section of the Program Listing.

Spool runs under all Model III DOSes. You can install it by typing its file name from DOS Ready; if the computer reboots, there is probably a competing high-memory driver. To solve the problem, decrease the constant called Start by 100 hexadecimal and reassemble the program.

Unfortunately, Spool won't function with programs that have their own printer input/



System Requirements

- Model 4/4P
- 64K RAM
- Model III DOS
- Editor/assembler

Program Listing. Spool.

```

00010 ;*****
00020 ;* Model 4 Print Spooler *
00030 ;* by Craig Chaiken *
00040 ;*
00050 ;* 64K Machine - Accesses 16K of RAM not utilized in *
00060 ;* Model III Mode. (Note - Model 4s only, not 4Ps) *
00070 ;* 128K Machine - Accesses 32K of RAM in BANK 2 *
00080 ;* (Change Constants as Indicated) *
00090 ;*****
00100 ;
00110 ;*** Constants ***
00120 ;
FF70 00130 START EQU 0FF70H
4012 00140 INTVEC EQU 4012H
4026 00150 PRTDCB EQU 4026H
03C2 00160 OLDPRT EQU 03C2H
003B 00170 PRTOU EQU 003BH
4411 00180 HIMEM EQU 4411H
0000 00190 BANRES EQU 00H ;01H - 128K Model 4P Only
0003 00200 BANSEL EQU 03H ;63H - 128K Model 4 & 4P
0040 00210 BLOCKS EQU 40H ;80H - 128K Model 4 & 4P
00220 ;
FF70 00230 ORG START
00240 ;
00250 ;*** Install and Protect Print Spooler ***
00260 ;
FF70 2187FF 00270 LD HL,NEWPR
FF73 222640 00280 LD (PRTDCB),HL
FF76 2B 00290 DEC HL
FF77 221144 00300 LD (HIMEM),HL
FF7A 2A1340 00310 LD HL,(INTVEC+1)
FF7D 22F1FF 00320 LD (PATCH),HL
FF80 21AEFF 00330 LD HL,NEWVEC
FF83 221340 00340 LD (INTVEC+1),HL
FF86 C9 00350 RET
00360 ;
00370 ;*** New Printer Driver Routes Output to Memory ***
00380 ;
FF87 F3 00390 NEWPR DI
FF88 3E03 00400 LD A,BANSEL ;ROM out, RAM in
FF8A D384 00410 OUT (84H),A
FF8C 2AFDFE 00420 LD HL,(BOTTOM)
FF8F 71 00430 LD (HL),C ;Store Byte
FF90 3E00 00440 LD A,BANRES ;ROM in, RAM out
FF92 D384 00450 OUT (84H),A
FF94 CDF3FF 00460 CALL INCPTR ;Increment Pointer
FF97 22FDFE 00470 LD (BOTTOM),HL
FF9A FB 00480 EI
00490 ;
FF9B 2AFDFE 00500 WAIT LD HL,(BOTTOM) ;Buffer Full?
FF9E ED5BFFBF 00510 LD DE,(TOP) ; Then Loop Until
FFA2 23 00520 INC HL ; Emptied By INTVEC
FFA3 AF 00530 XOR A
FFA4 ED52 00540 SBC HL,DE
FFA6 28F3 00550 JR Z,WAIT
FFA8 7C 00560 LD A,H
FFA9 FE40 00570 CP BLOCKS
FFAB 28EE 00580 JR Z,WAIT
FFAD C9 00590 RET
00600 ;
00610 ;*** Interrupt Driven Buffer Dump ***
00620 ;
FFAE F3 00630 NEWVEC DI
FFAF E5 00640 PUSH HL
FFB0 D5 00650 PUSH DE
FFB1 F5 00660 PUSH AF
00670 ;
FFB2 3E03 00680 OUTPUT LD A,BANSEL ;Output Until Printer
FFB4 D384 00690 OUT (84H),A ; Is Not Ready
FFB6 2AFBFF 00700 LD HL,(TOP)
FFB9 ED5BFFDF 00710 LD DE,(BOTTOM)
FFBD AF 00720 XOR A
FFBE ED52 00730 SBC HL,DE
FFC0 2828 00740 JR Z,EXIT
00750 ;
FFC2 DBF8 00760 IN A,(0F8H) ;Printer Ready?
FFC4 E6F0 00770 AND 0F0H
FFC6 FE30 00780 CP 30H
FFC8 2020 00790 JR NZ,EXIT
00800 ;
    
```

Listing continued

Listing continued

```

FFCA 2AFBFF 00810 LD HL, (TOP) ;Get and Output
FFCD 56 00820 LD D, (HL) ; Byte From Buffer
FFCE 3E00 00830 LD A, BANRES
FFD0 D384 00840 OUT (84H), A
FFD2 CDF3FF 00850 CALL INCPTR
FFD5 22FBFF 00860 LD (TOP), HL
FFD8 7A 00870 LD A, D
FFD9 21C203 00880 LD HL, OLDPRT
FFDC 222640 00890 LD (PRTDCB), HL
FFDF CD3B00 00900 CALL PRTOUT
FFE2 2187FF 00910 LD HL, NEWPRT
FFE5 222640 00920 LD (PRTDCB), HL
FFE8 18C8 00930 JR OUTPUT
00940 ;
FFEA AF 00950 EXIT XOR A ;Jump to Old
FFEB D384 00960 OUT (84H), A ; Interrupt Handler
FFED F1 00970 POP AF
FFEE D1 00980 POP DE
FFEF E1 00990 POP HL
FFF0 C3 01000 DEFB 0C3H
FFF1 0000 01010 PATCH DEFW 0
01020 ;
FFF3 23 01030 INCPTR INC HL ;Increment Pointer
FFF4 7C 01040 LD A, H ; If End Of Buffer
FFF5 FE40 01050 CP BLOCKS ; Then Wrap-Around
FFF7 C0 01060 RET NZ ; To Beginning
FFF8 2600 01070 LD H, 0 ; Of Buffer
FFFA C9 01080 RET
01090 ;
FFFB 0000 01100 TOP DEFW 0
FFFD 0000 01110 BOTTOM DEFW 0
FF70 01120 END START
00000 Total Errors
    
```

End

output, such as Scripsit and VisiCalc. There are network versions of these programs, however, that do support print spooling. As an alternative, you can patch programs to use the ROM line-printer driver.

Finally, you can disable Spool by pressing the reset button. There's no need for a more elegant disabling method since the

utility requires so little overhead and need never be disabled. ■

Craig Chaiken is an instructor in the University of Hartford's Department of Engineering. You can write to him at 32 Beverly Drive, Avon, CT 06001.

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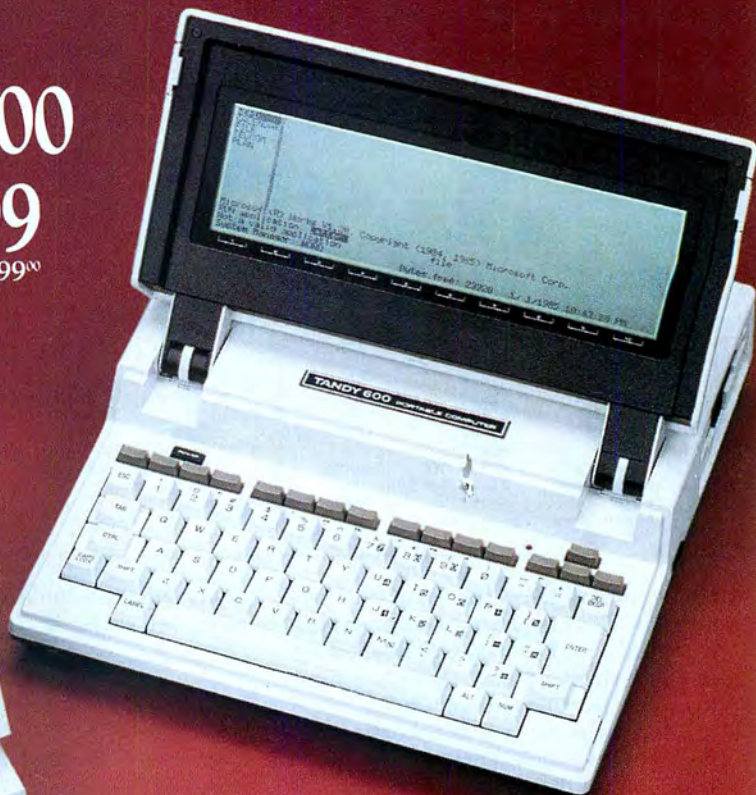
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an electronic personal appointment calendar with alarm, address/phone directory, telephone auto-dialer and built-in modem for data transfer. The Tandy 200 can even generate tone dialing signals for use with long distance services.

The Tandy 200 can fill virtually any computing need. You can even write your own custom programs using the built-in BASIC programming language.

It's all clear! Your results are clearly displayed on the Tandy 200's high-contrast flip-up liquid

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Thanks for the Memory

When you learn how to address the memory in your MS-DOS computer, you clear a high hurdle en route to mastering 8088 Assembly language—and advanced Basic, too. This month, I'll begin with a primer on memory addressing that leads nicely into my second and third topics: Basic's BLOAD/BSAVE statements and disabling the break key (again). What I have to say on memory addressing applies to the 8088 microprocessor that runs the IBM PC and the Tandy 1000/1200. It also applies to the 80186 that powers the Tandy 2000 and to the more sophisticated 80286 as it is used on the IBM PC/AT and the Tandy 3000 under MS-DOS 3.x (in compatibility mode).

Addressable You

Most MS-DOS machines use a 20-line address bus to access up to 1 megabyte (MB) of memory. When the 8088 CPU accesses a memory location, it sends out an address to the memory hardware on the address bus. Each line in the address bus can be either on or off; the number of possible on/off combinations in the 20 address lines can be calculated as 2 to the 20th power ($2^{20} = 1\text{MB} = 1,024\text{KB} = 1,048,576$ bytes). In binary arithmetic (base 2), that's 1 followed by 20 zeros. The actual address ranges from zero (all address lines off) to 1,048,575 (20 binary 1's, or all lines on). The Tandy 1000's 8088 stores information as bytes sent out the 8-bit data bus and written to the RAM location specified on the address bus. The address bus also determines which RAM or ROM byte moves to the CPU in a read operation.

The 16-bit architecture of the 8088 adds an addressing complication, however. How do you represent a 20-bit address with 16-bit registers that only handle numbers up to 65,535? Of the many possible approaches, Intel (designer of the CPU) chose to represent memory addresses with two 16-bit words: the segment word and the offset word. The segment word points to a 64K segment in memory—a 64K window into the 1MB addressable memory space. The offset word points to a byte in the selected 65,536-byte segment. Segments must start on 16-byte boundaries in memory called paragraphs; 65,536



paragraphs add up to 1MB.

Because a segment address represents a multiple of 16 (10 hexadecimal), you multiply it by 16 to calculate the 20-bit address of the paragraph it points to. If you use hexadecimal (hex) number representation, tack a zero onto the end. The segment B800 hex is the start of video memory on the Tandy 1000 and on an IBM with a color graphics adapter (CGA). The display memory thus starts at absolute address B80000 hex (753664 decimal).

What sometimes confuses people is that a given byte in memory can be represented by many segment/offset combinations. The first byte in memory can only be represented as 0000:0000 (the four digits before the colon represent the segment; the four after represent the offset). The two addresses (in hex) 0000:0010 and 0001:0000 represent the 16th byte in memory, but a byte in the middle of memory can be addressed with 4,096 segment/offset combinations.

Whether your program in Assembly language or Basic, you must specify both segment and offset addresses to access a memory byte. The 8088 has four 16-bit segment registers used just for specifying memory segments in machine language. Addresses in other 16-bit registers are always offsets based on one of the segment registers. In Basic, the DEF SEG statement sets the segment address; a PEEK

or POKE statement specifies the offset into that segment.

GW-Basic limits program storage to one segment; no matter how much RAM you install, you always have less than 64K of space to work with (Basic's data segment). When you use a PEEK or POKE statement to access a memory byte, you operate by default inside that 64K data segment. If you want to work outside Basic's data segment, you must change the segment address with the DEF SEG statement. For instance, the statement:

```
DEF SEG = &HB800
```

puts you at the start of video memory. You can alter the display directly with POKES:

```
10 SCREEN 0,0:CLS:DEF SEG=&HB800:
   POKE 1504,72:POKE 1506,73:DEF SEG
```

Using DEF SEG without an address puts you back in Basic's 64K space.

Memory Images

After Beep in your Basic manual come BLOAD and BSAVE (the "B" stands for binary). BSAVE transfers an exact copy of some area of memory to disk. With BLOAD, you can load the saved memory image back to its original location or to another RAM location. BSAVE and BLOAD are often used to display a series of graphics screens (as fast as the drive on which they are stored).

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>WRAP THE TOWEL AROUND MY HEAD

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DAVE'S MS-DOS COLUMN

Program Listing 1. Creating a loadable machine-code subroutine.

```
10 LENGTH=96 :PROTECT=65535-LENGTH :START=PROTECT+1 'addresses
20 CLEAR ,PROTECT 'protects LENGTH bytes below the top of Basic (65535)
30 OPEN "I",1,"ROUTINE.BIN" 'random file with record length of 1
40 FOR I%=START TO 65535:AS=INPUT$(1,1):POKE I%,ASC(AS):NEXT
50 CLOSE
60 BSAVE "ROUTINE.IMG",START,LENGTH 'Start = 65440 when length = 96
```

End

Program Listing 2. A simple method of disabling the break key.

```
10 I=27 'the DOS Ctrl-Break interrupt number
20 DEF SEG=0:POKE I*4,&H53:POKE I*4+1,&HFF:POKE I*4+2,0:POKE I*4+3,&HFF
```

End

Basic video mode

0 (text mode, width 40)
0 (text mode, width 80)
1,2,3 (graphics)
4,5,6 (graphics)

Size of screen in bytes

2048 (0800 hex)
4096 (1000 hex)
16384 (4000 hex)
32768 (8000 hex)

(Note: Modes 3-6 are for the Tandy 1000 only.)

Table. Memory size of video screens (or displays).

I've seen some graphics displays that take several minutes to create. Once saved to disk, however, they pop right onto the screen with BLOAD.

The Basic technique is short and simple. When you've finished a routine that creates a graphics screen you want to save, add the following line to the end:

```
10000 DEF SEG=&HB800:BSAVE "filespec.IMG",0,&H4000:DEF SEG
```

You must tell BSAVE how many bytes to store. The size of a screen in bytes varies with video mode (see the Table). The sample value (&H4000 or 16K) could be for video mode 3 (low resolution, 16 colors). You must also provide a file name for the saved image. (I used the extension IMG because Basic adds an inappropriate BAS if you don't supply your own extension.)

BSAVE requires that you specify both a segment and offset address for the area you want saved. Usually, the segment is the color graphics video memory area at B800 hex. If you use an IBM-type monochrome monitor, use &HB000 in the DEF SEG statement. The offset is zero, assuming you're using video page zero (the default).

To display a saved screen, use BLOAD with the file name (for this example: BLOAD "filespec.IMG"). Unless you set a different segment and offset, Basic loads the memory image right back where it came from. Basic knows where that is because the segment, offset, and length are stored in a header at the start of the image file.

You can also use memory-image files to store machine-language subroutines and BLOAD them into high memory, where you can invoke them with the Call

statement. (Be sure to protect the image area first with the /M: parameter when you load Basic or with the Clear statement from within Basic.)

You can't load some little COM file in there, however. BLOAD requires a 7-byte header on any file it loads. The header (created by BSAVE) consists of the byte FD hex (BSAVE's signature) followed by three word values stored least-significant byte first. The words contain the segment, offset, and length of the memory image, in that order. A display screen stored with BSAVE in Basic screen mode 3 (low resolution, 16 colors) from page zero would have the following header (in hex):

```
FD 00 B8 00 00 00 40
```

The trick is turning the assembled routine you've debugged into a BSAVE memory image. You could assemble the header as data at the start of your routine (once you know the length). Another approach is to read in the machine code byte by byte from its disk file, POKE each byte into the location it will occupy when used, and then BSAVE it. Program Listing 1 POKES a relocatable routine into the top 96 bytes of Basic's data space. (You must start above the memory top specified in the Clear statement.)

Because Basic doesn't necessarily load into the same place in memory, specify the subroutine's offset when loading it:

```
1000 DEF SEG:BLOAD
"ROUTINE.IMG",65440
```

If you don't specify an offset, Basic loads the memory image using the segment and offset stored in the file header. When you specify an offset, Basic uses the current segment address. (The DEF SEG statement forces it to Basic's data

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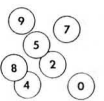
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The copy technique is not advised for long batch files or if you tend to make typos.

segment, in case it's not there.)

If you have enough RAM to load Debug above Basic through the Shell command, you've got a third technique for creating a loadable machine-language subroutine. Load your machine-code file when you invoke Debug:

SHELL "DEBUG ROUTINE.BIN"

With the R command, examine the 8088 registers CS, IP, and CX to note the segment, offset, and length of the file. After quitting Debug (with Q), you are back in Basic, but your machine code is still in memory. Use DEF SEG and BSAVE to create a memory-image file of your code using the noted register values (with Basic's hex notation). (See Feedback Loop, p. 12.) With this technique, always specify the offset when you BLOAD the machine-language subroutine.

That Break Key

Did I devote all of last month's column to a method of disabling keys? I've just come across a simpler technique—a virtual one-liner—that's great if you want to disable only the break key or the print-screen routine (see Program Listing 2). It can't stop the print key from hanging you up and it won't disable the hold key.

Line 20 replaces the low-memory interrupt vector specified in line 10 with an address pointing to an IRET (interrupt return) instruction in ROM. In this example, line 20 short-circuits the break key routine that Basic installed at that vector (27 or 1B hex). The address of this particular IRET instruction (always at address F000:FF53 in ROM) pops up in the interrupt vector table (the first 1,024 bytes of RAM) whenever a standard interrupt routine is supposed to do nothing. It seems to be a standard for PCs and clones. Using Debug, I found an IRET at this address in the Tandy 1000, 1000 SX, 1000 EX, 1200, 3000 HL, and 3000 HD. (The 2000 uses 0600:09D8 as a dummy interrupt vector, but its interrupt system is nonstandard.)

You can disable the print-screen function by assigning the value 5 to variable I in line 10. You should never use this technique to change the interrupt vector

for hardware interrupts or for the BIOS (basic input/output system) and DOS service routines. If an interrupt is called while you are POKING in a new address, your computer is certain to hang up. The break-key disable routine ends when you leave Basic. The print-screen disable routine is permanent unless you restore the original address before leaving Basic.

Copy CON Appends

Creating short batch files or a CON-FIG.SYS file with the DOS Copy command is a common technique. You do it by copying from the console device (CON), meaning the keyboard and display, to a text file you want to create. After typing in the Copy command line, type in each line of the file (pressing the enter key to start a new line). To end the file, press the F6 key (or control-Z) and press enter again. This copies the typed lines to disk under the specified file name. Entering the following lines creates a small CONFIG.SYS file that speeds up floppy disk input/output (I/O) if you've got more than a modicum of memory:

```
COPY CON CONFIG.SYS
BUFFERS = 10
FILES = 10
^Z
```

The technique overwrites an existing file of the same name. If you already have a CONFIG.SYS file, you'll overwrite it. You can, however, use the Append form of the Copy command to add a few lines to the end of an existing file. Entering the following lines adds a new line to an existing CONFIG.SYS file:

```
COPY CONFIG.SYS + CON
DEVICE = ANSI.SYS
^Z
```

If you put the end-of-file marker (control-Z) at the end of the last line of your batch files (a trick that prevents an extra DOS prompt after execution), you should start the appended text with a carriage return (press the enter key). The copy technique is not advised for long batch files or if you tend to make typos. Use an ASCII text editor like Edlin or a word processor to create and edit such files. By the way, the new versions of DeskMate (DeskMate II and Personal DeskMate) create real ASCII files suitable for batch processing. ■



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DEBUG

Restoration Project

The five programs in David Goblen's "Restorative Powers" (October 1986, p. 126) for recovering Scripsit files after reset require changes to allow normal upscrolling. In line 311 of Program Listings 1-4, add -26 to the Call statement. For example, line 311 of Listing 1 should now be:

```
6D4E CDAF5D 00311 CALL 5DAFH-26
:INITIALIZE POINTERS
```

In Program Listing 5, you must add -26 to the Call statement in line 580.

-Eds.

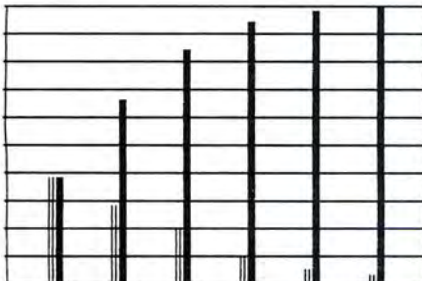
Off-Color Remarks

We accidentally omitted the last lines of Milton Simpson's Grafplot program for producing graphs and charts on the Color Computer ("Graph-Itti," October 1986, p. 171). The missing lines are shown here in the Figure.

Figure. Final lines of Milton Simpson's Grafplot program.

```
5000 SCREEN0
5010 PRINT"ENTER BOTTOM-OF-GRAPH
IDENTIFI- CATION - TWO LINES MA
X"
5020 PRINT:PRINT"ENTER LINE #";K
;" 33 CHARACTER"
5030 LINEINPUTS$(K)
5040 P=LEN(S$(K)):IFP>33THEN2920
5050 NEXT
5060 Y=168
5070 FORK=1TO2
5080 ES=S$(K)
5090 IFES=""THEN5190
5100 P=LEN(S$(K))
5110 SCREEN1,1
5120 Q=P/2
5130 FORX=137-Q*6TO131+Q*6STEP6
5140 AS=LEFT$(ES,1)
5150 GOSUB2440
5160 P=P-1
5170 ES=RIGHT$(ES,P)
5180 NEXT
5190 Y=Y+10
5200 NEXT
5210 RETURN
5220 CLS:PRINT:PRINT"ADD ANOTHER
LINE TO THE GRAPH Y/N"
5230 AS=INKEY$
5240 IFA$="Y"THEN3190
5250 IFA$="N"THEN2570ELSE5230
5260 PRINT"PRESS ANY KEY TO CONT
INUE
5270 AS=INKEY$
5280 IFA$=""THEN5270
5290 RETURN
```

End



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Lessons in Language

If you're going to write programs, you want to write the best ones you can. If you plan to sell your programs and make a little money, you need to consider which language to use for which machine and under which operating system. Sometimes, the factors you need to consider when choosing a programming language conflict.

Two universal programming considerations are development time and applications speed. Assembly language produces the fastest applications, but if you're writing a complex program and want to finish it in this lifetime, Assembly is not the language to choose. Even if you are a good Assembly-language programmer, development time is slow.

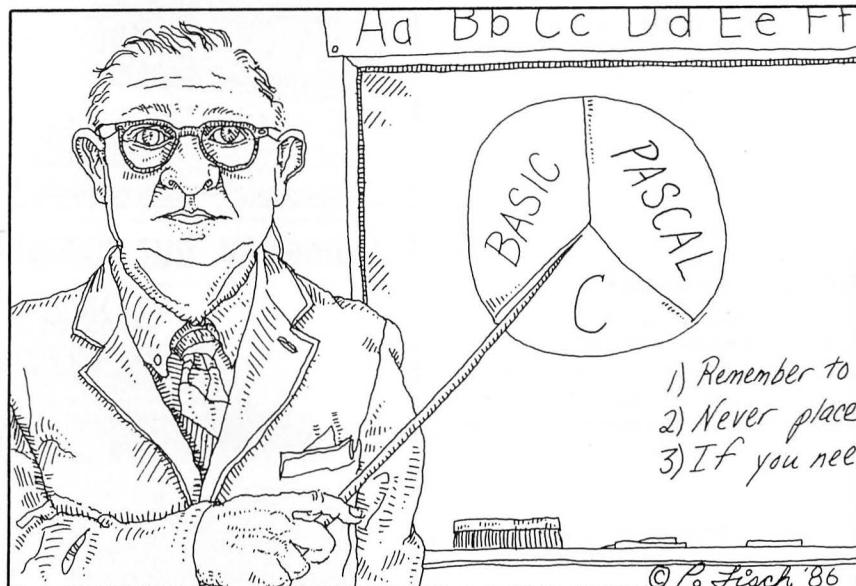
A good operating system can speed development, but the best operating system for program development is not always the most popular one. From a business point of view, it doesn't make sense to write programs for unpopular systems. To complicate matters further, once you've decided upon the "best" language and the "best" operating system, you have to make sure they're compatible. This is not always a safe bet.

In an attempt to balance these factors, some programmers choose a "pretty good" language for a relatively popular machine running a generic DOS. In other words, they compromise. If you're starting out in the business of writing software, however, and want guidance on choosing a language, this approach doesn't shed much light. It might help you find a language that works, but not the one that works best.

Better methods do exist. This month, I'll share some of the criteria I use when selecting a language. In so doing, I'll also describe some key features of popular languages, including Assembly, Basic, Pascal, and C.

Speed Demon

To choose a language, first determine the requirements of your program. If speed is critical, Assembly language is your best bet. If the program must be small as well, you're almost forced to use Assembly. Other factors to consider are nonstandard features and hardware. I once worked on a program that required a computer to monitor and buffer com-



munications from 255 devices operating simultaneously at speeds of 9,600 baud. The only way to write such a program was in Assembly. Other languages either were too slow or didn't provide the required services.

Some programs might seem to require Assembly, but really don't. If a program performs many mathematical operations, a compiled language will probably work better.

Speed isn't everything, however. If a language meets the needs of the application, that's enough. Programs that spend a lot of time waiting for operator input and comparatively little time calculating are little improved when rewritten in Assembly. The same is true of programs that spend a lot of time reading and writing to disk. With such programs, overall speed depends on factors outside the program's control. A classic example is the program designed to print a report. If the program sends data faster than the printer can handle it, the extra speed is superfluous. You could make the program 10 times faster by rewriting it in Assembly, but you wouldn't be able to print the report any faster.

False Appearances

Programmers frequently write applications for which one language seems clearly superior. If you look beneath the surface, however, you often find the lan-

guage makes little difference.

Consider a report program sending output to a printer that is capable of printing 300 characters per second (cps). Suppose each page contains six blank lines and 10 more lines of fixed information, such as titles and headings (each 130 characters long), for which no calculations are performed. The other 50 lines (each of which is also 130 characters long) contain calculated information.

If language A can calculate the information and send it to the printer at 250 cps and language B can do so at 1,000 cps, then language B should be far faster than A, which can't even run the printer at full speed. You'd expect a difference in speed of at least 50 cps. If language A sends 1,300 characters of fixed information at 3,000 cps, and language B sends them at 5,000 cps, language B still appears to have the advantage.

For the purposes of the example, assume that blank lines take .05 seconds to print, and that each language sends them at the same speed. Most printers have a buffer of at least several-thousand characters. Language B keeps the buffer full, since the printer can run the whole job at full speed. Therefore, language B takes 26 seconds (60 lines \times 130 characters per line \div 300 cps) to print the data on the full page and .3 seconds (6 blank lines \times .05 seconds) to print the blank lines. The total print time is 26.3 seconds.

Language A, on the other hand, takes .43 seconds (1,300 characters ÷ 3,000 cps) to send the fixed information to the printer and 26 seconds (50 lines × 130 characters per line ÷ 250 cps) to send the calculated data. Adding .3 seconds for the blank lines, language A's total time to print a page is 26.73 seconds. To print a 100-page report, language A takes only 43 seconds longer than language B—not much of a difference.

If the printer had no buffer, language B would still print at a speed of 300 cps. The total time it would require to print a 100-page report would be the same. Language A, however, would send the fixed information in 4.33 seconds (1,300 characters ÷ 300 cps), the calculated information in 26 seconds, and the blank lines in .3 seconds. The total time would be 30.63 seconds. In this case, language A takes 390 seconds longer than language B to print a 100-page report—a difference of 6.5 minutes.

Of course, language B could finish the job even faster on a faster printer. Your computer, too, could finish the job faster if you bought a large printer buffer—say 512K or more—to put between your computer and the printer. At 7,800 characters per page, a 512K buffer could hold as many as 65 pages of your report. You'd get back computer function after a little over 15 minutes if you used the faster language and the buffer, even though the printer would continue typing away for another half-hour.

Another area in which the surface capabilities of a language can be deceiving is disk output. Consider two programs writing identical data to a disk file. Program A can send the data at 10,000 cps; program B can send it at 100,000 cps. Program B will run faster, right? Not necessarily. If the operating system accepts data at 10,000 cps, program B will spend a good deal of time waiting for the operating system to catch up. The only way to take advantage of the language's speed is to bypass the operating system.

Beyond Assembly

What language should you use if you don't need the speed and flexibility of Assembly? If interpreted Basic (supplied with your computer) is fast enough to do the job and has the necessary features, you need look no further. If it isn't fast enough, you might want to consider a Basic compiler. Compiled programs never run more slowly than interpreted ones and often run as much as 150 times faster. Microsoft claims that programs run three times faster under its Basic compiler than they do under interpreted Basic. This is a modest assessment; depending on what the program does, the speed differential can be much greater.

Turbo Pascal isn't any faster than compiled Basic, which is about as fast as Fortran and C.

In general, compiling produces the greatest gains for programs that spend little time waiting for operator input, that do little reading and writing of disk files, and that aren't slowed by a printer. Compiled programs perform floating-point math about three times faster than interpreted programs, and integer arithmetic about 30 to 150 times faster.

If interpreted Basic doesn't have the features you need, you have two alternatives: stick with Basic and use Assembly-language routines for special features, or use a different language. Many programmers claim that Basic (compiled or not) is slower than Pascal and C. This is not so. Turbo Pascal isn't any faster than compiled Basic, which is about as fast as Fortran and C.

For some applications, other languages have advantages over Basic. C and Turbo Pascal, for example, seem to handle character strings faster than compiled Basic. But neither language has dynamic string allocation or deallocation with garbage collection. In Turbo Pascal, strings are limited to 255 bytes.

In compiled Basic, you can dimension an array of 1,000 strings, any of which might be up to 32,767 characters long. Under MS-DOS, that array would use about 4,000 bytes of storage space when created. Each element would use 2 more bytes, plus the length of the string, when something is stored. If all 1,000 strings contain data, the overhead is only 6,000 bytes.

In Pascal or C, you have two choices: declare the length of each of the strings and use all that memory, whether you need it or not; or declare an array of 1,000 pointers to an area of memory where the string data will be stored. If you choose the former, an array of 1,000 strings (each of which might be 255 bytes long) would require 255,000 storage bytes. If you choose the latter, handling strings whose lengths change will be your responsibility. So, whenever I need to use dynamic strings, I use Basic.

C is the best language, however, if you need to ensure that programs will run on Unix systems, as well as on your personal

computer. Versions of Basic that run on Unix systems do not closely resemble Microsoft Basic, but all versions of C are similar enough so that (if you play by the rules) you can transport programs from a microcomputer to larger Unix systems without much trouble.

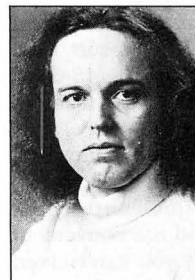
Pascal, on the other hand, is not a transportable language. All useful versions of Pascal have extensions, which are not portable to versions of Pascal on other systems. On microcomputers, Turbo Pascal is the de facto standard for Pascal. As far as extensions are concerned, it closely resembles UCSD Pascal. Mainframes and minis don't run Turbo Pascal and few run UCSD Pascal.

Of course, you can write applications in Fortran or Cobol. These languages have well-defined standards, and compilers exist for them on most microcomputers. For some applications, Fortran is the preferred language. It's the only language I know of that has a complex data type. If you need to massage a large array of complex numbers for an engineering problem, Fortran is a natural choice.

Cobol has its fans, but I'm not one of them. I find it verbose and lacking the features most of my applications require. Nevertheless, you can easily pump out reports with Cobol, and it's not bad for massaging data bases.

One of the best languages available today is APL, which is a natural at spreadsheet-type work. The only problem with APL is that it's expensive. To supply each of my customers with a copy of APL or a copy of an APL run-time package would mean my programs would have to cost at least several-hundred dollars. Nevertheless, APL is less expensive than most popular spreadsheet programs—and it does more.

For general purposes, I think Basic is the best language. It won't solve all problems, but it's the language that best suits applications programming. Many of you might disagree, but I suggest you hold your fire until after reading next month's column, in which I'll compare the three most popular high-level languages for microcomputers—Pascal, C, and Basic. Three guesses as to which one I rank first. ■



Bruce Tonkin is an independent software developer, industry critic, and author of The Creator data-base manager. You can write to him at 34069 Hainesville Road, Round Lake, IL 60073.

Shell Proof

Though both TRSDOS and MS-DOS include commands that will get you what you need to know, neither provides enough on-screen information. And there are still times when you need more flexibility.

This is where a DOS shell can come in handy. A shell can provide you with valuable on-screen information (such as current directory and available free space) and can help automate copy and delete functions. It shouldn't cause any problems with other programs you're using.

TRSDOS Helper

Shell, a 12K program for TRSDOS 6.2 users, is one of the most useful Model 4 shells. It is compatible with Misosys Inc.'s Pro-Wam (formerly Pronto) memory-resident utility and doesn't conflict with Radio Shack's hard-disk driver.

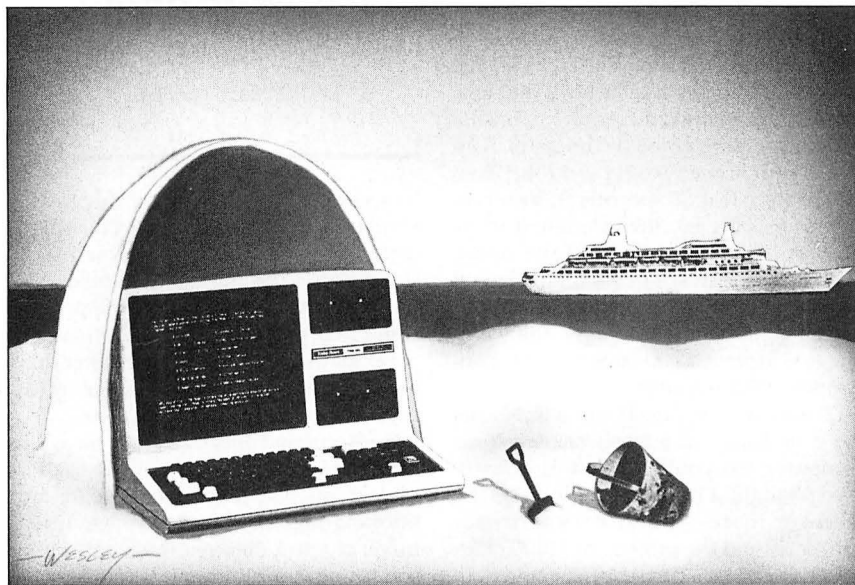
Shell displays helpful information: The top line displays the current drive number, the directory page you are on, the name of the disk, the amount of free space, and the extensions being shown. The files are listed in alphabetical order in five rows across the screen.

Shell has a handy screen-save feature that blanks the screen if 60 seconds have passed and you haven't pressed a key. Pressing any key brings you back to the shell.

You can use the single letter-key commands at the bottom of the screen by themselves or in combination with the shift key. To display the attributes of a single file, put the cursor on the file and press the A key. To enter Basic, press the B key. To load and run a Basic file, put the cursor on that file (it must have a BAS extension) and press the enter key.

Other commands let you copy files, perform mass file transfers, kill and purge, show files with a particular extension, mark files for mass commands, show system files and system status of drives and devices, format, back up, set RS-232C parameters, and execute DOS commands. You can also write 48-character descriptions of your files and store the descriptions in a special file.

Shell includes a simple text editor that is much easier to use than a word processor for building JCL (job-control language) files. It is fast and has convenient editing commands, but you can't chain files into it (load one file, then another),



nor can you print files from the editor.

Shell is distributed as freeware, which means that you send its author, Stephen Milliken, the donation you feel is appropriate. The documentation lists his address.

One for MS-DOS

Of the MS-DOS shells available, Dosamatic is one of the most versatile. Not only does it help organize your disks and files, but you can switch between Dosamatic and other programs, provided you have enough memory.

Dosamatic displays your drive with its name and path; it also lists the number and percentage of free disk space. It shows you how many files are in the current directory and how much space they use. It also displays the amount of total and available RAM.

The left side of the screen displays the disk drives (A-E), directories, and files, including the root and parent directories. Switching directories is as simple as placing the cursor over the appropriate one and pressing enter. If you move the cursor over a file and press enter, an action menu pops up. From this menu, you can see the attributes of a file, browse through a file in either ASCII or binary, copy a file, enter Debug, edit a file using MS-DOS's Edlin text editor, execute a file, and print or rename a file.

Pressing the escape key displays another menu that lets you turn the color off or on, execute a DOS command, exit,

set a file mask, search for a particular file, show the date/time or hidden files, sort files, and change the volume label. You also use the escape key to leave either command menu.

When you decide to execute a file, the shell prompts you for command parameters, asks whether you're using a graphics program, and asks how much memory you want to allocate to that program. After you answer these questions, it runs the program. Press alternate-F10 to return to Dosamatic, suspending operation of the other program. You can set up as many programs as your machine's memory will allow.

A couple of caveats are in order. First, some programs don't want to work with Dosamatic. Second, Dosamatic has problems dealing with the special graphics mode of the Tandy 1000, which affects programs such as Personal Desk-Mate. Third, switching programs might mean changing subdirectories, so have your paths worked out.

Marin-Pacific Software is distributing the program as user-supported software. The documentation and the on-line help file include information on how to register and receive the latest version. It costs \$39.■

Ryan Davis-Wright is an 80 Micro technical writer. Address correspondence to 80 Pine St., Peterborough, NH 03458.

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PC Cross-Zap is a utility program that runs on your PC or PC-compatible. With it you can copy files to or from TRS-80 disks at will. You can also format a disk, copy disks, explore, read and write sector data, repair bad directories and much more. Long after your TRS-80 is gone you will still be able to read your old disks. Even when your TRS-80 disks are gone you can continue to use PCXZ to read, fix and modify MS-DOS and other disks so your investment will never be lost.

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Main Features

With PCXZ you can format a TRS-80 disk (not the mixed density Model I types). You can copy files from a TRS-80 disk error free, without losing any data. Just like HyperCross 3.0 you can instruct PCXZ to convert your BASIC files on the fly as they are copied. ASCII and word processor text files are converted so they are in the correct format for your PC. Copying can be by file or using wild cards. You can also copy files from PC format back to your TRS-80 disks.

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System Requirements PC, XT, AT or compatible, Tandy 1000 or 1000Ex (needs DMA), 100 SX, 1200, 3000 with at least one 40 track drive and 256K minimum memory.

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Formats supported: IBM-PC and MS-DOS compatibles include DOS 1.1, 2.0-3.2 Tandy 2000, single and double sided, 3.5 and 5 inch. CP/M from Aardvark to Zorba, including all popular TRS80 formats such as Holmes, Montezuma, and Omikron. TRS-80 Color Computer format also supported.

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Super Trace

If you program in Basic, you've probably used the trace command (TRON) as a debugging aid. The TRSDOS 6 Trace command provides a similar debugging tool for Assembly-language programmers. It creates a display in the upper-right corner of the screen showing the current value of the program counter (PC) register in the Z80 microprocessor.

Unlike Basic's TRON, however, TRSDOS's Trace doesn't show the address of each instruction as it is executed. Instead, it displays the value of the PC register approximately 3.75 times per second. There's no way to use Trace to find out what a program is doing between these widely separated snapshots, but it can help you locate endless loops or functions in programs written by someone else.

Trace also won't help if your program is crashing because of a stack overflow or if a register value isn't changing properly. Nor can you make Trace less "granular" by sampling the contents of the PC register more often.

This month's demonstration program is an extended Trace routine that displays the Z80 registers 3.75 times, 30 times, or 60 times per second, depending on how you install it. The prime (or alternate) Z80 registers aren't included in this version, but they could be added easily enough.

This gives me a chance to return to a subject I haven't discussed since October 1984: How to use the DOS-interrupt task processor (Double-Action Programming With the Z80 Chip, p. 172). I'll also demonstrate a useful macro instruction that is available in some advanced assemblers.

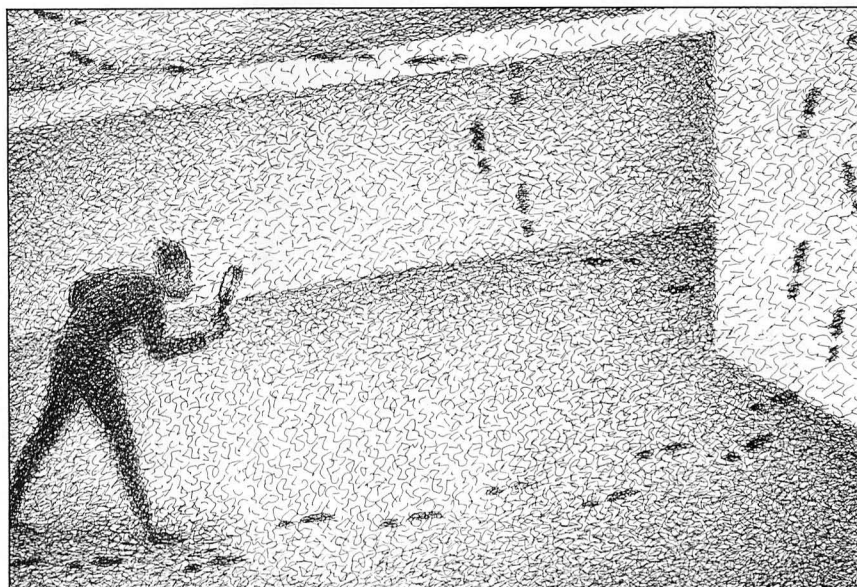
We Interrupt This Program

When you write an application pro-



System Requirements

Model 4/4P/4D
TRSDOS 6.2
Assembly language
PRO-Create 4.3a



gram, you assume that the computer will devote all its attention to the program while it is running. In fact, the computer rarely runs a program straight through from beginning to end.

With the Model 4 set to System (fast) mode, the real-time clock interrupts the program 60 times each second and demands the Z80's attention. During these interrupts, the keyboard is scanned for a break, pause, or shift-break keystroke, the software time counter is updated, and up to 12 interrupt tasks are executed. The computer then returns to the main program.

The program seems to run without interruption if there are few tasks and their codes are short, but with many long tasks the computer can get so bogged down that no work ever gets done. For this reason, task programs are usually designed as short Assembly-language utilities.

TRSDOS 6 maintains a task-control-block vector table of logical slots numbered zero to 11 for the 12 possible tasks. Each slot has a priority ranking that tells the system how often to execute the related task program. Slot 11 has the highest priority and is executed on every real-time clock interrupt. Slots 8-10 have medium priority; tasks installed in them are executed 30 times a second regardless of the System speed setting. Slots zero to 7 have the lowest priority,

and tasks installed in them are executed once every 266.67 milliseconds (3.75 times per second).

Four slots are reserved for System tasks. Low-priority slots 3 and 7 are used by System Alive and System Trace routines when they are active. Two of the middle-priority slots, 9 and 10, are reserved for the spooler and type-ahead routines. The other eight slots—six with low priority, one with middle priority, and the one with high priority—are reserved for user's tasks.

Writing a task is like writing a filter program: You must create and debug the code in normal memory and write an installation module that will move the task to protected memory and set up the correct links to TRSDOS.

Call Supervision

Five TRSDOS supervisory calls (SVCs) simplify task programming and installation. Each task's installation module should contain the @CKTSK SVC, which verifies that the slot is unoccupied, and the @ADTSK SVC to do the installing.

You can remove a task from a slot with the @RMTSK SVC. The task's code remains in memory but is never called by TRSDOS.

A task that must be able to remove itself from the task table should employ @KLTSK, which erases the link of the

Data fields can be easily accessed as offsets from IX whenever control passes to a task.

current task from the task table and returns control to TRSDOS. A task can also replace itself with a new task by using the @RPTSK SVC.

Task structures resemble filter programs, but they're simpler. A task must begin with a task control block (TCB) that opens with the starting address of the task itself; the rest of the TCB is available as a data area. Since the IX register contains the beginning TCB address, data fields can be easily accessed as offsets from IX whenever control passes to a task.

A task must end with a return (RET) instruction, and it can make calls to any of the TRSDOS SVCs in the same manner as other programs.

Trace Elements

The general idea of a trace program is simple: Take the values in the Z80 registers, convert them to ASCII hexadecimal (hex) numbers, and display them on the screen. There's a bit of a problem with this description, however; such a program couldn't really display the current values of the Z80 registers because every display would be the same and the trace information would be useless. Instead, it would have to display the values that were in the Z80 registers before it was called.

If you install a trace program as an interrupt task, the needed register values will be on the stack, but they won't be in consecutive order or in the top stack positions. You must do some detective work to find them.

Program Listing 1 is a short program that helps you locate the stack positions of the original register values. It begins by setting up a short task that calls Debug, then loads each register with a known (and unusual) value. Lastly, it jumps to a tight loop at a known address so the value in the program counter will also be identifiable on the stack.

Run Listing 1 and examine the Debug display. You should find that all of the main registers have been changed except IY (along with the prime registers,

Program Listing 1. Program that locates original Z80 register values.

```

00100 ;-----
00110 ; Test program to determine the placement of register
00120 ; values on the stack at interrupt time
00130 ;
00140 ; This is not a well-behaved program -- REBOOT after
00150 ; leaving Debug.
00160 ;
00170 ; Assembled with PRO-Create 4.3a
00180 ;-----
00190 ;
00200 @DEBUG EQU 27 ;Invoke Debug
00210 @ADTSK EQU 29 ;Add a task process
00220 ;
00230 SVC MACRO #NUM
00240 LD A,#NUM
00250 RST 28H
00260 ENDM
00270 ;
00280 ORG 3000H ;Location of interrupt routine
00290 ;-----
00300 ; Define the interrupt task
00310 ;-----
00320 TCB DW TASK ;Pointer to task code
00330 FLAG DB 0 ;Gateway flag to avoid recursion
00340 ;
00350 TASK LD A,(IX+2) ;Get gateway flag
00360 OR A ;Test it
00370 RET Z ;Return if it is 0
00380 ;
00390 CPL ;Else complement the flag
00400 LD (IX+2),A ;And save the new value
00410 SVC @DEBUG ;Then jump into Debug
00420 RET
00430 ;-----
00440 ; Install the task and setup the registers
00450 ;-----
00460 START LD DE,TCB ;Point to task header
00470 LD C,0 ;Add to slot 0
00480 SVC @ADTSK ;Task is installed
00490 ;
00500 LD IX,0FFFFH ;Set known values in each
00510 LD IY,0EEEEH ; register
00520 LD HL,0DDDDH
00530 LD DE,0CCCCCH
00540 LD BC,0AAAAAH ;Value for AF register
00550 PUSH BC ;Transfer to AF
00560 POP AF
00570 LD BC,0BBBBBH
00580 EX AF,AF' ;Now the alternate registers
00590 EXX
00600 LD BC,9999H ;Value for AF'
00610 PUSH BC
00620 POP AF
00630 LD BC,8888H
00640 LD DE,7777H
00650 LD HL,6666H
00660 EXX
00670 EX AF,AF'
00680 DI ;Interrupts off until program is ready
00690 PUSH AF
00700 LD A,-1 ;Open the gateway
00710 LD (FLAG),A ;Save it in place
00720 POP AF ;Recover register
00730 LD SP,8000H ;Set our stack
00740 JF HOLD ;Go wait for an interrupt
00750 ;
00760 ORG 3332H
00770 HOLD EI ;Interrupts on
00780 HOLD1 JR HOLD1 ;Loop until interrupt time with
00790 ; PC = 3333h
00800 ;
00810 END START
    
```

End

Program Listing 2. Complete trace routine.

```

00100 ;-----
00110 ;
00120 ; Full Register Trace Routine for TRSDOS 6.2
00130 ; Assembled with PRO-Create 4.3a
00140 ;
00150 ;-----
00160 ;
00170 ; SVC's used
00180 ;
00190 @ADTSK EQU 1DH
00200 @CKTSK EQU 1CH
00210 @CHNIO EQU 14H
00220 @DSP EQU 02H
00230 @DSPLY EQU 0AH
00240 @EXIT EQU 16H
00250 @FLAGS EQU 65H
00260 @GTMOD EQU 53H
00270 @HEX8 EQU 62H
00280 @HEX16 EQU 63H
00290 @HIGH$ EQU 64H
00300 @PARAM EQU 11H
00310 @VDCTL EQU 0FH
    
```

Listing 2 continued

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Listing 2 continued

```

00320 ;
00330 ;      Stack offsets
00340 IX_OFF EQU 4
00350 DE_OFF EQU 8
00360 BC_OFF EQU 10
00370 AF_OFF EQU 18
00380 HL_OFF EQU 20
00390 PC_OFF EQU 22
00400 SP_VAL EQU 24
00410 IY_OFF EQU -2
00420 ;
00430 ;      Symbolic Constants
00440 CR EQU 0DH
00450 LF EQU 0AH
00460 ETX EQU 03H
00470 C_ON EQU 0EH
00480 C_OFF EQU 0FH
00490 CTRL_T EQU 14H
00500 ;
00510 ;      Macro commands
00520 SVC MACRO #NUM
00530 LD A,#NUM
00540 RST 28H
00550 ENDM
00560 ;
00570 PRINT MACRO #ADDR
00580 LD HL,#ADDR
00590 SVC @DSPLY
00600 ENDM
00610 ;
00620 DSPCHAR MACRO #CHAR
00630 PUSH BC
00640 LD C,#CHAR
00650 SVC @DSP
00660 POP BC
00670 ENDM
00680 ;
00690 WRITREG MACRO #PAIR,#RELOC
00700 LD E,(IX+#PAIR%&_OFF) ;;Get LSB
00710 LD D,(IX+#PAIR%&_OFF+1) ;; and MSB
00720 LD HL,#PAIR%&_POS ;;HL=> destination area
00730 RLO#RELOC EQU $-2 ;;For relocation
00740 SVC @HEX16 ;;move value
00750 ENDM
00760 ;
00770 ;-----
00780 ;      Beginning of keyboard filter
00790 ;      this section is used to turn the trace routine on
00800 ;      and off, toggled by <Ctrl><T>
00810 ;-----
00820 ;
00830 ORG 3000H ;will be relocated to high memory
00840 ;-----
00850 ; TRSDOS filter memory header
00860 ;-----
00870 BEGIN JR START ;Jump to beginning of routine
00880 OLDHI DW $-$ ;Space for old HIGH$
00890 DB MODDCB-BEGIN-5 ;Length of module name
00900 MODNAME DB 'RTRACE' ;Module name
00910 MODDCB DW $-$ ;Word for DCB address
00920 DW 0 ;Reserved for TRSDOS
00930 ;-----
00940 ; Link to *KI chain
00950 ;-----
00960 CHAIN PUSH IX
00970 LD IX,(MODDCB) ;Get DCB address
00980 RLO1 EQU $-2
00990 SVC @CHNIO ;Move down the chain
01000 POP IX ;Recover register
01010 RET
01020 ;-----
01030 ; Start of filter code
01040 ;-----
01050 START JR NC,CHAIN ;Go if not a GET request
01060 CALL CHAIN ;Else get keystroke
01070 RLO2 EQU $-2
01080 RET NZ ;Return if no key
01090 CP CTRL_T ;Control-T pressed?
01100 JR Z,CHANGE ;Yes -- go
01110 CP A ;Else reset Z flag
01120 RET ;And return to caller
01130 ;
01140 CHANGE PUSH IX ;Else save register
01150 LD IX,TRIGGER ;IX=> trigger register
01160 RLO3 EQU $-2
01170 LD A,(IX) ;Get current value
01180 CPL ;Flip it
01190 LD (IX),A ;Save new value
01200 POP IX ;Restore register
01210 OR 1 ;Set NZ flag
01220 LD A,0 ;Return no-key
01230 RET ;Move back up the chain
01240 ;
01250 ;-----
01260 ; This is the interrupt task that is installed
01270 ; during setup. It is governed by two flags, both
01280 ; of which must be non-0 to enter the code:
01290 ; TRIGGER is toggled with Ctrl-T by the user
01300 ; GATEWAY is toggled on and off by this program to
01310 ; avoid recursion.
01320 ;-----
01330 ;
01340 TCB DW TSKSTRT ;Point to beginning of task

```

Listing 2 continued

which TRSDOS never uses). The original values of all the modified registers appear somewhere in the first 11 words on the stack. I used the Debug display to generate the list of stack offsets that are near the beginning of Program Listing 2; you'll probably want to verify that the same offsets hold true on your computer.

Listing 2 was easy to write once I found the correct values for the registers. The program begins like most that have appeared in this column—with a list of TRSDOS SVCs. Next comes a list of register-value locations relative to the stack pointer when the program is called.

Most of the macro commands I've included near the beginning of the program should be easy for you to understand, except for the last one: WRITREG. At the start of the task routine, the stack pointer is copied into the IX register; under this arrangement, all of the original register values on the stack can be found as an offset from IX. The WRITREG macro functions in the program to copy the original value of each register pair into DE, copy a position in the display string into HL, and then use the @HEX16 SVC to convert the value in DE to an ASCII string.

The address of the display string depends on where the trace routine is placed in high memory and must be changed during installation. You must place a relocation label (RLO plus a number) inside the macro.

The easiest way to understand how WRITREG works is to examine the code it produces. For example:

```
WRITREG BC.8
```

will produce the following lines of source code:

```

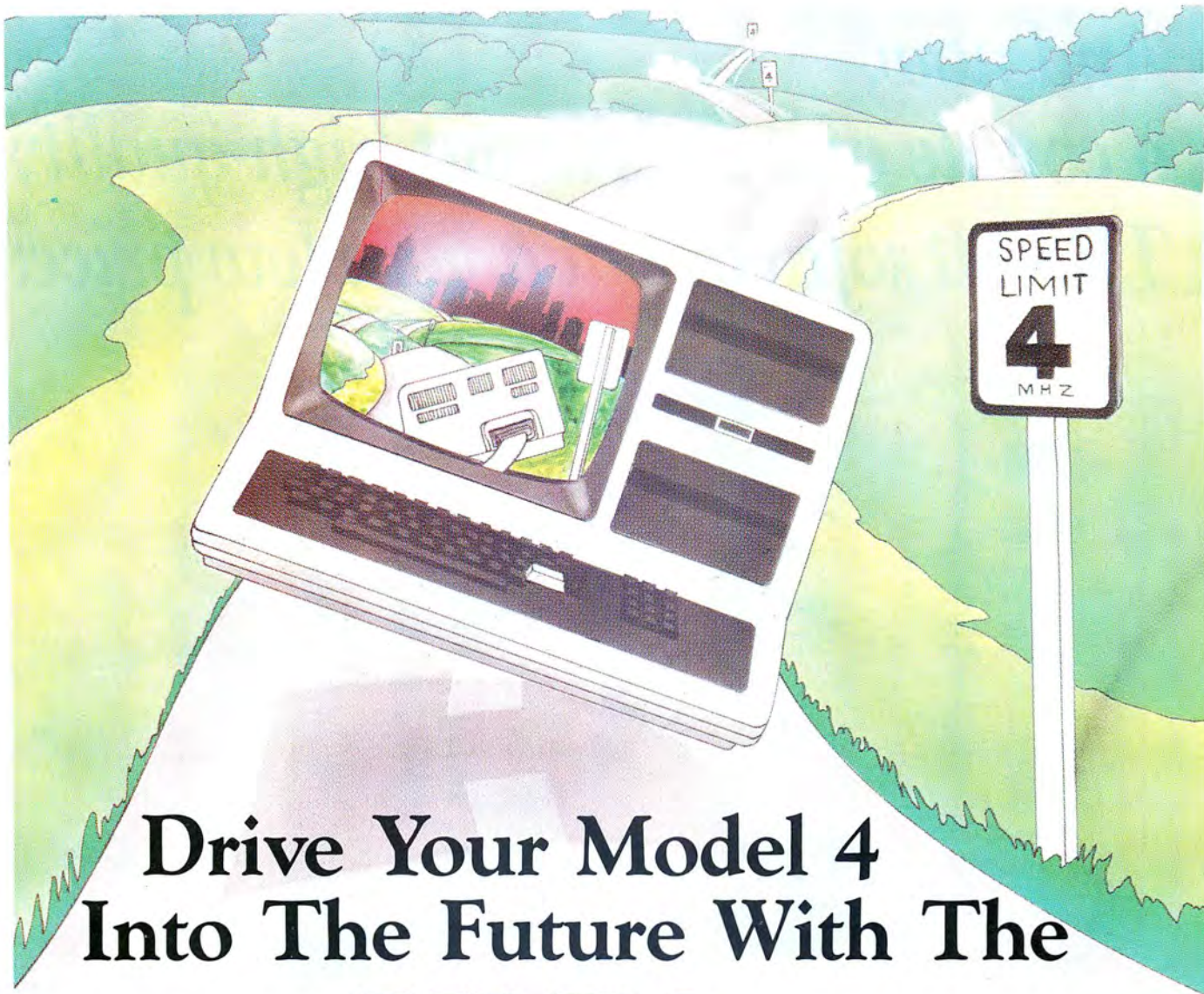
LD E,(IX+BC_OFF)
LD D,(IX+BC_OFF+1)
LD HL,BC_POS
RLO8 EQU $-2
SVC @HEX16

```

The first part of the actual code (beginning in line 770) is a short keyboard filter. Its job is to wait until the user presses control-T, then toggle a "trigger" byte in the TCB. When the trigger is set to zero, the task won't display anything on screen; when it is set to OFF hex, the trace routine is enabled.

The trace routine begins on line 1250. It contains the address (which must be changed during relocation and installation) of the trace code plus 2 bytes of data. The first byte is the trigger that is toggled by the keyboard filter. The second, "gateway" byte is crucial to keeping the program from interrupting itself, resulting immediately in stack overflow and system crash.

Continued on p. 118



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Continued from p. 114

When the trigger and gateway bytes are nonzero, the program executes when it is called by TRSDOS's task handler and immediately begins by changing the gateway to zero. From that point on, the program is safe from being invoked a second time while it is running, even if it needs more than one interrupt cycle to finish.

After closing the gateway, the program builds a one-line display string in memory. First, it picks up the original value of the A register and uses the @HEX8 SVC to insert the value in the display string in ASCII form. Next, it picks up the original value of the flag register and tests each bit to decide whether to put a flag's symbol or a dash in the display string. Then it uses the WRITREG macro to convert the original values of the other registers to ASCII.

When everything has been converted to ASCII, the current cursor location is saved, the cursor is placed at the top-left corner of the screen, and a single line is printed. The cursor is then restored and turned back on.

A subtle bug crops up in TRSDOS when the cursor is turned off and on. The video driver seems to get confused about whether the cursor is on or off and sometimes leaves a nonblinking cursor on one line as it moves a blinking cursor to the next. You might see this happening a lot while the trace program is still running. I haven't yet found a way to prevent these scattered cursor characters from being left at random locations on the screen.

There's an interesting in-line macro near the end of the trace module. The data area there is used to store the display string, which the program builds and sends to the screen. To avoid getting a long list of define-byte (DB) commands and labels, I let the IRP macro command (see line 2170) create much of the string for me. IRP takes each argument inside the angle braces and substitutes the argument string for the dummy string throughout the body of the macro. For example, the first two iterations of the IRP macro produce the following four lines:

```

                DB      'BC>'
BC_POS         DB      '....'
                DB      'DE>'
DE_POS         DB      '....'
    
```

IRP is handy anytime you must create a repetitive structure in an Assembly-language program.

Free Installation

The remainder of the program (beginning at line 2260) is used only once for installing both the keyboard filter and the interrupt task. Much of it is the same as the filter installation module

Listing 2 continued

```

01350 RLO4 EQU $-2
01360 *TRIGGER DB 0 ;Off to start
01370 GATEWAY DB -1 ;Start with gate open
01380 ;
01390 ; Beginning of Task Processing
01400 ;-----
01410 TSKSTR LD A,(IX+2) ;Get the Trigger byte
01420 AND (IX+3) ;Merge the gateway byte
01430 RET Z ;Leave if both are 0
01440 CPL ;Else set A = 0
01450 LD (IX+3),A ;Close the gateway
01460 ;
01470 LD IX,0 ;Empty IX register
01480 ADD IX,SP ;IX=> stack frame
01490 PUSH IY ;IY wasn't on the stack
01500 ; Display A
01510 LD C,(IX+AF_OFF+1) ;Get original value of A
01520 LD HL,A_POS ;HL=> storage area
01530 RLO5 EQU $-2
01540 SVC @HEX8
01550 ; Display flags
01560 LD C,(IX+AF_OFF) ;Get original flag values
01570 LD HL,FLGTBL ;DE=> table of flag names
01580 RLO6 EQU $-2
01590 LD DE,F_POS ;HL=> storage area
01600 RLO7 EQU $-2
01610 LD B,8 ;Loop for 8 bits
01620 T1 SLA C ;Shift bit into carry flag
01630 LD A,(HL) ;Get display value
01640 JR C,T2 ;Go if carry set
01650 LD A,'-' ;Else set a blank
01660 T2 LD (DE),A ;Save character
01670 INC DE ;Bump both pointers
01680 INC HL
01690 DJNZ T1 ;Loop for 8 bits
01700 ; Display BC -- PC
01710 WRITREG BC,8
01720 WRITREG DE,9
01730 WRITREG HL,10
01740 WRITREG IX,11
01750 WRITREG IY,12
01760 WRITREG PC,13
01770 ; Display SP
01780 PUSH IX ;Move our first SP
01790 POP DE ; to DE
01800 LD HL,SP_VAL ;Offset to original SP
01810 ADD HL,DE ;HL = val of SP before interrupt
01820 EX DE,HL ;Value to DE
01830 LD HL,SP_POS ;HL ==> position in string
01840 RLO14 EQU $-2
01850 SVC @HEX16
01860 ;-----
01870 ; Now display the trace string
01880 ;-----
01890 LD B,4 ;Function: return curs. posn.
01900 SVC @VDCTL ;Get current cursor position
01910 PUSH HL ;Save it on stack
01920 DSPCHAR C_OFF ;Turn off cursor
01930 LD HL,0 ;Move it to top left
01940 LD B,3 ;Function: set cursor posn
01950 SVC @VDCTL ;Do it
01960 PRINT TLINE ;Display trace line
01970 RLO15 EQU $-5
01980 POP HL ;Retrieve old cursor posn.
01990 LD B,3 ;Function: set cursor posn.
02000 SVC @VDCTL ;Reset cursor
02010 DSPCHAR C_ON ;Turn cursor back on
02020 ;-----
02030 ; Clear stack and turn gateway back on
02040 ;-----
02050 POP IY ;Stack back to normal
02060 LD A,-1 ;"ON" value for gateway
02070 LD (GATEWAY),A ;Open the gate
02080 RLO16 EQU $-2
02090 RET ;We're done.
02100 ;-----
02110 ; Data for the interrupt routine
02120 ;-----
02130 FLGTBL DB 'SZ.H.PNC'
02140 TLINE DB 'AF>' ;Build blank trace-display line
02150 A_POS DB '---'
02160 F_POS DB '-----'
02170 IRP XX,<BC,DE,HL,IX,IY,SP,PC>
02180 DB ' &XX>'
02190 XX_POS DB '-----'
02200 ENDM
02210 DB ETX ;Mark end of trace line
02220 ;
02230 MODEND EQU $-1
02240 MODLEN EQU $-BEGIN
02250 ;
02260 ;-----
02270 ; Installation Routine for the filter and interrupt
02280 ; process. The program must be invoked with SET, and
02290 ; includes one parameter with three possible values:
02300 ; SLOT=(0 ... 11)
02310 ; The default value is SLOT=0
02320 ; SLOT may be abbreviated to S
02330 ; If the requested slot is in use, the program will abort
02340 ; with an error message.
02350 ;-----
02360 ;
02370 INIT PUSH DE ;Save DCB pointer
    
```

Listing 2 continued

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Listing 2 continued

```

02380      LD      (MODDCB),DE      ;And put into filter
02390      PUSH   HL              ;Save command line ptr
02400      PRINT  SIGNON          ;Say hello
02410      POP    HL              ;Recover pointer
02420      LD    DE,PARMTBL      ;DE ==> parameter
02430      SVC   @PARAM          ;Parse the parameter
02440      JP    NZ,BADPRM       ;Leave if parameter error
02450      LD    A,(RESP)        ;Get response type
02460      OR    A                ;Any parameters at all?
02470      JR    Z,INIT_1       ;No -- go
02480      AND   80H              ;Numeric response?
02490      JP    Z,BADPRM       ;No -- go
02500      LD    HL,(SLOT_NUM)    ;Get the user value
02510      LD    DE,12           ;DE = maximum value+1
02520      SBC   HL,DE           ;Test user's value
02530      JP    NC,BADPRM      ;Error if too high
02540 ;
02550      LD    DE,MODNAME      ;DE ==> filter name
02560      SVC   @GTMOD          ;Already installed?
02570      JP    Z,INSTLD       ;Error if already in memory
02580 ;
02590      SVC   @FLAGS          ;IY==> flag table
02600      BIT   3,(IY+'C'-'A')  ;SET used to install program
02610      JP    Z,NOSET        ;No -- error
02620 ;
02630      LD    HL,0              ;Function: get value
02640      LD    B,L              ;B=0: work with HIGH$
02650      SVC   @HIGH$         ;Get current high$
02660      LD    (OLDHI),HL      ;Save current value
02670      JP    NZ,NOHIGH      ;Error if HIGH$ not available
02680 ;
02690 ;-----
02690 ; Is the task slot available?
02700 ;-----
02710      LD    A,(SLOT_NUM)    ;Get requested slot number
02720      LD    C,A              ; into C register
02730      SVC   @CRTSK        ;Slot available?
02740      JP    NZ,SLTBSY      ;No -- go
02750 ;-----
02760 ; All tests have been passed
02770 ; Relocate both modules to high memory
02780 ;-----
02790      LD    IY,RELTAB        ;IY==> relocation table
02800      LD    DE,MODEND        ;DE = end of main program
02810      LD    HL,(OLDHI)      ;HL = current HIGH$
02820      SBC   HL,DE           ;Calculate relocation distance
02830      PUSH  HL              ;Move distance
02840      POP   BC              ; to BC register pair
02850      LD    L,(IY+0)        ;Get LSB of address to change
02860      LD    H,(IY+1)        ; and MSB
02870      LD    A,H              ;Copy MSB
02880      OR    A                ;Is it 0?
02890      JR    Z,MOVE          ;Yes -- go move the modules
02900      LD    E,(HL)          ;Else get present LSB
02910      INC  HL              ;Point to MSB
02920      LD    D,(HL)          ;DE = value to change
02930      EX   DE,HL           ;Value is in HL
02940      ADD  HL,BC            ;Add the offset
02950      EX   DE,HL           ;Put new value in DE
02960      LD    (HL),D         ;Put back new MSB
02970      DEC  HL              ;Point to LSB
02980      LD    (HL),E         ;New value is now in place
02990      INC  IY              ;Bump twice
03000      INC  IY              ; to point to next address
03010      JR    RELOC1        ;And move the next value
03020 ;-----
03030 ; Move and protect
03040 ;-----
03050      MOVE   LD    DE,(OLDHI) ;DE ==> destination
03060      LD    HL,MODEND        ;HL ==> end of modules
03070      LD    BC,MODLEN        ;BC = bytes to move
03080      LDDR  ;Move it all
03090      EX   DE,HL           ;New HIGH$ is in HL
03100      LD    B,0              ;Function: use HIGH$
03110      SVC   @HIGH$         ;Have TRSDOS set new HIGH$
03120      INC  HL              ;HL ==> filter's entry point
03130 ;-----
03140 ; Set type and address in filter's DCB
03150 ;-----
03160      POP   IX              ;Get DCB address from stack
03170      LD    (IX),01000101B   ;Set as @GET/@CTL filter
03180      LD    (IX+1),L        ;Set LSB of address in DCB
03190      LD    (IX+2),H        ; and MSB
03200 ;-----
03210 ; Now set interrupt routine in its slot
03220 ;-----
03230      LD    DE,TCB          ;DE ==> task control block
03240      RLO17 EQU    $-2
03250      LD    A,(SLOT_NUM)    ;Get the slot number
03260      LD    C,A              ; into C register
03270      SVC   @ADTSK        ;Put task in the slot
03280      PRINT SUCCESS        ;Report successful installation
03290      LD    HL,0            ;Report no error to DOS
03300      SVC   @EXIT         ;And leave
03310 ;-----
03320 ; These are the error exits
03330 ;-----
03340      BADPRM LD    HL,BADPRM$ ;Point to message
03350      DB    0FDH            ;Skip next instruction
03360      INSTLD LD    HL,INSTLD$
03370      DB    0FDH
03380      NOSET  LD    HL,NOSET$
03390      DB    0FDH

```

Listing 2 continued

I've used here many times before.

There are some new wrinkles, however. First, I've used the TRSDOS @PARAM SVC to parse the parameter (if any) included on the command line that invokes this month's program. It's up to you to pick the program's installation slot (if you don't specify a slot, the program tries to use slot zero). The System (Trace) command is always installed in a low-priority slot. If you need a faster trace to pinpoint where a program is going wrong, install the program in slot 8 or 11.

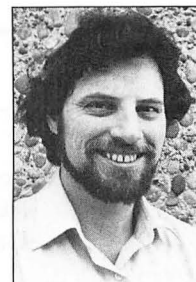
The @PARAM SVC, if it finds a parameter named Slot or S followed by an equals sign and a number, will place that number at the location labeled SLOT_NUM. It is then up to the installation routine to determine whether the number specified is a legal slot number (between zero and 11) and whether the slot isn't being used.

There are six possible error exits from the installation program. At first glance, lines 3340-3480 appear to display the same error message regardless of which message is intended. In fact, the single bytes of OFD hex between each error label are a way of avoiding repetitive program code. If the program enters the error routines with a jump to BADPRM, for example, it loads the address of the bad-parameters error message into the HL register.

Then, because of the OFD hex byte, the computer sees the next command as LD IY,INSTLD\$. The extra bytes keep the address in HL from being changed, and merely alter the address in IY (which won't be used later in the program anyway) at each error label.

Near the end of the program, I've again used the IRP macro to generate repetitive code for me. Instead of typing out a long list of relocation labels, I've defined the form of one label and used IRP to have the assembler create the proper labels and addresses.

There are many things in Listing 2 that I haven't discussed in previous columns, including the TRSDOS tasker, the @PARAM SVC, and the IRP in-line macro. I plan to cover those topics in future columns. ■



Write Hardin Brothers at 280 N. Campus Ave., Upland, CA 91786. Enclose a stamped, self-addressed envelope for a reply. You can also contact Hardin on CompuServe's WE-SIG (PCS-117).

THE NEXT STEP

Listing 2 continued

```

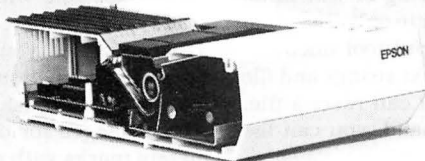
03400 NOHIGH LD HL,NOHIGH$
03410 DB @FDH
03420 NOSLOT LD HL,NOSLOT$
03430 DB @FDH
03440 SLTBSY LD HL,SLTBSY$
03450 SVC @DSPLY ;Print message
03460 PRINT ABORT
03470 LD HL,-1 ;Return error code to TRSDOS
03480 SVC @EXIT
03490 ;-----
03500 ; Data areas
03510 ;-----
03520 PARMTBL DB 80H ;Mark beginning of table
03530 DB 10010100B ;Accept numeric entry, abbr., name 4-bytes
03540 DB 'SLOT'
03550 RESP DB $-$ ;TRSDOS's response
03560 DW SLOT_NUM ;Address to receive value
03570 NOP ;End of parameter table
03580 ;
03590 SLOT_NUM DW 0 ;Will hold user's slot choice
03600 ;
03610 RELTAB IRP X,<1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17>
03620 DW RLOX
03630 ENDM
03640 DW 0 ;Mark end of table
03650 ;
03660 SIGNON DB 'TRSDOS 6 Expanded Trace Program',CR
03670 BADPRM$ DB 'Illegal parameter.',CR
03680 INSTLDS DB 'Program already installed.',CR
03690 NOSLOT$ DB 'No interrupt slots available.',CR
03700 NOHIGH$ DB 'High memory not available for installation.',CR
03710 NOSET$ DB 'Program must be installed with SET command.',CR
03720 SLTBSY$ DB 'Requested interrupt slot is already in use.',CR
03730 ABORT DB 'Installation aborted.',LF,CR
03740 SUCCESS DB 'Program successfully installed.',LF
03750 DB 'Use the FILTER command to connect to *KI.',LF
03760 DB 'Press Ctrl-T to toggle trace display on and off.',CR
03770 ;
03780 END INIT
    
```

End

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Continued from p. 32

DosTamer-PC

★★★

DosTamer-PC runs on the Tandy 1000 (256K) and requires one disk drive. The Babbage Patch, P.O. Box 252, Temple City, CA 91780, 818-286-1334. \$49.95.

One utility you should have at your disposal is an interface between you and MS-DOS. This interface should let you perform MS-DOS commands with greater ease and give you more capabilities with simplified keystrokes. **DosTamer-PC** is such a utility.

DosTamer is a shell program that patches itself to the main operating system, letting you execute most DOS functions with one or two keystrokes. **DosTamer** has two major modes, Directories and Files. The Files screen displays sorted directory entries in lines 1-20, a file and directory statistics line, date/time, and a mini help menu on line 25. You can auto-execute, copy, erase, and rename files. And you can manipulate multiple files with the global tagging feature for copying, erasing, and searching files with wild-card characters.

I liked conjuring system statistics at the stroke of a key, viewing files, and swapping them from a hidden to unhidden state. Another convenient feature writes a comment line for each file to help you keep track of what the file is for. You can create, erase, or recall comments at the stroke of a key.

In the Directories mode, you can list all subdirectories or access and rename files within a selected subdirectory. You can personalize **DosTamer's** menu by changing the border, foreground, and background colors in areas of the display. The input prompts can be customized, as well. You can set Basic files to auto-execute via Basic or BasicA depending on your selection, and you can enter or change the menu at any time. **DosTamer** incorporates a unique feature called Xtra-Menu, which creates custom commands for easy recall and execution. For example, this could be used to send formatting control codes to a printer—much easier than calling them from Basic.

The manual has a few typos, but it is short and to the point. I found it adequate, as the commands were easy to locate and reference. One problem was **DosTamer's** inability to view different drive directories on demand. When moving between drives, I kept getting an error message and the program would not respond to commands. The trouble occurred with any drive I tried to access. You probably will use this feature often, so check to see if it's been corrected before you purchase **DosTamer-PC**.

—David Engelhardt

Hip-Pocket Helpers

★★★

Hip-Pocket Helpers runs on the Tandy 1000/1200/2000/3000 and requires 128K and one disk drive. Alps, 1502 County Road 25, Woodland Park, CO 80863, 800-232-2577. \$79 for the complete set or \$49 for any five individual Helpers.

ALPS **Hip-Pocket Helpers** is a utility package designed to assist you in many disk- and file-based MS-DOS functions. It consists of 29 utilities, ranging from directory trees to disk-verification functions, all easy to run and handy when you need to perform nearly any file or disk function.

One of the package's highlights is the CHMOD utility, which lets you change a file attribute from normal state to hidden so it is not listed in a directory, or from read-only to restrict-access to prevent accidental damage. It creates a system or archive file to be included in backup utilities. CHMOD cannot hide a program from Copyhide, which copies a hidden file that the DOS Copy command doesn't recognize. The program marks the copied file as a changed file for backup purposes, and installs it with the current system date, not the original one. A note to the cautious: The new file will not be hidden until you use the CHMOD command.

If you hide a file and forget its name, you can use Findfile. Fortunately, a hidden file cannot hide from this utility. This might be a drawback if whomever you are trying to hide a file from is aware of the Findfile command argument. You have an alternative should you remember anything at all about the file name. A third program, SEARCHS, can search for a user-specified string of text in all files in all directories or in only those you designate. This powerful tool uncovers lost files and locates text strings and file extensions. Also, you can reset a file. With the Reset command, you can list current file attributes.

You must exercise a great deal of caution in using the Cleanup command, which deletes all files on a disk and reformats. The program does not have a utility to retrieve cleaned-up files, so watch out. It is helpful in emptying out cluttered directories, and you can use it with DELETEDB, which deletes files with dates older than you specify. This is another command that you should handle with care.

Of importance to those with Laserjet printers are the Setcom and Serprint command arguments, which configure and set up the serial ports for serial printer devices. Softfeed and REMOVE-NL are correction programs that add line feeds and remove unnecessary ones. Neither program can be stopped once

you invoke it, and both remain active until you reset the system.

With all the utilities available in ALPS **Hip-Pocket Helpers**, from special file-transfer capabilities to directory print-outs and a command to time an operation, it seems strange that I managed to get along without them before now. Despite their idiosyncrasies, they perform well, albeit at a steep retail price. If you have been looking for the capabilities that **Hip-Pocket Helpers** offer, this package is worthwhile.

—Jeffrey Parker

Deskmerge

★★

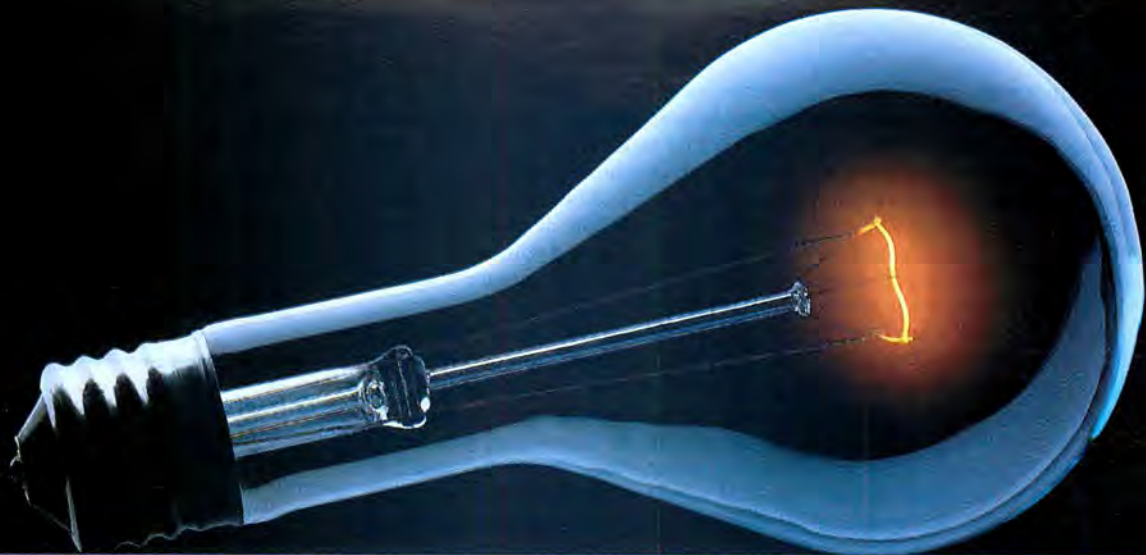
Deskmerge runs on the Model 1000 (128K) and requires one disk drive. Try-O-byte, 1008 Alton Circle, Florence, SC 29501, 803-662-9500. \$29.99.

Deskmerge is a DeskMate accessory that lets you merge the information in files created by Filer into documents written with Text to produce form letters, mailing labels, and so on. **Deskmerge** is not copy-protected, so you can put it where you want it. Its documentation, which is almost superfluous, comes in a DOC file on the program disk.

To use **Deskmerge**, you prepare a "form" with DeskMate's Text. You can use other editors as long as they behave exactly like Text. Where you want to insert data from your Filer records, you type the appropriate field name bracketed by vertical bars (the symbol over the 4 on the numeric keypad). **Deskmerge** is case- and space-rigid, so the field name must be precisely accurate. Also, if two fields have exactly the same name—possible with Filer—**Deskmerge** reads only the first of them. Finally, to avoid surprises, you must be sure to use Filer's Pack function, which removes deleted records. **Deskmerge** chokes on a record flagged for deletion, which Filer merely marks with a D, and quits.

Deskmerge executes from MS-DOS, not from within DeskMate. Using its setup menu, you supply the names of your Filer and Text files, enable or disable record selection by a key field, similarly toggle a manual-selection mode, and set the format for your printed document. **Deskmerge** adds nothing to DeskMate's already limited formatting capability.

Deskmerge forgives a misspelled file name and lets you retype it, or detects a missing printer and lets you put it on line. However, once it opens your files and sets to work, it aborts to MS-DOS if it runs into a problem. If you want to change something and start over, you can break to MS-DOS. When **Deskmerge** is done, it quits to MS-DOS, so every time you use the program you start at the be-



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ginning. You cannot save previously set document formats or run consecutive jobs. I found this annoying.

Deskmerge has other limitations. Unless I began my text with a blank line, the first word of the document showed up positioned unpredictably from one page to the next. The program could not keep track of the top of the page when printing letters, no matter what I tried. The automatic record selection by a key field proved virtually useless: Since the only logical operation allowed is exactly equal to, Deskmerge extracts from your files everyone named Tolstoy, for example, but cannot select everyone whose name begins with T. And the program doesn't sort, so you cannot print mailing labels in zip-code order, for instance.

Deskmerge is the sort of software I expect to find in an anthology of worthwhile computer programs, in a book, in a magazine, or in a user's group library. It performs a useful function missing from Tandy's DeskMate and, within its limits, it works. But it would have to do a lot more than it does to come between me and 30 bucks.

—Harry Bee

Hacker II

★★★★

Hacker II: The Domsday Papers runs on the Tandy 1000 and requires one disk drive. Activision Inc., P.O. Box 7287, Mountain View, CA 94039, 415-960-0410. \$39.95.

A leading Russian scientist has authored a deadly plan, dubbed The Domsday Papers, to destroy the United States, and you have been assigned to carry out a covert CIA mission to retrieve the document from a vault in a secret Siberian military complex. U.S. agents have planted small slave robots called mobile remote units (MRUs) in hidden areas of the complex; you manipulate them via the multifunction switching matrix (MFSM), a sophisticated transceiver that taps into the complex's myriad surveillance cameras. The MRUs must get to the vault, obtain the Domsday Papers, and deliver them to waiting CIA agents without being spotted by cameras or a goose-stepping sentry. If detected, your MRUs are stalked and pulverized by the Annihilator, a fast-moving robot guard.

To boot up, just insert the disk in drive A and go. You are presented with text describing the crisis, followed by information on the MFSM and a quiz about its operation. (Later on, you have the option of skipping this introductory section.) The main screen is a front view of the MFSM—four monitors positioned over a control panel. Using a joystick,

mouse, or the keyboard to operate the controls, you tune in each screen separately. The most critical of these, the TGS, is an overhead grid-like map that you use to spot and follow the slow-moving MRUs. The MFSM displays 38 different camera angles, and you can override any one of the security monitors with a bogus videotape playback.

In the original Hacker, you accidentally stumbled into a top-secret computer network and pieced together an intricate puzzle before being flushed out of the system. In this sequel, you must rely on creative logic to succeed, and the MFSM operates for only a limited time before its long-range scanner heats up and cannot accurately control the robots. An MRU must get past all the obstacles, retrieve small clues locked inside four filing cabinets positioned throughout the complex, and use the clues to open the vault. Depending on your tolerance, this game of wits can be fascinating or frustrating. I found it a challenge to play a game that requires a lot of use before you can master it.

The first step in tackling the assignment is to use the TGS to draw a map of the corridors, then attempt to negotiate a path to the filing cabinets and vault without being spotted. Easier said than done, as the surveillance cameras and guard are always moving and watching. It took much planning and split-second timing before I could reach the first filing cabinet. By the time you acquire enough information to obtain the Domsday Papers, the vault is heavily protected and nearly impossible to crack.

This is a colorful, well-designed, and suspenseful game that should give you several runs for the money. It is full of unexpected turns and twists. The package includes a "for your eyes only" guide explaining the MFSM's functions; it is diverting but provides little insight into the nature of your spy operation. Overall, Hacker II is a fun but grueling challenge, even for a jaded gamer.

—Jeffrey Frentzen

Refer

★

Refer runs on the Tandy 1000/1200 (128K) and requires one disk drive. James Halstead & Associates, 1551 Plainfield, Joliet, IL 60435, 815-725-0346. \$39.

Remember when anyone capable of throwing together a few lines of Basic code could market a program and find an audience? Just a decade ago. Ancient history. These days, when sophisticated features are a dollar a dozen, an offering like Refer is startling. Its pop for the peso is inaudible.

Hacker II is a fun but grueling challenge, even for a jaded gamer.

This programming utility claims, among other things, that it concurrently cross-references variables, values, keywords, line numbers, or labels in any language. This would be attractive to anyone involved in lengthy projects. Of course, the attraction depends on a certain interpretation of the concept of cross-referencing, and there's the rub.

Supplied on Refer's program disk are four executable programs, their Basic source code, and text files containing the reserved words of several languages: Basic, Pascal, and C, among others. Predictably, the C file is short. One program prints a page of what passes for documentation. Another prints labels for backup copies of the program disk. The third provides a primitive mechanism for creating reserved word files—not for extending or editing existing files. Then there's Refer.

Refer reads any source code in any language, including French, written with any line-oriented editor and stored in an ASCII file. It begins by listing your program, whether you like it or not. If lines begin with numbers and look like Basic, Refer "pretty prints" the listing by hacking up the lines at every colon, whether the colon actually separates Basic statements, is part of a drive specification, or belongs to a literal string. If there are no line numbers, Refer adds them. That done, Refer spews forth a list of all the "things" (my own term) it found in your program along with their locations. A thing is any string of alphanumeric characters that appear together. What delimits a thing are characters that are not alphanumeric. Refer sorts and orders its thing list without analysis, classification, or comment, other than where to look for them. That's all, except for an option that lets you suppress reserved words, which makes for a shorter list of things.

Is Refer really so ridiculous? Try this: Your program contains the statement $\text{pi} = 3.14$. To Refer, pi is a thing. So are 3 and 14. The program cannot recognize something so fundamental as an ordinary decimal value. It performs the same sort of quack surgery to amputate file names from their extensions. Refer is ridiculous indeed.

—Harry Bee

Listing 1 continued from p. 57

```

02070 LEAVE LD SP,(STAKSAV) ;Back to system stack
02080 SVC @EXIT ;Back to TRSDOS
02090 ;-----
02100 ; Close any open files
02110 ;-----
02120 CLOSE LD DE,CHKFCB ;DE ==> checkbit file block
02130 LD A,(DE) ;Get first byte
02140 OR A ;Is it 0?
02150 JR Z,CLOSE_2 ;Yes -- go
02160 SVC @CLOSE,1 ;Else close it
02170 CLOSE_2 LD DE,DATFCB ;DE ==> data file block
02180 LD A,(DE) ;Get first byte
02190 OR A ;Is it 0?
02200 RET Z ;Yes -- we're done
02210 SVC @CLOSE,1 ;Else close it
02220 RET ;And return
02230 ;
02240 ;-----
02250 ; Both Programs Start Here
02260 ;-----
02270 BEGIN LD (STAKSAV),SP ;Save the stack
02280 LD SP,OURSTAK ;Move to our stack
02290 SVC @CLS
02300 PRINT HELLO ;Identify program
02310 GETNAM PRINT PROMPT ;Ask for
02320 LD HL,NAMEBUF ; file name
02330 LD BC,24<8:0 ;Room for filename/ext.password:d
02340 SVC @KEYIN ;Get the name
02350 JR NC,NAMECHK ;Go if no <Break> key
02360 LD HL,0 ;Else show "no error"
02370 JP LEAVE ;And end
02380 ;
02390 NAMECHK LD A,B ;Get length of filespec
02400 OR A ;Test length
02410 JR Z,GETNAM ;Loop if no name
02420 ;-----
02430 ; End of Common Code
02440 ;-----
02450 END

```

End

Program Listing 2. Write (Model 4 version).

```

00100 ;-----
00110 ; TRSDOS 6.2 Version of Hamming Code "WRITE" Program
00120 ; Assembled with PRO-CREATE version 4.3a
00130 ;
00140 ; Program Conversion Written by Hardin Brothers
00150 ;-----
00160 ORG 3000H
00170 START JP BEGIN
00180 *GET HAMMING/ASM ;Include common code
00190 ;
00200 LD DE,DATFCB ;DE ==> file control block
00210 SVC @FSPEC,1 ;Check & move filespec
00220 LD B,0 ;Open file with LRL=256
00230 LD HL,DATBUF ;HL==> input buffer
00240 SVC @OPEN,1 ;Open an existing file
00250 JR Z,FSPEC2 ;No error -- go
00260 CP 2AH ;LRL error?
00270 JP NZ,ERROUT ;No -- leave
00280 ;
00290 FSPEC2 LD HL,NAMEBUF ;HL ==> input buffer
00300 LD BC,24 ;Maximum possible length
00310 LD A,'/' ;Check for slash or CR
00320 FS_1 CPI ;Check a byte
00330 JP M,FS_1 ;Loop until no carry
00340 HL ;Back up a space
00350 LD (HL),CR ;Set end of new file name
00360 LD HL,NAMEBUF ;HL ==> beginning of name again
00370 LD DE,CHKFCB ;DE ==> file control block
00380 SVC @FSPEC,1 ;Move the file spec

```

Listing 2 continued

Listing 2 continued

```

00390 LD HL,EXTTXT ;HL==> '/CHK' extent
00400 SVC @FEXT,1 ;Set it in file
00410 LD HL,CHKBUF ;HL==> output buffer
00420 LD B,0 ;LRL = 256
00430 SVC @INIT ;Open the file
00440 PRINT STAT ;Start the status routine
00450 DISPCB CUROFF ;Turn off cursor
00460 ;-----
00470 ; Main Program Loop
00480 ;-----
00490 MAINLP LD DE,DATFCB ;DE ==> input file control block
00500 SVC @GET,1 ;Get a byte in A
00510 JR Z,MAIN_1 ;Okay -- go
00520 CP 1CH ;End of file?
00530 JP Z,DONE ;Yes -- go
00540 JP ERRROUT ;Else leave with error
00550 ;
00560 MAIN_1 PUSH AF ;Save byte
00570 INCW TOTAL ;Add one to total
00580 POP AF ;Recover byte
00590 LD C,0 ;Set Hamming byte to 0
00600 LD B,A ;Transfer input byte to B
00610 IRP X,<1,2,3,4> ;Repeat for all four groups.
00620 SETBIT X ;Set Hamming bits
00630 ENDM
00640 LD A,B ;Get back original byte
00650 XOR C ;Test overall parity
00660 JP PO,MAIN_2 ;Go if parity is odd
00670 SET PARITY,C ;Else set overall parity bit
00680 ;
00690 MAIN_2 LD DE,CHKFCB ;DE ==> output File Control Block
00700 SVC @PUT ;Put the byte in C
00710 CALL STATUS ;Show our progress
00720 JR MAINLP ;Loop back
00730 ;-----
00740 ; Show progress
00750 ;-----
00760 STATUS DISPCB CURUP ;Move up a line
00770 SHOW TOTAL ;Display running total
00780 RET
00790 ;-----
00800 ; Unique Messages
00810 ;-----
00820 HELLO DB 'Hamming Code Check-Byte Generator',LF,CR
00830 STAT DB LF,LF,' 0 bytes processed',CR
00840 DS 256 ;Room for our stack
00850 OURSTAK EQU $
00860 END START

```

End

Program Listing 3. Check (Model 4 version).

```

00100 ;-----
00110 ; TRSDOS 6.2 Version of Hamming Code "Check" Program
00120 ; Assembled with Pro-Create version 4.3a
00130 ;
00140 ; Program Conversion Written by Hardin Brothers
00150 ;-----
00160 ORG 3000H
00170 START JP BEGIN
00180 *GET HAMMING/ASM ;Include common code
00200 ;
00210 LD DE,DATFCB ;DE ==> data control block
00220 SVC @FSPEC ;Check & move filespec
00230 LD B,1 ;Open file with LRL=1
00240 LD HL,DATBUF ;HL==> Data buffer
00250 SVC @OPEN,1 ;Open an existing file
00260 JR Z,FSPEC2 ;No error -- go
00270 CP 2AH ;LRL error?
00280 JP NZ,ERROUT ;No -- leave

```

Listing 3 continued

Listing 3 continued

```

00290 ;
00300 FSPEC2 LD HL,NAMEBUF ;HL ==> input buffer
00310 LD BC,24 ;Maximum possible length
00320 LD A,'/' ;Check for slash or CR
00330 FS_1 CPI ;Check a byte
00340 JP M,FS_1 ;Loop until positive
00350 DEC HL ;Back up a space
00360 LD (HL),CR ;Set end of new file name
00370 LD HL,NAMEBUF ;HL ==> beginning of name again
00380 LD DE,CHKFCB ;DE ==> file control block
00390 SVC @FSPEC ;Move the file spec
00400 LD HL,EXTTXT ;HL==> '/CHK' extent
00410 SVC @PEXT,1 ;Set it in file
00420 LD HL,CHKBUF ;HL==> check bits buffer
00430 LD B,1 ;LRL = 1
00440 SVC @OPEN,1 ;Open the file
00450 JR Z,MAINST ;No error -- go
00460 CP 2AH ;LRL error?
00470 JP NZ,ERROUT ;No -- leave
00480 ;-----
00490 ; Main program loop
00500 ;-----
00510 MAINST DISPCB CUROFF ;Turn off cursor
00520 PRINT STAT ;Print status lines
00530 MAINLP EQU $
00540 CALL STATUS
00550 LD DE,DATFCB ;DE ==> data fcb
00560 LD HL,DATUDEC ;HL ==> data area
00570 SVC @READ,1 ;Get a byte
00580 JR Z,MAIN_1 ;Okay -- go
00590 CP 1CH ;End of file?
00600 JP Z,DONE ;Yes -- go
00610 JP ERROUT ;Else leave with error
00620 ;
00630 MAIN_1 INCW TOTAL ;Working on another byte
00640 LD C,0 ;Set Hamming byte to 0
00650 LD B,(HL) ;Transfer input byte to B
00660 IRP X,<1,2,3,4> ;Repeat for all four groups
00670 SETBIT X ;Set Hamming bits
00680 ENDM
00690 LD A,B ;Get back original byte
00700 XOR C ;Test overall parity
00710 JP PO,MAIN_2 ;Go if parity is odd
00720 SET PARITY,C ;Else set overall parity bit
00730 ;
00740 MAIN_2 LD DE,CHKFCB ;DE ==> Check File Control Block
00750 LD HL,CHKUREC ;HL ==> Check UREC
00760 SVC @READ ;And get a byte from it
00770 LD A,(HL) ;Put it in A
00780 XOR C ;Merge old & new checkbits
00790 JR Z,MAINLP ;They're the same -- loop back
00800 ;
00810 CP 80H ;Overall parity bit error?
00820 JR NZ,MAIN_3 ;No -- look some more
00830 XOR C ;Toggle parity bit of C
00840 JP CHKERR ;Handle check-bit error
00850 ;
00860 MAIN_3 AND 7FH ;Turn off the parity bit
00870 CP 13 ;Error code too high?
00880 JP NC,MULTERR ;Report multi-bit error
00890 IRP XX,<1,2,4,8> ;These are errors in the check bits
00900 CP XX ;Is this our error?
00910 JP NZ,COUTXX ;No -- go
00920 LD A,C ;Else use new value
00930 JP CHKERR ;Report check-bit error
00940 COUTXX EQU $
00950 ENDM
00960 IRP YY,<3,5,6,7,9,10,11,12> ;These are data bit errors
00970 DFIX YY ;Test and fix the error
00980 ENDM
00990 LD A,80H ;Should never get here
01000 JP ERROUT ;Report an error if we do.
01010 ;-----
01020 ; Fix a data error

```

Listing 3 continued

Listing 3 continued

```

01030 ;-----
01040 DATERR BACKUP DAT ;Store new value
01050 INCW DATCNT ;Add one to count
01060 JP MAINLP ;And loop back
01070 ;-----
01080 ; Fix a check-bit error
01090 ;-----
01100 CHKERR BACKUP CHK ;Store new value
01110 INCW CHKCNT ;Increment count
01120 JP MAINLP ;And loop back
01130 ;-----
01140 ; Report a multi-bit error
01150 ;-----
01160 MULTERR INCW MULTCNT ;Count this error
01170 JP MAINLP ;And loop back
01180 ;-----
01190 ; Show program progress
01200 ;-----
01210 STATUS UP3
01220 SHOW TOTAL ;Display total processed
01230 SHOW DATCNT ;Data bytes corrected
01240 SHOW CHKCNT ;Check bytes corrected
01250 SHOW MULTCNT ;Multi-bit errors detected
01260 RET
01270 ;-----
01280 ; Unique Messages
01290 ;-----
01300 HELLO DB 'Hamming Code Correction Program',LF,CR
01310 STAT DB LF,LF,' 0 bytes processed',LF
01320 DB ' 0 data byte errors corrected',LF
01330 DB ' 0 checkbit errors corrected',LF
01340 DB ' 0 multi-bit errors uncorrected',ETX
01350 ;-----
01360 ; Unique Data
01370 ;-----
01380 MULTCNT DW 0 ;Multiple bit errors
01390 DATCNT DW 0 ;Data bit errors
01400 CHKCNT DW 0 ;Check bit errors
01410 DATUDEC DS 1 ;Record area for data file
01420 CHKUREC DS 1 ;Record area for check file
01430 DS 256 ;Room for our stack
01440 OURSTAK EQU $ ;Top of stack
01450 END START

```

End

Program Listing 4. Write (Model III version).

```

00100 ;#####
00110 ;# "WRITE"
00120 ;# VERSION 2.1
00130 ;# by Stewart F. Hunter
00140 ;#####
00150 ;
00160 ORG 7000H
00170 COMPUT CALL 01C9H ;CLEAR THE SCREEN
00180 LD HL,BUFFER
00190 LD HL,IMSG ;ASK FOR INPUT FILE NAME
00200 CALL DDISPLAY
00210 LD HL,IDCB
00220 LD B,24
00230 CALL 5D9H ;INPUT LINE INTO (HL)
00240 LD HL,IDCB
00250 LD DE,ODCB
00260 MOVNAM LD A,(HL) ;MOVE FILE NAME TO OUTPUT FILE
00270 CP 0DH ;BUFFER AND ADD EXTENSION.
00280 JR Z,MOVN2
00290 CP '/'
00300 JR Z,MOVN2
00310 LD (DE),A
00320 INC HL
00330 INC DE

```

Listing 4 continued

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Captain's Log... War Date 10.01.44



"Captain's Log, October 1, 1944. 0250 Hours. Fleet submarine USS Hammerhead proceeding Southwest at cruising speed. Our mission: intercept enemy convoy off the coast of Borneo. Disperse and destroy."



"0300 Hours. Two hours until dawn. Radar picks up convoy, escorted by two destroyers. We believe that one of the enemy's valuable cargo ships is part of convoy formation."



"0400 Hours. Lookouts on the bridge. Target identification party reports one cargo ship, 4,000 tons, troopship of 10,250 tons, with two *Kaibokan*-type escorts. Moving into attack position."

Tandy 1000/IBM PC Jr. screens shown



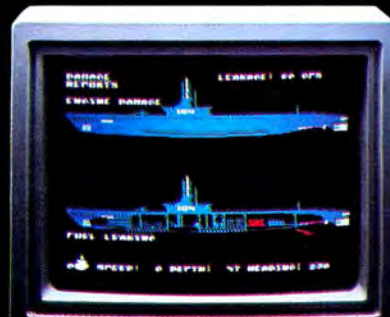
"0500 Hours. Sound General Quarters! Battle stations manned. Preparing for torpedo run. Gauge Panel OK. Periscope OK. Charts and Attack Plot Board OK. All mechanical systems OK."



"0525 Hours. Torpedo rooms report full tubes forward and aft. Battery at full charge for silent running. We hope water temperature will provide thermal barrier to confuse enemy sonar."



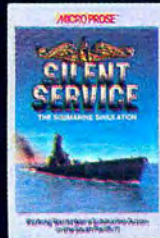
"0600 Hours. We are at final attack position. Convoy moving at 10 knots. Target distance decreasing rapidly... Crash Dive! Escorts have spotted us and are turning to attack! Rig to run silent."



"0700 Hours. Depth charged for one hour. Some minor damage, but repair parties at work. Destroyer propeller noises receding. We'll come to periscope depth for our return punch."



"0715 Hours. Torpedo tubes 1, 2, 3 fired. Two destroyers hit and sinking. One of the enemy's last cargo ships coming into 'scope view — an ideal target position. On my mark... Fire Tube 4! Fire 5!"



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Listing 4 continued

```

00340      JR MOVNAM
00350 MOVN2  LD HL,EXT
00360      LD BC,6
00370      LDIR
00380      LD HL,IBUFFR
00390      LD DE,IDCB
00400      LD B,1
00410      CALL 4424H      ;OPEN INPUT FILE
00420      LD IY,IDCB
00430      LD (IY+1),0A0H
00440      LD (IY+9),1
00450      JP NZ,DSKERR    ;JUMP IF DISK ERROR
00460 COMPU2 LD HL,BUFFER
00470      LD DE,ODCB
00480      LD B,1
00490      CALL 4420H      ;CREATE OUTPUT FILE
00500      JP NZ,DSKERR    ;JUMP IF DISK ERROR
00510 GET    LD HL,DATA
00520      LD DE,IDCB
00530      CALL 4436H      ;READ A CHAR. FROM INPUT FILE
00540      JP Z,COMP
00550      CP 28            ;EOF?
00560      JP Z,CLOSE
00570      JP DSKERR
00580 COMP  LD HL,MASK
00590      LD IX,CHKBTS
00600      XOR A
00610      LD B,4
00620      LD (CHKBTS),A  ;ZERO CHECK BITS
00630 COMPL1 LD A,(DATA)
00640      AND (HL)
00650      CALL PE,SETBIT
00660      INC HL
00670      DJNZ COMPL1
00680      LD A,(DATA)
00690      OR A
00700      JP PO,DPO
00710      LD A,(IX)
00720      OR A
00730      JP PE,CPE
00740      JP COMPX
00750 DPO   LD A,(IX)
00760      OR A
00770      JP PE,COMPX
00780 CPE   SET 7,(IX)
00790 COMPX JP WRBYT      ;EXIT COMPUTATION ROUTINE
00800 SETBIT LD A,B
00810      CP 4
00820      JP Z,B0
00830      CP 3
00840      JP Z,B1
00850      CP 2
00860      JP Z,B2
00870 B3    SET 3,(IX)
00880      RET
00890 B2    SET 2,(IX)
00900      RET
00910 B1    SET 1,(IX)
00920      RET
00930 B0    SET 0,(IX)
00940      RET
00950 MASK  DEFB 5BH
00960      DEFB 6DH
00970      DEFB 8EH
00980      DEFB 0F0H
00990 WRBYT LD HL,CHKBTS  ;WRITE CHECK BITS TO OUTPUT FILE
01000      LD DE,ODCB
01010      CALL 4439H
01020      JP NZ,DSKERR
01030      JP GET
01040 ;DISK INPUT/OUTPUT ERROR ROUTINE
01050 DSKERR OR 0C0H
01060      CALL 4409H
01070      JP 402DH

```

Listing 4 continued

Listing 4 continued

```

01080 ODCB  DEFS 64
01090 IDCB  DEFS 64
01100 IMMSG DEFB 0DH
01110      DEFM 'NAME OF FILE? '
01120      DEFB 0
01130 EXT   DEFM '/CHK'
01140      DEFB 0DH
01150 CRMSG DEFM ' CHECK FILE CREATED'
01160      DEFB 0DH
01170      DEFB 0
01180 ;DISPLAY MESSAGE POINTED TO BY HL REGISTER
01190 DSPLA LD A,(HL)
01200      OR A
01210      RET Z
01220      CALL 33H
01230      INC HL
01240      JR DSPLA
01250 DSPL  LD A,(HL)
01260      CP 3AH
01270      RET Z
01280      CALL 33H
01290      INC HL
01300      JR DSPL
01310 ;CLOSE BOTH FILES
01320 CLOSE LD DE,IDCB
01330      CALL 4428H      ;CLOSE INPUT FILE
01340      JP NZ,DSKERR
01350      LD DE,ODCB
01360      CALL 4439H      ;WRITE REMAINING BYTES TO OUTPUT
01370      JP NZ,DSKERR
01380      LD DE,ODCB
01390      CALL 4428H      ;CLOSE OUTPUT FILE
01400      JP NZ,DSKERR
01410      LD A,0DH
01420      CALL 33H
01430      LD HL,ODCB
01440      CALL DSPL
01450      LD HL,CRMSG
01460      CALL DSPLA
01470      JP 402DH      ;EXIT TO DOS
01480 IBUFFR DEFS 256
01490 BUFFER DEFS 256
01500 DATA  DEFB 0
01510 CHKBTS DEFB 0
01520      END COMPUT

```

End

Program Listing 5. Check (Model III version).

```

00100 ;*****
00110 ;# "CHECK"
00120 ;# VERSION 2.3
00130 ;# by Stewart F. Hunter
00140 ;*****
00150 ;
00160      ORG 7000H
00170 CHECK  CALL 01C9H      ;CLEAR THE SCREEN
00180      LD HL,BUFFER
00190      LD HL,DMSG        ;ASK FOR DATA FILE NAME
00200      CALL DSPLA
00210      LD HL,DCB
00220      LD B,24
00230      CALL 5D9H        ;INPUT LINE INTO (HL)
00240      LD HL,DCB
00250      LD DE,CDCB
00260 MOVNAM LD A,(HL)
00270      CP 0DH
00280      JR Z,MOVN2
00290      CP '/'
00300      JR Z,MOVN2
00310      LD (DE),A

```

Listing 5 continued

Listing 5 continued

```

00320 INC HL
00330 INC DE
00340 JR MOVNAM
00350 MOVN2 LD HL,EXT
00360 LD BC,6
00370 LDIR
00380 LD HL,DBUFFR
00390 LD DE,DDCB
00400 LD B,1
00410 CALL 4424H ;OPEN INPUT FILE
00420 LD IY,DDCB
00430 LD (IY+1),0A0H
00440 LD (IY+9),1
00450 JP NZ,DSKERR ;JUMP IF DISK ERROR
00460 LD HL,BUFFER
00470 LD DE,CDCB
00480 LD B,1
00490 CALL 4424H ;OPEN CHECK FILE
00500 JP NZ,DSKERR ;JUMP IF DISK ERROR
00510 GET LD HL,DATA
00520 LD DE,DDCB
00530 CALL 4436H ;READ A CHAR. FROM INPUT FILE
00540 JP Z,RDCHK
00550 CP 20 ;EOF?
00560 JP Z,CLOSE ;IF SO,CLOSE FILES AND EXIT
00570 JP DSKERR
00580 RDCHK LD HL,CHKBTS
00590 LD DE,CDCB
00600 CALL 4436H ;READ A CHECK BYTE FROM CHK FILE
00610 JP NZ,DSKERR
00620 CALL ASSEM ;ARRANGE BITS INTO ADRS HI AND LO
00630 CORREC LD IX,LO ;CHECK DATA BYTE WITH CHECK BYTE
00640 LD HL,MASK
00650 LD IY,TEST
00660 XOR A
00670 LD C,A
00680 LD (TEST),A
00690 BB LD A,(HI)
00700 AND (HL)
00710 LD (TEMP),A
00720 INC HL
00730 LD A,(IX)
00740 AND (HL)
00750 LD E,A
00760 LD A,(TEMP)
00770 XOR E
00780 JP PO,AA
00790 EVEN LD A,C
00800 OR A
00810 JP Z,B01
00820 CP 1
00830 JP Z,B11
00840 CP 2
00850 JP Z,B21
00860 SET 0,(IY)
00870 JP AA
00880 B01 SET 3,(IY)
00890 JP AA
00900 B11 SET 2,(IY)
00910 JP AA
00920 B21 SET 1,(IY)
00930 AA INC HL
00940 INC C
00950 LD A,C
00960 CP 4
00970 JP NZ,BB
00980 LD A,(IY)
00990 OR A ;ERRORS IN DATA OR CHECK BITS?
01000 JP NZ,ERRFND ;JUMP IF SO
01010 LD A,(HI)
01020 XOR (IX) ;ERROR IN PARITY BIT?
01030 JP PE,PARERR ;JUMP IF SO
01040 XOR A ;ELSE NO ERROR FOUND
01050 JP ENDIT

```

Listing 5 continued

Listing 5 continued

```

01060 PARERR LD A,16 ;SET TEST TO CORRECT PARITY BIT
01070 LD (IY),A
01080 ERRFND LD HL,SAVE
01090 LD B,A
01100 LD A,80H
01110 ROTATE RLCA
01120 DJNZ ROTATE
01130 LD (HL),A
01140 LD A,(TEST)
01150 CP 9
01160 JP NC,HBERR ;JUMP IF ERROR IN HI BITS
01170 LD A,(IX)
01180 XOR (HL)
01190 LD (IX),A
01200 JP CHKPAR
01210 HBERR LD A,(HI) ;CORRECT ERROR IN HI BITS
01220 XOR (HL)
01230 LD (HI),A
01240 CHKPAR LD HL,HI
01250 LD A,(LO)
01260 XOR (HL)
01270 JP PO,SNGL
01280 DBL LD HL,(DECNT)
01290 INC HL
01300 LD (DECNT),HL
01310 XOR A
01320 INC A ;RESET Z FLAG
01330 SCF ;SET C FLAG
01340 ENDIT JP CHKTYP
01350 SNGL LD A,(TEST)
01360 CP 1
01370 JP Z,SNGL2
01380 CP 2
01390 JP Z,SNGL2
01400 CP 4
01410 JP Z,SNGL2
01420 CP 8
01430 JP Z,SNGL2
01440 CP 16
01450 JP Z,SNGL2
01460 LD HL,(SECNT)
01470 INC HL
01480 LD (SECNT),HL
01490 SNGL2 XOR A
01500 INC A ;RESET Z FLAG
01510 JP ENDIT
01520 CHKTYP JP Z,GET ;JUMP IF NO ERROR DETECTED
01530 JP C,GET ;JUMP IF UNCORRECTABLE ERROR
01540 CALL DISAS ;RECONSTRUCT DATA AND CHECK BYTES
01550 LD IX,DDCB
01560 LD IY,DATA
01570 LD HL,DBUFFR
01580 LD (BUFF),HL
01590 LD A,(TEST)
01600 CP 1
01610 JP Z,INITC
01620 CP 2
01630 JP Z,INITC
01640 CP 4
01650 JP Z,INITC
01660 CP 8
01670 JP Z,INITC
01680 CP 16
01690 JP Z,INITC ;JUMP IF ERROR IN CHECK BIT
01700 JP CHKT1 ;JUMP IF ERROR IN DATA BIT
01710 INITC LD HL,(CBCNT)
01720 INC HL
01730 LD (CBCNT),HL
01740 LD IX,CDCB ;ELSE SET UP TO WRITE CHECK FILE
01750 LD IY,CHKBTS
01760 LD HL,BUFFER
01770 LD (BUFF),HL
01780 CHKT1 LD L,(IX+10)
01790 LD H,(IX+11)

```

Listing 5 continued

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Listing 5 continued

```

01800 LD B,8
01810 XOR A
01820 CHKT2 SLA L
01830 RL H
01840 DJNZ CHKT2
01850 LD A,(IX+5)
01860 LD C,A
01870 ADD HL,BC
01880 LD (RECRD),HL
01890 LD A,(IX+8) ;STORE EOF BYTE#
01900 LD (EOFB),A
01910 LD L,(IX+12) ;STORE EOF SECTOR#
01920 LD H,(IX+13)
01930 LD (EOF),HL
01940 PUSH IX
01950 POP DE
01960 CALL 4445H ;BACK UP FILE 1 RECORD
01970 JP NZ,DSKERR
01980 PUSH IY
01990 POP HL
02000 PUSH IX
02010 POP DE
02020 CALL 4439H ;WRITE CORRECTION TO DISK BUFFER
02030 JP NZ,DSKERR
02040 PUSH IX
02050 POP DE
02060 CALL 4428H ;CLOSE FILE TO WRITE BUFFER TO
02070 JP NZ,DSKERR ;DISK.
02080 LD HL,(BUFF)
02090 PUSH IX
02100 POP DE
02110 LD B,1
02120 CALL 4424H ;REOPEN FILE
02130 JP NZ,DSKERR
02140 LD A,0A0H
02150 LD (IX+1),A
02160 LD A,1
02170 LD (IX+9),A
02180 LD A,(EOFB)
02190 LD (IX+8),A ;RESTORE EOF BYTE#
02200 LD HL,(EOF) ;AND EOF SECTOR
02210 LD (IX+12),L
02220 LD (IX+13),H
02230 LD BC,(RECRD)
02240 PUSH IX
02250 POP DE
02260 CALL 4442H ;REPOSITION TO PREVIOUS RECORD
02270 JP NZ,DSKERR
02280 JP GET ;CONTINUE
02290 ;DISK INPUT/OUTPUT ERROR ROUTINE
02300 DSKERR OR 0C0H
02310 CALL 4409H
02320 JP 402DH
02330 CDCB DEFS 64
02340 DDCE DEFS 64
02350 DMSG DEFB 0DH
02360 DEFM 'NAME OF FILE? '
02370 DEFB 0
02380 EXT DEFM '/CHK'
02390 DEFB 0DH
02400 SEMSG DEFM ' ERRORS DETECTED AND CORRECTED IN'
02410 DEFM ' DATA BITS.'
02420 DEFB 0DH
02430 DEFB 0
02440 CBMSG DEFM ' ERRORS DETECTED AND CORRECTED IN'
02450 DEFM ' CHECK BITS.'
02460 DEFB 0DH
02470 DEFB 0
02480 DEMSG DEFM ' MULTIPLE BIT ERRORS DETECTED BUT NOT'
02490 DEFM ' CORRECTABLE.'
02500 DEFW 0D0DH
02510 DEFB 0
02520 ;DISPLAY MESSAGE POINTED TO BY HL REGISTER
02530 DDISPLAY LD A,(HL)

```

Listing 5 continued

Listing 5 continued

```

02540 OR A
02550 RET Z
02560 CALL 33H
02570 INC HL
02580 JR DDISPLAY
02590 ;CLOSE BOTH FILES
02600 CLOSE LD DE,CDCB ;CLOSE CHECK FILE
02610 CALL 4428H
02620 JP NZ,DSKERR
02630 LD DE,DDCB
02640 CALL 4428H ;CLOSE DATA FILE
02650 JP NZ,DSKERR
02660 LD A,0DH
02670 CALL 33H
02680 LD HL,(SECNT)
02690 CALL CVRT
02700 LD HL,SEMSG
02710 CALL DDISPLAY
02720 LD HL,(CBCNT)
02730 CALL CVRT
02740 LD HL,CBMSG
02750 CALL DDISPLAY
02760 LD HL,(DECNT)
02770 CALL CVRT
02780 LD HL,DEMSG
02790 CALL DDISPLAY
02800 JP 402DH ;EXIT TO DOS
02810 CVRT LD (4121H),HL
02820 LD A,2
02830 LD (40AFH),A
02840 CALL 0FBFH
02850 CALL DDISPLAY
02860 RET
02870 ASSEM LD HL,HI
02880 XOR A
02890 LD (HL),A
02900 LD (LO),A
02910 LD A,(DATA)
02920 SRL A
02930 SRL A
02940 SRL A
02950 SRL A
02960 LD (HL),A ;PUT DATA BITS 7-4 IN HI
02970 LD A,(CHKBTS)
02980 BIT 7,A ;TEST PARITY BIT
02990 JP Z,AS2
03000 SET 7,(HL) ;SET PARITY BIT IN HI
03010 AS2 LD HL,LO
03020 LD A,(DATA)
03030 SLA A
03040 SLA A
03050 SLA A
03060 AND 70H
03070 LD (HL),A ;PUT DATA BITS 3-1 IN LO
03080 LD A,(DATA)
03090 BIT 0,A
03100 JP Z,AS3
03110 SET 2,(HL)
03120 AS3 LD A,(CHKBTS)
03130 AND 3 ;GET 1ST TWO CHECK BITS
03140 OR (HL)
03150 LD (HL),A ;PUT INTO LO
03160 LD A,(CHKBTS)
03170 BIT 2,A
03180 JP Z,AS4
03190 SET 3,(HL) ;PUT 3RD CHECK BIT INTO LO
03200 AS4 BIT 3,A
03210 JP Z,AS5
03220 SET 7,(HL) ;PUT 4TH CHECK BIT INTO LO
03230 AS5 RET
03240 DISAS LD HL,CHKBTS
03250 XOR A
03260 LD (HL),A
03270 LD (DATA),A

```

Listing 5 continued

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Listing 5 continued

```

03280      LD A, (HI)
03290      SLA A
03300      SLA A
03310      SLA A
03320      SLA A
03330      LD (DATA),A      ;PUT BITS 7-4 INTO DATA
03340      LD A, (HI)
03350      BIT 7,A          ;TEST PARITY BIT
03360      JP Z,DI2
03370      SET 7,(HL)      ;SET PARITY BIT IN CHKBT5
03380 DI2   LD HL,DATA
03390      LD A, (LO)
03400      SRL A
03410      SRL A
03420      SRL A
03430      AND 0EH
03440      OR (HL)
03450      LD (HL),A      ;PUT BITS 3-1 INTO DATA
03460      LD A, (LO)
03470      BIT 2,A
03480      JP Z,DI3
03490      SET 0,(HL)      ;SET DATA BIT 0
03500 DI3   LD HL,CHKBT5
03510      LD A, (LO)
03520      AND 3
03530      OR (HL)
03540      LD (HL),A
03550      LD A, (LO)
03560      BIT 3,A
03570      JP Z,DI4
03580      SET 2,(HL)
03590 DI4   BIT 7,A
03600      JP Z,DI5
03610      SET 3,(HL)
03620 DI5   RET
03630 HI    DEFB 0
03640 LO    DEFB 0
03650 DECNT DEFW 0
03660 SECNT DEFW 0
03670 CBCNT DEFW 0
03680 TEMP  DEFB 0
03690 RECRD DEFW 0
03700 SAVE  DEFB 0
03710 BUFF  DEFW 0
03720 TEST  DEFB 0
03730 EOF   DEFW 0
03740 EOFB  DEFB 0
03750 MASK  DEFB 0FH
03760      DEFB 80H
03770      DEFB 80H
03780      DEFB 78H
03790      DEFB 06H
03800      DEFB 66H
03810      DEFB 05H
03820      DEFB 55H
03830 DBUFFER DEFS 256
03840 BUFFER  DEFS 256
03850 DATA  DEFB 0
03860 CHKBT5  DEFB 0
03870      END CHECK

```

End

Program Listing 6. Hamming.CMN. Macros, definitions, and code common to Write and Check (Tandy 1000 version).

```

;=====
; MS-DOS Version of Hamming Code Programs
; Assembled with Microsoft's MASM 4.0
; This is code common to both programs (HAMMING.CMN)
;
; Program Conversion Written by Hardin Brothers
;=====

```

Listing 6 continued

Listing 6 continued

```

; MS-DOS Macros
;-----
line_in macro buffer,length      ;;Read in line from keyboard
mov dx,offset buffer            ;;DS:DX ==> keyboard
mov byte ptr [buffer],length+1 ;;Store maximum length
mov ah,0ah                      ;;Get keyboard input
int 21h
endm

create macro buffer              ;;Create a new file
mov dx,offset buffer            ;;DS:DX ==> file name
mov cx,0                        ;;No special attributes
mov ah,3ch                      ;;Create a file
int 21h
endm

open macro buffer,access         ;;Open existing file
mov dx,offset buffer            ;;DS:DX ==> file name
al,access                       ;;Specify type of access
mov ah,3dh                      ;;Open a file
int 21h
endm

close macro handle_loc          ;;Close a file
mov bx,handle_loc              ;;BX = handle
mov ah,3eh                      ;;Close the file
int 21h
endm

read_b macro handle_loc         ;;Read one byte from file
mov bx,handle_loc              ;;BX = handle
mov dx,offset byte_buf         ;;DS:DX ==> transfer buffer
mov cx,1                        ;;Read 1 byte
mov ah,3fh                      ;;Read from file
int 21h
endm

write_b macro handle_loc        ;;Write one byte to file
mov bx,handle_loc              ;;BX = handle
mov dx,offset byte_buf         ;;DS:DX ==> transfer buffer
mov cx,1                        ;;Write one byte
mov ah,40h                      ;;Write to file
int 21h
endm

exit macro code                 ;;Exit from program
mov al,code                    ;;Exit code in AL
mov ah,4ch                      ;;Exit process
int 21h
endm

print macro string              ;;Print message on screen
mov dx,offset string           ;;DS:DX ==> string
mov ah,09h                      ;;Print a string
int 21h
endm

cls macro                       ;;Clear the screen
mov ax,0600h                    ;;Scroll screen up
mov bx,0f00h                    ;;White on black
mov cx,0                        ;;Start at top corner
mov dx,184fh                    ;;To bottom corner
int 10h
mov ax,0200h                    ;;Set cursor position
mov bx,0                        ;;On page 0
mov dx,0                        ;;Set to top left corner
int 10h
endm

get_bol macro                   ;;Get beginning of line coord.
mov bh,0                        ;;On page 0
mov mov ah,3                    ;;Get cursor position
int 10h
xor dl,dl                        ;;Set col. to 0

```

Listing 6 continued

```

mov          curs_pos,dx
endm

set_bol macro
mov bh,0
mov ah,2
mov dx,curs_pos
int 10h
endm

convert macro wrd,loco
local lpl
mov di,offset loco
mov cx,5
mov al,' '
rep stosb
di
mov ax,wrd
cx,10
mov dx,0
lpl: mov dx:ax / cx
      add dl,'0'
      mov [di],dl
      dec di
      or ax,ax
      jnz endm
endm

dw_inc macro loco
local out
add word ptr loco,1
jnc out
inc word ptr loco[2]
equ $
out
endm

backup macro loch,handle
local skip
mov bx,handle
mov dx,word ptr loch
mov cx,word ptr loch[2]
sub dx,1
skip: jnc skip
      dec cx
      mov ax,4200h
      int 21h
endm

;----- Program Constants
;-----
b0 = 01h
b1 = 02h
b2 = 04h
b3 = 08h
b4 = 10h
b5 = 20h
b6 = 40h
b7 = 80h

mask1 equ b0 or b1 or b3 or b4 or b6
mask2 equ b0 or b2 or b3 or b5 or b6
mask3 equ b1 or b2 or b3 or b7
mask4 equ b4 or b5 or b6 or b7

h1 = 01h
h2 = 02h
h3 = 04h
h4 = 08h
parity = 08h

lf = 0ah
cr = 0dh

;Store result
;Set cursor position
;On page 0
;Set cursor
;No address stored above

;Convert word to decimal
;DS:DI=> result buffer
;Five spaces needed
;Set them all blank
;Point to last space
;Get value to convert
;Use base 10
;MSW = 0
;dx:ax / cx
;Make ASCII
;Store remainder
;Point to previous space
;Are we done?
;Loop until done

;Increment a dword
;Add 1 to LSW
;Leave if no carry
;Else add 1 to MSW

;Backup file one position
;Get file handle
;Set CX:DX to
;Present file location
;Decrement CX:DX

;Lseek function

;Data bit values

;Hamming bit masks
;Hamming code bits

;ASCII values for line feed
; and carriage return

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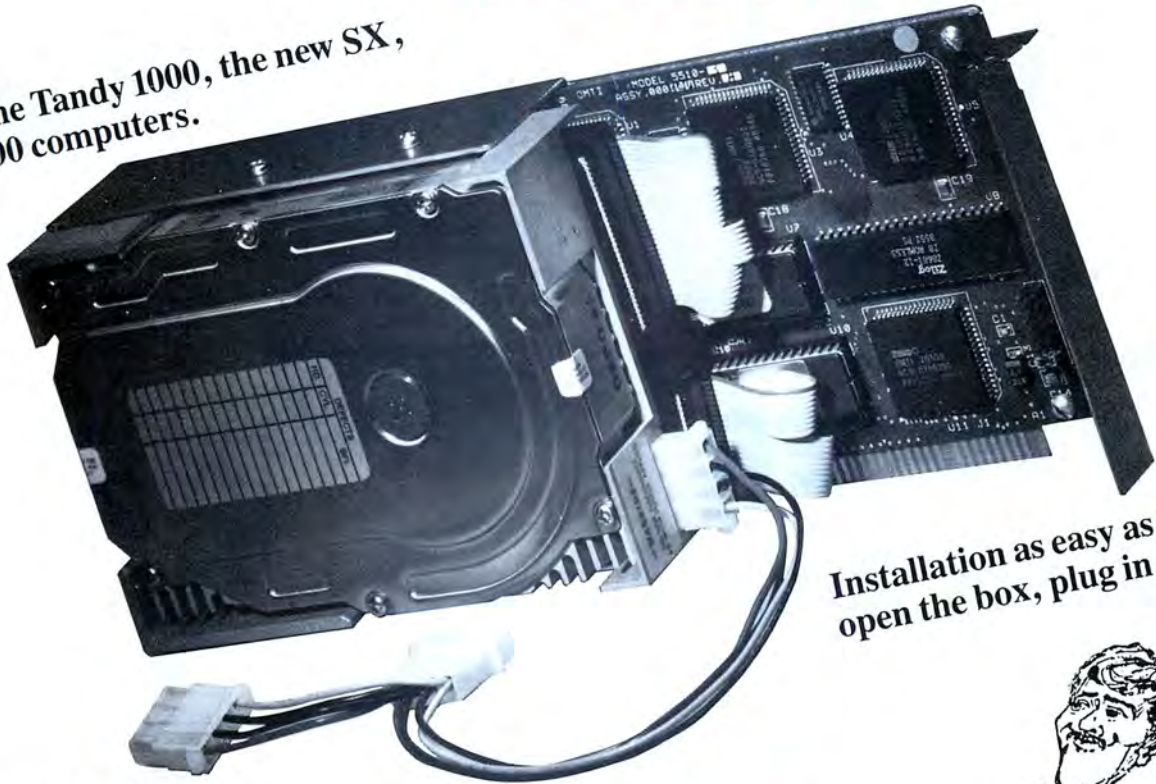
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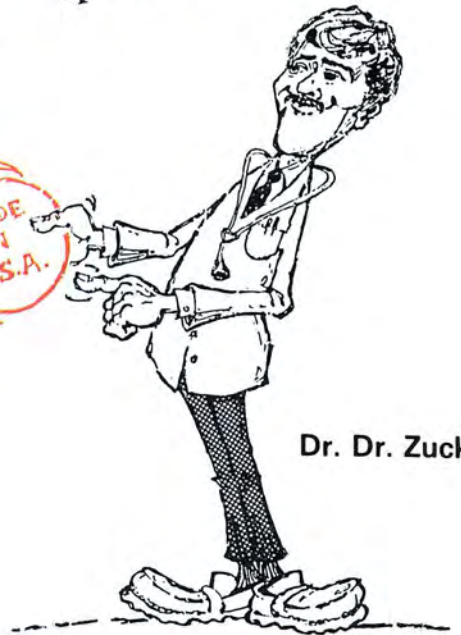
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Listing 6 continued

```

;-----
;          Program Macros
;-----

setbit macro num          ;;Check & set Hamming bits
local out
mov al,mask&num          ;;Get the mask value
and al,bl                ;;Mask off data bits
jpo out                  ;;Leave if parity already odd
or bh,h&num              ;;Else set Hamming bit
out
equ endm

dfix macro num            ;;Fix a data byte error
local dfixl,out
cmp al,num               ;;Is this our bit code?
jnz out                  ;;No -- leave
if num gt 8              ;;For error in B4,B5,B6,B7
= num - 5
else
if num gt 4              ;;For error in B1,B2,B3
= num - 4
dfixl
else
dfixl = 0                ;;For error in B0
endif
endif
mov ah,1 shl dfixl       ;;AH gets bit to toggle
xor ah,bl                ;;Fix the byte
jmp daterr               ;;Report change
out
equ $
endm

;-----
;          Common Messages and Data
;-----

prompt db "Enter input file name ==> $"
success db lf,cr,"Program successfully completed",cr,lf,'$'
errmsg db lf,cr,"System error -- program halting prematurely",cr,lf,'$'
exttext db '.CHK',0

;-----
;          Data areas
;-----

dat_handle dw 0           ;Hold file handles
chk_handle dw 0
total dw 0                ;Count processed bytes
byte_buf db ?            ;File transfer buffer
nambuf db 17 dup (0)     ;Buffer for file name
curs_pos dw ?            ;Hold cursor position

;-----
;          Common Program Code
;-----

;-----
;          Exit for all errors
;-----

error_out proc near
print errmsg             ;Report abort
call close_files        ;Tidy everything up
exit -1                  ;Report error to system
error_out endp

;-----
;          Normal Exit
;-----

done proc near
print success            ;Report success
call close_files        ;Tidy things up
exit 0                   ;Report success to system

```

Listing 6 continued

Listing 6 continued

```

done endp

;-----
;          Close all open files
;-----

close_files proc near
test dat_handle,-1      ;Is data file open?
jz close_2              ;No -- go
close dat_handle        ;Else close it

close_2: test chk_handle,-1 ;Is check file open?
jz close_3              ;No -- go
close chk_handle        ;Else close it

close_3: ret
close_files endp

;-----
;          Add extent of '.CHK' to filename in nambuf+2
;-----

make_chk proc near
mov si,offset nambuf+2 ;Point to the name
mov cx,11               ;d:filename.

chk_1: lodsb              ;Get a byte
cmp al,'.'              ;Beginning extension?
jz chk_2                ;Yes -- go
cmp al,0                ;End of name?
jz chk_2                ;Yes -- go
loop chk_1               ;Else look some more

chk_2: dec si            ;Back up to '0' or '.'
mov di,si               ;We'll start here
mov si,offset exttext   ;Point to new extension
mov cx,5                ;Move five bytes
rep movsb               ;Add new extension
make_chk endp

;-----
;          Start Program Execution Here
;-----

begin: mov ax,cs            ;Get the code segment
mov ds,ax               ;Make it the data segment
mov es,ax               ; and the extra segment
mov ss,ax               ; and the stack segment
mov sp,offset local_stack ; and set the stack

cls                      ;Clear the screen
print hello              ;Announce this program

get_nam: print prompt      ;Ask for file name
line_in nambuf,14        ;Room for d:filename.extCR
mov al,[nambuf+1]        ;Get input length
or al,al                 ;Test length
jz get_nam               ;Loop until entry

mov bx,offset nambuf+2   ;Point to name text
xor dx,dx                ;DX = 0
mov dl,byte ptr [nambuf][1] ;DX = length of name
add bx,dx                ;BX ==> character after name
mov byte ptr [bx],0      ;Terminate with ASCII 0

;-----
;          Continue in individual programs
;-----

```

End

Program Listing 7. Write (Tandy 1000 version).

```

;=====
; MS-DOS Version of Hamming Code "WRITE" Program
; Assembled with Microsoft's MASM 4.0
;
; Program Conversion Written by Hardin Brothers
;=====
hwrite segment byte
assume cs:hwrite, ds:hwrite, es:hwrite, ss:hwrite

org 100h ;Make into a .COM file
start: jmp begin ;Branch around common code

include hamming.cmn

open nambuf+2,0 ;Open file for reading
jnc set_1 ;No error -- go
jmp error_out ;Go if error
set_1: mov dat_handle,ax ;Else save handle

call make_chk ;Make filename.chk
create nambuf+2 ;Open a new file
jnc set_2 ;No error -- go
jmp error_out ;Go if error
set_2: mov chk_handle,ax ;Else save handle

print stat_msg ;Print status text
get_bol ;Find beginning of this line
;-----
; Main Program Loop
;-----
mainlp:
call status ;Report current status
read_b dat_handle ;Read a byte
jnc main_1 ;No error -- go
jmp error_out ;Else abort program
main_1: or ax,ax ;End of file?
jnz main_2 ;No -- go
jmp done ;Else report success

main_2: inc total ;Add to running count
mov bh,[byte_buf] ;Get the byte
mov bh,0 ;Hamming code = 0
irp setbit x,<1,2,3,4> ;Test each bit
endm
xor bl,bh ;Test overall parity
jpo main_3 ;Already odd -- go
or bh,parity ;Set overall bit

main_3:
mov byte_buf,bh ;Xfer Hamming byte
write_b chk_handle ;Write the byte
jmp mainlp ;Loop until done

;-----
; Show program progress
;-----
status proc near
convert total,numbuf ;Convert running total
set_bol ;Set the cursor
print numbuf ;Display byte count
ret
status endp
;-----
; Unique Messages
;-----
hello db "Hamming Code Check-Bit Generator",cr,lf,lf,'$'
stat_msg db lf,lf,cr," 0 bytes processed$"
numbuf db "$"

db 127 dup(?)
local_stack db ?

hwrite ends
end start

```

End

Program Listing 8. Check (Tandy 1000 version).

```

;=====
; MS-DOS Version of Hamming Code "CHECK" Program
; Assembled with Microsoft's MASM 4.0
;
; Program Conversion Written by Hardin Brothers
;=====
hcheck segment byte
assume cs:hcheck, ds:hcheck, es:hcheck, ss:hcheck

org 100h ;Make into a .COM file
start: jmp begin ;Branch around common code

include hamming.cmn

open nambuf+2,2 ;Open file for read & write
jnc set_1 ;No error -- go
jmp error_out ;Go if error
set_1: mov dat_handle,ax ;Else save handle

call make_chk ;Make filename.chk
open nambuf+2,2 ;Open file for read & write
jnc set_2 ;No error -- go
jmp error_out ;Go if error

set_2: mov chk_handle,ax ;Save handle
print stat1_msg ;Print status message
get_bol ;Save this line position
print stat2_msg ;Print rest of status msg.

;-----
; Main Program Loop
;-----
mainlp:
call status ;Show program progress
read_b dat_handle ;Read a data byte
jnc main_1 ;No error -- go
jmp error_out ;Error -- abort
main_1: or ax,ax ;End of data file?
jnz main_2 ;No -- continue
jmp done ;Else report success

main_2: inc total ;Add to running total
dw_inc file_posn ;Add to file position
mov bh,[byte_buf] ;Get this byte
mov bh,0 ;Hamming code is 0
irp setbit x,<1,2,3,4> ;Calculate Hamming code
endm
xor bl,bh ;Test overall parity
jpo main_3 ;Already odd -- go
or bh,parity ;Set overall bit
main_3: mov bx,[byte_buf] ;Get character again
push bx ;Save char & code
read_b chk_handle ;Get check byte
pop bx ;Recover original
mov al,[byte_buf] ;Move check byte to al
xor al,bh ;Are they the same?
jnz main_4 ;No -- continue
jmp mainlp ;Else get another

main_4: cmp al,80h ;Parity bit error only?
jnz main_5 ;No -- go
mov ah,bh ;Else get new value
jmp chkerr ;And report checkbit error

main_5: and al,7fh ;Strip overall parity bit
cmp al,13 ;Error code too high?
jb main_6 ;Code okay -- go
inc multcnt ;Else its a multi-bit error
jmp mainlp ;Get next byte

```

Listing 8 continued



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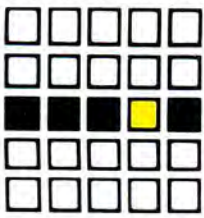
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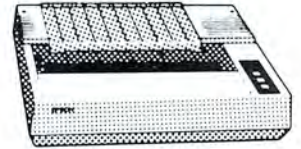
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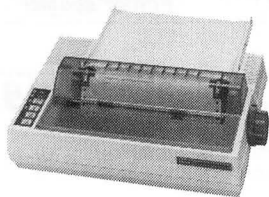
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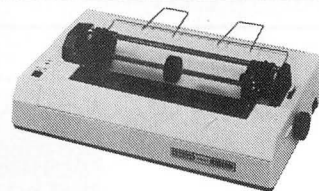
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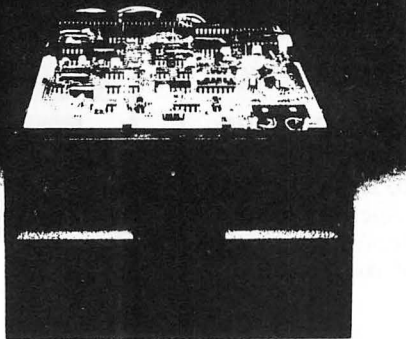
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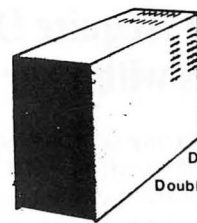
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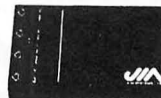
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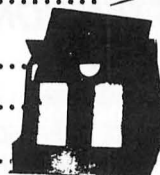
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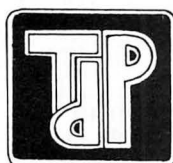
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



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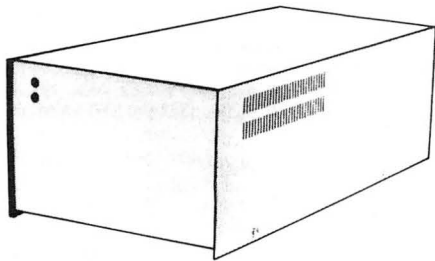
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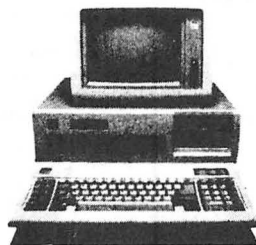
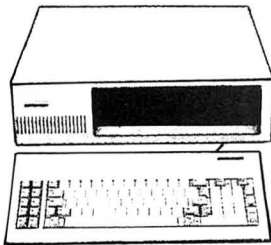
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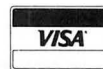
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- Kowalshyn, "Making the Grade," 9:68. (4, 1000) A computerized grade book for easy student management.

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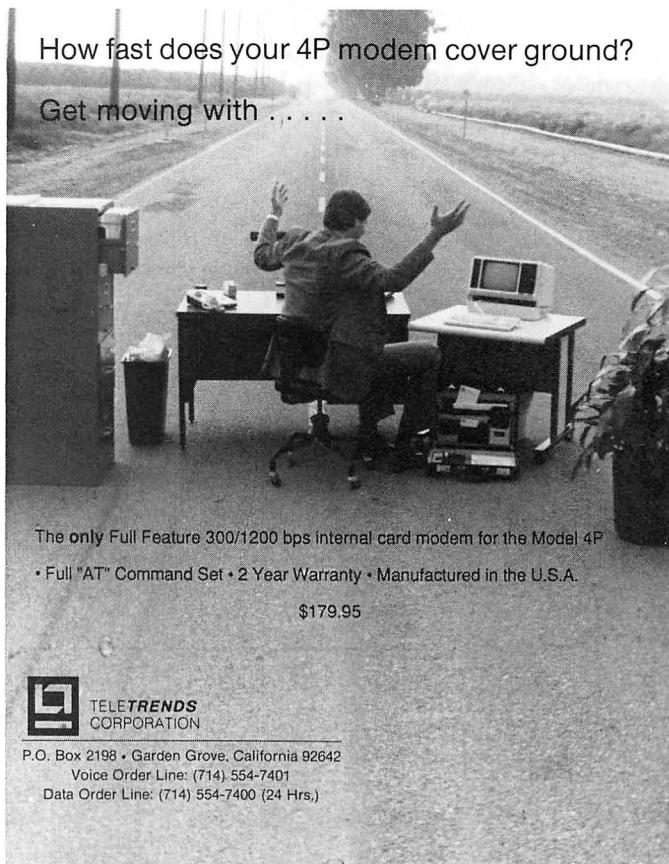
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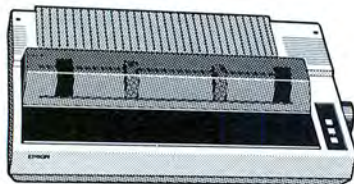
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MS-DOS

High-Speed Half Card

Packram-II is a high-speed, 2-megabyte (MB), EMS-compatible RAM board designed to fit in the short slot of an IBM XT or compatible, such as the Tandy 1200 or 3000.

Packram-II comes with an enhancement-software package that includes a disk-caching driver that increases disk I/O speeds as much as 300 percent and RAM-disk software that lets you use the board as an additional disk drive, but with speeds 10 times faster than those of conventional hard-disk drives.

Also included in the package: Lotus/Intel/Microsoft extended-memory compatibility, Intel Above Board compatibility, background operation, and print-spooling software to provide near-zero-wait printing. You can use part of Packram-II's 2MB of RAM to satisfy 640K requirements.

This half card sells for \$695 from Earth Computers, P.O. Box 8067, Fountain Valley, CA 92728, 714-964-5784.

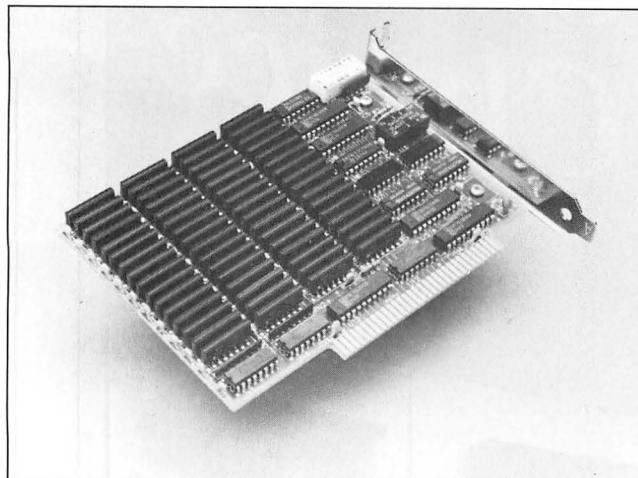
Circle 553 on Reader Service card.

Modular Networking System

Software Products International's Open Access II is a six-function modular business software system incorporating data-base, spreadsheet, word-processing, communications, graphics, and time-management capabilities.

An optional package called Open Access II-Network (OAI-Net) is a networking version that allows simultaneous use of any or all modules among multiple IBM PC/XT/AT or compatible computers.

Open Access II's data base uses a free-text format that eliminates line numbers and column restrictions, including global update functions that let the same operations



Packram-II is a 2-megabyte speed-up board for the Tandy 1200 and 3000.

be performed on selected records. A disk-based memory-management technique ensures adequate data storage for systems with as little as 256K of internal memory, and conversion utilities accommodate files from other popular spreadsheet and word-processing programs, such as WordStar, R:base, and dBase.

The graphics-enhanced spreadsheet lets users define up to five target values, then works backwards to perform what-if calculations. The spreadsheet supports the EGA card and includes a text editor, a mail-merge function, and the ability to display up to four spreadsheets on a single screen.

The networking version includes all the features of Open Access II, including a communications module with VT100 and TTY emulation, plus a work-area editor to capture and manipulate incoming data. It is compatible with the Novell Network environment running on PC-Net, Omni-Net, Ether-Share, MS-Net, and other networking systems.

Open Access II is not copy-protected and retails for \$595. OAI-Net is available in several configurations for \$995. Contact Software Products Inter-

national, 10240 Sorrento Valley Road, San Diego, CA 92121, 800-521-3511.

Circle 568 on Reader Service card.

Paint and Show

VCN Concorde is a new integrated graphics program capable of producing medium and high resolution for business graphics, high-quality text, freehand screen painting, animation, and self-running presentations. With multiple-level zoom, a choice of 64 colors, unlimited patterns and complete scaling, this package offers a variety of applications aimed at the corporate micro-computer user.

The program plots tailored graphs using data from Lotus's 1-2-3, Symphony, Multiplan, and DIF-format spreadsheets and comes with a data base of over 2,000 icons, symbols, and images that let the user represent ideas in pictures. The animation function draws from an enclosed library disk, and you can use it in interactive training lessons and self-running slide presentations incorporating hundreds of dissolve and fade options.

VCN Concorde runs on the IBM PC/XT/AT and compatibles and sells for \$695, including the icon library, Image Database. Contact Vi-

sual Communications Network Inc., 238 Main St., Cambridge, MA 02142, 617-497-4000.

Circle 569 on Reader Service card.

Stats on Graphs

GraphStation (release 2.0) from Software Clearing House statistically analyzes and displays data generated by Lotus's 1-2-3 and Symphony spreadsheets.

No translating or reformatting of existing spreadsheet files is required. A new module called GraphSheet projects the values and formulas from cells onto the data points of a screen graph. You can change input values by pointing to new positions on the scale. Additional features include linear- and nonlinear-regression analysis, four-quadrant graphing of scatter and line charts, and curve-fitting by running average.

GraphStation requires DOS 2.0 or higher, 384K RAM, and a hard disk. It runs on IBM PC/XT/ATs and compatibles, including the Tandy 3000, and sells for \$495. It was developed by Signature Information Systems Corp. Contact Software Clearing House Inc., 771 Neeb Road, Cincinnati, OH 45238, 513-451-6742.

Circle 566 on Reader Service card.

National Strategies

Strate-gem is a unique program that puts the U.S. government's long-range business forecasts close at hand. It includes a data base of forecasts for each state and runs on IBM PC/XT/ATs and compatibles.

Screen menus let you select from among 7,956 topics, including income and employment in 55 industries and population statistics. Strate-gem then plots the data selected for the years 1968-2035. It can also be linked with spreadsheet programs containing data on individual companies.

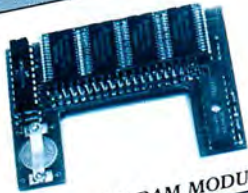
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disks and sells for \$65. Contact Hershey Consultants Inc., 210 Goddard Blvd., King of Prussia, PA 19406, 215-962-0130.

Circle 555 on Reader Service card.

Publishing Power

PowerForm, the new desk-top-publishing program from The 'Puter Group, is designed to run on IBM-compatible computers.

The program combines design, composition, and paste-up functions in one table-top station. The text and rules are displayed on screen in their actual position and size. Files output to most PostScript-driven laser printers and major typesetting systems, including Compugraphic.

The laser version of PowerForm sells for \$395. VHS and Beta demonstration videos are available for \$15. Contact The 'Puter Group, 1717 W. Beltline Highway, Madison, WI 53713, 608-273-1803.

Circle 564 on Reader Service card.

Student's Companion

Savant Corporation's A-Plus—The Homework Solution is an icon-driven, integrated study tool employing a screen simulation of a student's desk. It is designed for students in junior high school and up.

The package consists of four main elements: A-Plus, an operating environment that organizes information in graphical three-ring binders (also including a calculator, clock, and calendar); A-Write, a foreign-language word processor allowing text and graphic integration; A-Draw, an icon-based drawing program; and a utilities program for organizing the work.

A-Plus runs on IBM PC/XTs and compatibles with a color/graphics or EGA adapter, 256K RAM, DOS 2.0 or higher, and one or two disk drives. The complete system costs \$89.95; a scaled-down version with the A-Plus shell and A-Write costs \$59.95.

Contact Savant Corp., P.O. Box 1077, Waltham, MA 02254, 617-891-9175.

Circle 565 on Reader Service card.

Full-Access Shell

The Norton Commander is a DOS shell that works cooperatively with DOS, allowing full access to all DOS functions including unhindered use of the standard command line and the full screen. The Commander uses as much or as little of the screen as desired.

The program supports single- and multiple-file operations, features integral editing and viewing functions, implements single-key execution of program and data files, and supports all mouse-pointing devices that use a Microsoft-compatible software interface (Microsoft Mouse, Mouse Systems Mouse, Maynard Mouse, and so on).

Its user-defined command menu includes single- or multiple-file copying, displaying one or two directory panels at a time, renaming directories and single or multiple files, editing files up to 20K long, tagging files for multiple operations, speed-key file selection, a cyclable command stack, status panels, pop-up menus of user-defined DOS commands, and color support.

The Commander uses as little as 10K of memory, works on all IBM PC/XT/ATs and 100-percent compatibles, and costs \$75. Contact Peter Norton Computing Inc., 2210 Wilshire Blvd., Santa Monica, CA 90403, 213-453-2361.

Circle 559 on Reader Service card.

Another One For the Books

The Stamp Collector is a data-base program for philatelists; it consists of four programs with which you can enter, delete, change, search, sort, customize, and print collection information in multiple formats. The program catalogs foreign and domestic stamps by denomination, country, description, year, value, Scott catalog number, and source. A meeting list lets you sort and select meetings by date and location, and the source list provides sources for stamps and supplies, and information on trades and liquidations.

The program disk is not copy-protected and is user de-

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PRO-WAM supplied applications can turn your **128K Model 4,4P TRS-80** into a sophisticated business or personal machine rivaling the best of them. That's because **PRO-WAM** comes with many useful and powerful menu-driven time savers and work organizers. **PRO-WAM** includes eleven applications, a complete HELP facility, a data file sort program, a 99-page user manual, and is easily installed. While you operate other programs, you can request its services with a single key-stroke. **PRO-WAM** saves you typing with its **EXPORT** and **IMPORT** functions which allow you to move data across windows between programs. Requires 128K TRSDOS 6.2.

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How to Use 80 Micro Program Listings

Basic program listings in *80 Micro* include a checksum value at the end of each line. This value is the sum of the ASCII values of all characters and spaces in the line, excluding remarks. With our Checksum program, you can use these values to test the accuracy of your typing after you copy the listings from the magazine.

To check your typing, follow these steps:

- Type in the program *exactly* as listed, omitting the indentations where program lines continue to a second or third magazine line, the * characters, and checksum values. Checksum ignores all comments marked with an apostrophe, so type them in or leave them out, as you wish.

- Save the program in ASCII format with the command SAVE"filespec".A.

- Load and run Checksum (see the Program Listing). It gives you the option of sending the line numbers and checksum values to the printer or screen. Enter P for printer, S for screen. When printing to the screen, Checksum lists 14 lines and then waits for you to press the enter key.

- Compare the displayed line numbers and checksum values with the checksums shown in the listing. The program asks you if you want to reload the original program. Enter Y for yes. Finally, find and correct errors in lines having checksum values that don't match.

—Beverly Woodbury
Technical Editor

Program Listing. Checksum.

```

10 'CHECKSUM/BAS by Beve Woodbury -- 8/7/86                ** 97
20 ' Enhancements by Henry Herdrögen, Arthur Walker, Al Arena ** 98
30 CLEAR 1000:CLS:PRINT@140,"VERIFY CHECKSUMS ON PROGRAM" ** 3715
40 ON ERROR GOTO 410 ** 1241
50 PRINT:PRINT:INPUT "Enter name of File to verify";F$ ** 4280
60 PRINT:PRINT:PRINT "List Checksums to:" ** 3236
70 PRINT TAB(20) "<P>Printer";PRINT TAB(20) "<S>Screen" ** 3631
80 PRINT:PRINT:PRINT TAB(30);"? "; ** 2151
90 K$=INKEY$ ** 729
100 IF K$="P" OR K$="p" OR K$="S" OR K$="s" THEN 110 ELSE 90 ** 3356
110 PRINT K$:IF K$="P" OR K$="p" THEN LP=1 ** 2481
120 OPEN "I",1,F$ ** 901
130 IF EOP(1) THEN CLOSE:GOTO 370 ** 2001
140 LINE INPUT#1,L$:L=VAL(LEFT$(L$,6)) ** 2278
150 IF Z=2 AND L=0 THEN 130 ELSE Z=2 ** 2095
160 A=VARPTR(L$):GOSUB 300:Q=PEEK(A) ** 2241
170 LS=PEEK(A+1):MS=PEEK(A+2):A=MS*256+LS:GOSUB 300 ** 3112
180 IF INSTR(L$,"") THEN GOSUB 310 ** 990
190 IF RIGHTS(L$,1)=" " THEN IQ=Q:GOSUB 330 ** 2513
200 FOR K=1 TO Q:P=PEEK(A):CS=CS+P:A=A+1:NEXT K ** 2939
210 IF CS=0 THEN 130 ** 1128
220 IF CS<1000001 THEN D$="-" ** 1532
230 IF CS<10000 THEN D$="- " ** 1484
240 IF CS<1000 THEN D$="- " ** 1469
250 IF CS<100 THEN D$="- " ** 1454
260 IF LP=1 THEN LPRINT "Line";L;D$;CS,:CS=0:GOTO 130 ** 3376
270 PRINT "Line";L;D$;CS:CS=0:X=X+1 ** 2285
280 IF X=14 THEN X=8:PRINT TAB(30) "Press <ENTER> to continue." **
    ELSE 130 ** 4933
290 K$=INKEY$:IF K$<>CHR$(13) THEN 290 ELSE 130 ** 2714
300 IF A>32767 THEN A=(655361-A)*-1:RETURN:ELSE RETURN ** 3269
310 I=INSTR(L$,""):IQ=I-1 ** 944
320 IF LEN(L$)=INSTR(L$,"") THEN RETURN ** 1463
330 FOR I=IQ TO 1 STEP -1 ** 1483
340 C=ASC(MID$(L$,I,1)) ** 1264
350 IF C<33 THEN NEXT I ** 1379
360 RL$=LEFT$(L$,I):Q=LEN(RL$):RETURN ** 2321
370 PRINT:PRINT"CHECKSUM/BAS now in Memory" ** 3246
380 PRINT "Do you want to reload the PROGRAM that you are workin
    g on? (Y/N) ** 6161
390 Q$=INKEY$:IF Q$="Y" OR Q$="y" THEN CLS:LOAD F$ ** 3023
400 IF Q$="N" OR Q$="n" THEN END ELSE GOTO 390 ** 2704
410 PRINT "File not found...Please try again.":PRINT:RESUME 50 ** 4827
    End
    
```

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finable. Written for the IBM PC/XT/AT and compatibles, its retail cost is \$49. Contact Andent Inc., 1000 North Ave., Waukegan, IL 60085, 312-223-5077.

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Don't Change That Controller

Weltec Digital Inc. announces a 1.2MB formatted floppy-disk giving IBM PC/AT compatibility to your PC or PC/XT without any change to your controller card.

Additional features include a brushless direct-drive motor, full interchange of disks between IBM PC/AT and PC or PC/XT and compatible systems, internal or external configurations, and ANSI interface compatibility. The drive comes with a one-year warranty and retails for \$149. Contact Weltec Digital Inc., 17875 Sky Park N., Suite P, Irvine, CA 92714, 714-250-1959.

Circle 570 on Reader Service card.

Short-Slot Double Time

Future Domain Corp. announces the TMC-870 high-speed controller card for IBM PC/XT/ATs and compatibles like the Tandy 3000.

The TMC-870 package comes with a 360K floppy controller, a 1.2MB floppy controller, and a small-computer systems interface (SCSI) host adapter and requires one short slot. The TMC-870 supports 1.2MB, 800K, or 360K disk drives in the XT, AT, and compatibles and costs \$159. Contact Future Domain Corp., 1582

Parkway Loop, Suite A, Tus-tin, CA 92680, 714-259-0400. Circle 554 on Reader Service card.

Tooling Around

FormTool, version 2.0, is a major reworking of the Bloc Development Corp. program that lets users of IBM PC and compatible computers create, store, and generate forms for most business applications, including time sheets, activity logs, and productivity forms.

FormTool's word-processing abilities include word wrap, reformatting, justifying, and centering. Pop-up windows let you work on several forms at once, and the program provides creation of double lines and grids, custom page sizing, block-move within and to other forms, and standard or sideways printing.

The form organizer gives a history of each form, including size, date created and last edited, and a list by company department (or searched and sorted by any criterion). Eight fonts, variable type sizes, and foreign-character sets are also supported, as is an expanded range of laser and dot-matrix printers.

FormTool 2.0 sells for \$95 from Bloc Development Corp., 1301 Dade Blvd., Miami Beach, FL 33139-9990, 305-531-5486.

Circle 552 on Reader Service card.

Productivity Plus

Software of the Future has released SaleMaker, a client-management and telemarketing software system for the IBM PC/XT/AT and compatibles.

It is designed for those who

Circle 86 on Reader Service card.

THE RS-232 MODEL III MODEL 4



State of the art technology in board design, our direct replacement of Radio Shack's* internal RS-232 board, mounts inside the Model III or 4 on the existing brackets. All cables, screws and complete mounting instructions are included. Non-technical people will find that installation is quick, straight forward and simple requiring less than 15 minutes to complete.

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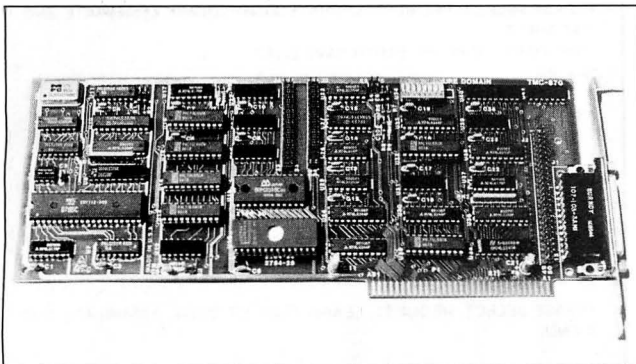
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Future Domain's TMC-870 controller card supports 1.2-megabyte drives and comes with an SCSI host adapter.

face the daily task of cultivating long-term relationships with clients or customers. It stores data such as business names, contact persons, phone numbers and addresses, and complete client histories. SaleMaker also includes pop-up window memo pads and branching script pages for sales presentations or product information.

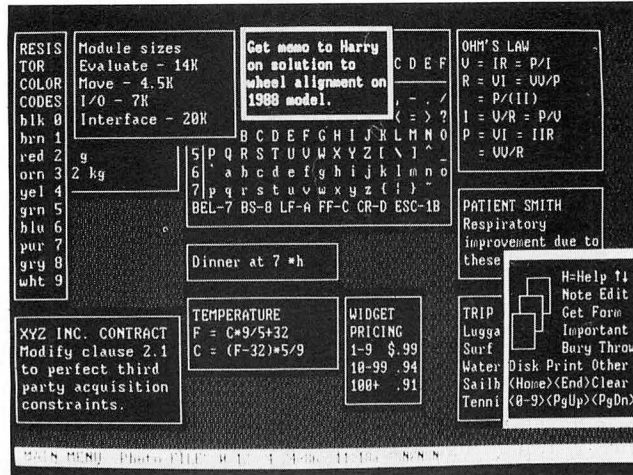
You can customize SaleMaker to organize data in unique ways for applications such as sales prospecting, credit and collections, fund raising, and networking.

The program requires 512K and two disk drives or a hard drive and is priced at \$495. A demo disk and more information are available from Software of the Future Inc., Box 531650, Grand Prairie, TX 75053, 214-264-2626.

Circle 567 on Reader Service card.

It's a Tornado

Tornado Notes, a RAM-resident productivity tool for



Micro Logic's Tornado Notes is a windowing system for IBM PCs and compatibles.

IBM PCs and compatibles, is based on a system of parallel text processing in which text windows are simultaneously viewed, moved, and accessed by content.

Unlike spreadsheets and data bases that process structured data, Tornado Notes lets you process random informa-

tion and offers instant access to related notes based on any word or phrase combination.

A windowing system automatically positions several note windows on the screen in a way that reduces overlap, giving the user more information for quick access without keystrokes. A built-in editor

includes cut and paste, time and date stamping, sequence numbering, graphics characters, and embedded printer control codes in addition to basic editing functions.

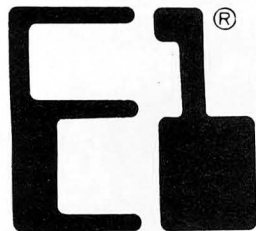
Tornado Notes runs on the IBM PC and compatibles with PC-DOS (MS-DOS) 2.0 or later, using 50K of RAM plus space for notes. The \$49.95 package is not copy-protected and includes a collection of reference notes. It is available on 30-day trial from Micro Logic Corp., P.O. Box 174, Dept. P, Hackensack, NJ 07602, 201-342-6518.

Circle 557 on Reader Service card.

Instant Tycoon

Wall Street Raider is a realistic simulation of the financial marketplace in which players engage in a high-powered game of empire building and corporate takeovers. Available for IBM PCs and compatible systems, the game comes with a manual that teaches the fundamen-

Circle 97 on Reader Service card.



Artificial Intelligence for TRS-80 Computers

System Requirements

Model 4/4P/4D Model I/III/1000

- 100% parsing of most questions.
- Handles hundreds of concepts & relationships.
- Responds in seconds!
- Rejection of duplicate information.
- Determines logical consequences of stored information.
- Manipulates symbols, rather than numbers.
- Communicates in English!
- Modes: Learn Accepts Inputs
Request Asks Questions
Forget Deletes Information
Dump Displays File Contents
Assimilate Optimizes Files
- Automatic error handling & reporting.

SAMPLE RUN:

EXPERT-1 PROGRAM

PLEASE SELECT REQUEST. LEARN. FORGET. DUMP. ASSIMILATE. END
? LEARN

IS NEW INFO CONCEPTUAL OR FOR THE DICTIONARY?
(ENTER C OR D) C

STATEMENT ? MR. SMITH IS A DOCTOR
STATEMENT ? A DOCTOR HAS MEDICAL KNOWLEDGE
STATEMENT ? MEDICAL KNOWLEDGE CAN SAVE LIVES
STATEMENT ? MRS. JONES IS A MEDICAL CONSULTANT
STATEMENT ? A MEDICAL CONSULTANT IS LIKE A DOCTOR

PLEASE SELECT: REQUEST. LEARN. FORGET. DUMP. ASSIMILATE. END
? REQUEST

**REQUEST ? CAN MR. SMITH SAVE LIVES?
Searching . . .

YES.

**REQUEST ? WHAT CAN MEDICAL KNOWLEDGE DO?
SAVE LIVES.

**REQUEST ? GIVE EXAMPLES OF A DOCTOR.
MR. SMITH

**REQUEST ? CAN MRS. JONES SAVE LIVES?
Searching . . . NO DIRECT ANSWER. I'M CHECKING FOR SIMILAR
CONCEPTS NOW. (INDIRECTLY)

YES

PLEASE SELECT: REQUEST. LEARN. FORGET. DUMP. ASSIMILATE. END
? END

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The program runs with a minimum of 256K and sells for \$39.95. Oasis Press, 720 S. Hillview Drive, Milpitas, CA 95035, 800-228-2275 (800-221-4089 in California). Circle 561 on Reader Service card.

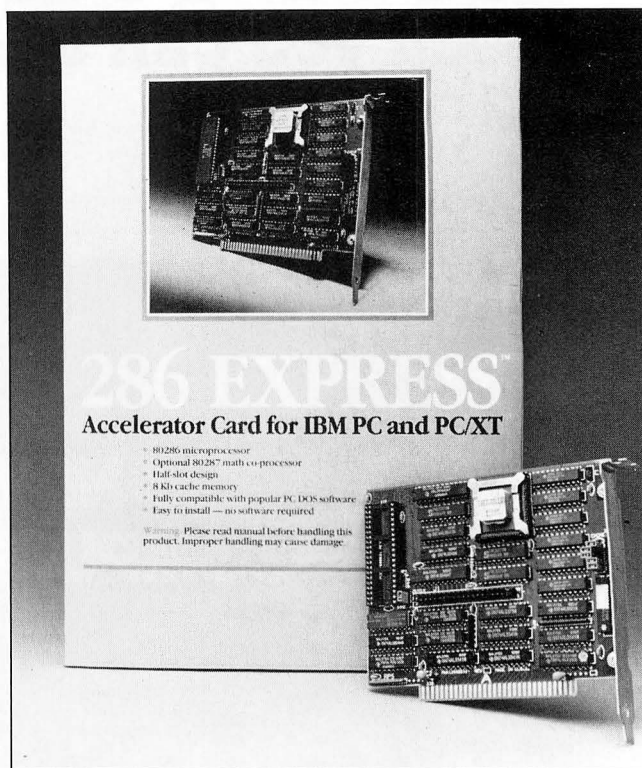
Faster and Faster

The 286 Express from PC Technologies is a full-featured, half-slot accelerator card for the IBM PC, PC/XT, and compatibles. It replaces the 8088 chip with an 80286 microprocessor, allowing the

computer to run faster than the standard AT.

An 8K cache-memory feature provides zero-wait-state access to most commonly used code and data. There is no need to trade out memory or disable the RAM on your motherboard; you can use all existing RAM, hardware, and peripheral cards without software modification. For number crunching, the 286 Express comes with an optional 80287 floating-point coprocessor that works with most popular spreadsheet and data-base software.

No software is required for installation, and the cost is \$595. The card works with the Tandy 1200 and is available through Tandy's Express Order Hardware service. For information, contact May-Craft Information Systems Inc., 4312 Beltwood Parkway S., Dallas, TX 75244, 800-527-7456 (214-392-3766 in Texas). Circle 556 on Reader Service card.



The 286 Express replaces the 8088 chip with a faster 80286 microprocessor.

Circle 152 on Reader Service card.

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PRINTER MAKE, MODEL NUMBER Contact us if your printer is not listed. We have many more in stock. We can probably RELOAD your old cartridges.	RIBBON SIZE Inches by Yards	NEW CARTRIDGES From the various manufacturers or made in our own shop. Ready to use.	RELOADS You SEND your used CARTRIDGES to us. WE put OUR NEW INSERTS in them.	INSERTS EZ-LOAD™ DROP IN, NO WINDING! EXACT REPLACEMENTS made in our own shop. Cartridges NOT included.
C ITOH Prowriter 1550-8510, NEC 8023-8025, APPLE DMP-IMAGEW	1/2 x 18	\$15/2 \$42/6 \$ 78/12	\$7/1 \$6 ea 2 or more	\$15/3 \$54/12 \$288/72
C ITOH STARWRITER F-10-40 } Carbon Film Black DIABLO HYTYPE II } Fabric Black	5/16 x 130	\$18/3 \$60/12 \$342/72	\$5 ea 3-11 \$4 ea 12 or more	\$24/6 \$42/12 \$234/72
	NOT EZ-LOAD 5/16 x 17	\$18/2 \$51/6 \$ 96/12	\$8/1 \$7 ea 2 or more	\$21/3 \$78/12 \$432/72
RADIO SHACK-TOSHIBA-COMMODORE-PANASONIC-RICOH Carbon Film - DWP 210 (Hytype II) Black (1445)	1/2 x 52	RS DMP-2200	\$18/1 \$16 ea 2 or more	\$30/3 \$57/6 \$108/12
DW II, DWP 410-510, RICOH 1200-1300-1600 Black (1419)	5/16 x 145	\$18/3 \$60/12 \$342/72	\$5 ea 3-11 \$4 ea 12 or more	\$24/6 \$42/12 \$234/72
Red, Green, Blue, Brown Colors (1419)	1/4 x 145	\$18/3 \$60/12 \$342/72	\$5 ea 3-11 \$4 ea 12 or more	\$24/6 \$42/12 \$234/72
Fabric (Long Life), DWP 210 (Hytype II) Black (1458)	1/4 x 130	\$21/3 \$72/12 \$414/72	\$6 ea 3-11 \$5 ea 12 or more	\$30/6 \$54/12 \$234/72
DW II, DWP 410-510, RICOH 1200-1300-1600 Black (1449)	5/16 x 17	\$18/2 \$51/6 \$ 96/12	\$8/1 \$7 ea 2 or more	\$21/3 \$78/12 \$432/72
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DMP-400-420, LP VI-VIII, PANASONIC KXP-130-1093 (1418)	5/16 x 20	\$15/2 \$42/6 \$ 78/12	\$7/1 \$6 ea 2 or more	\$15/3 \$54/12 \$288/72
DMP-500 (130 Inserts & Reloads Only) (1236) (1482)	1/2 x 20	\$22/2 \$63/6 \$120/12	\$7/1 \$6 ea 2 or more	\$15/3 \$54/12 \$288/72
DMP-2100, TOSHIBA P1340-1350-1351-351 (1442)	1/2 x 20	\$15/2 \$42/6 \$ 78/12	\$7/1 \$6 ea 2 or more	\$15/3 \$54/12 \$288/72
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MX-FX-RX 70-80-85, LX 80-90 (5/16 x 7), IBM PC (5152)	1/2 x 20	\$14/2 \$36/6 \$ 66/12	\$7/1 \$6 ea 2 or more	\$15/3 \$54/12 \$288/72
MX-FX-RX 100-185-286, IBM PROPRINTER (7/16 x 20) (4201)	1/2 x 30	\$18/2 \$51/6 \$ 96/12	\$8/1 \$7 ea 2 or more	\$18/3 \$66/12 \$360/72
DX 20-35 Carbon Film (Multistrike), OLIVETTI ET-121-221	5/16 x 290	\$21/3 \$72/12 \$414/72	(Call for Correctable Prices)	
NEC Spinwriter-Carbon Film - 2000-3500 (Reloads BCCOMPCO Only)	5/16 x 145	\$18/3 \$60/12 \$342/72	\$5 ea 3-11 \$4 ea 12 or more	\$24/6 \$42/12 \$234/72
-Fabric - 5500-7700 (Can Reload Most Types)	NOT EZ-LOAD 1/4 x 145	\$18/3 \$60/12 \$342/72	\$5 ea 3-11 \$4 ea 12 or more	\$24/6 \$42/12 \$234/72
-Fabric - 2000-3500 (Can Reload All)	1/2 x 14	\$18/2 \$51/6 \$ 96/12	\$8/1 \$7 ea 2 or more	\$15/3 \$54/12 \$288/72
Pinwriter P1-P2-P6	1/2 x 13	\$15/2 \$42/6 \$ 78/12	\$8/1 \$7 ea 2 or more	\$15/3 \$54/12 \$288/72
P3-P7	1/2 x 20	\$25/2 \$69/6 \$126/12	\$7/1 \$6 ea 2 or more	\$15/3 \$54/12 \$288/72
	1/2 x 27	\$30/2 \$84/6 \$156/12	\$8/1 \$7 ea 2 or more	\$18/3 \$66/12 \$360/72
OKIDATA Pacemark 2350-2410 Black	1/2 x 100	\$25 each	\$20/1 \$18 ea 2 or more	\$36/3 \$132/12 \$720/72
Microline 182-183-192-193	Inker Loop	\$20/2 \$57/6 \$108/12		
ML-80-82-83-92-93 (Call for ML-84 Prices)	1/2 x 16	\$21/6 \$36/12 \$198/72		
MANNESMAN-TALLY MT-160, RITEMAN INFORUNNER (Inker Loop)	9mm x 11	\$19/2 \$54/6 \$102/12		
MT-180-290	9mm x 13	\$20/2 \$57/6 \$108/12		
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PANASONIC KXP-1080-1090-1091-1092-1592-1595	Inker Loop	\$20/2 \$57/6 \$108/12		
BROTHER HR-15-25-35 } Carbon Film (Multistrike)	5/16 x 82	\$18/3 \$60/12 \$342/72		
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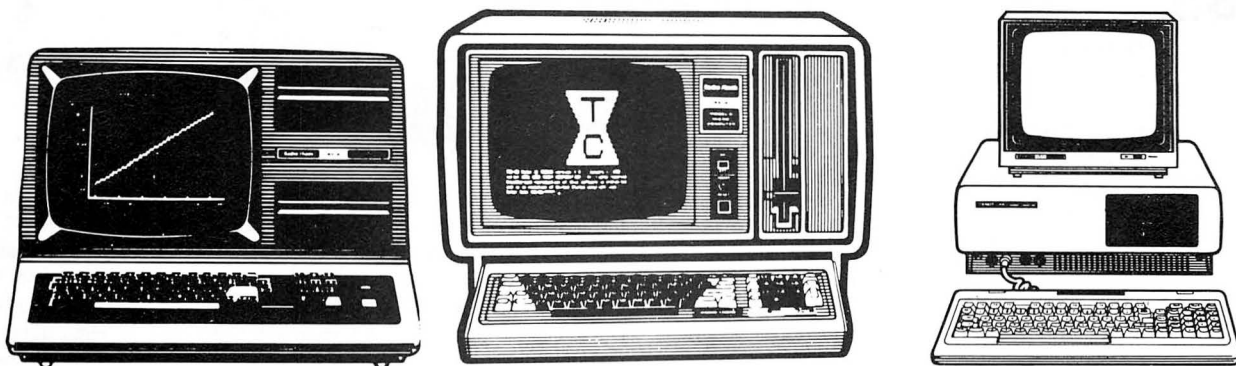
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another high quality product from Southwestern Digital

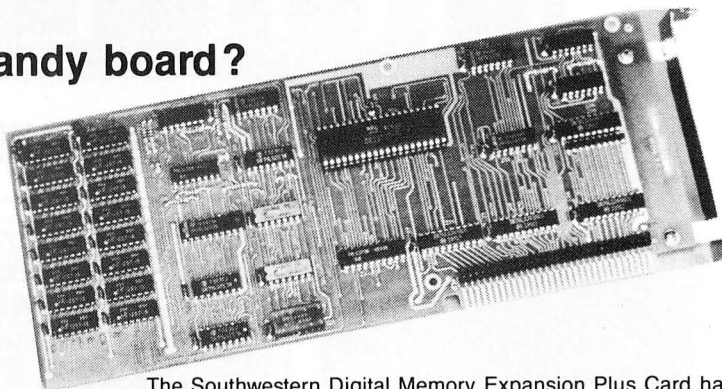
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Features:

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The Southwestern Digital Memory Expansion Plus Card has all the features of the Radio Shack Board but the price; you save almost \$400. Features include 512K installed, burned in, and tested to give you a total of 640K, a DMA circuit that is fully tested for hard drive operation, and an expansion port that will work with any of the Radio Shack Memory Plus Expansion Card options. High quality manufacturing, and features such as gold plated card edges make this the logical choice in upgrading your memory.

Tandy 1000 Add on Boards Serial, Clock, or Both

The Southwestern Digital new Add-On boards were developed for use with the Plus Card Port, (a piggy-back type, add on port established by Tandy to eliminate the need for an additional card slot). These cards are fully compatible with the Memory Expansion Plus Card from Southwestern Digital and the Memory Expansion Plus Board from Tandy.

RS232C PLUS Option Board

Mounts on a PLUS expansion board, and features selectivity between COM Port 1 and COM Port 2. The RS232C output connector is the standard Tandy female DB25, and is fully compatible with the Tandy output. \$85.

Clock/Calendar PLUS Option Board

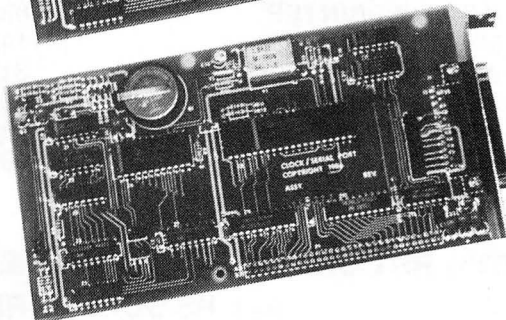
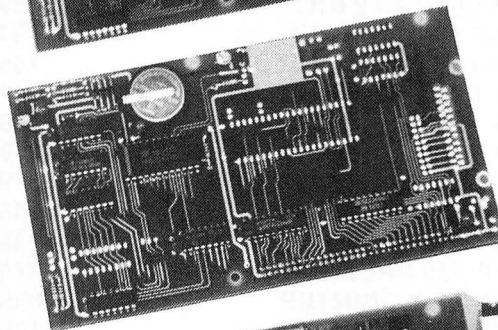
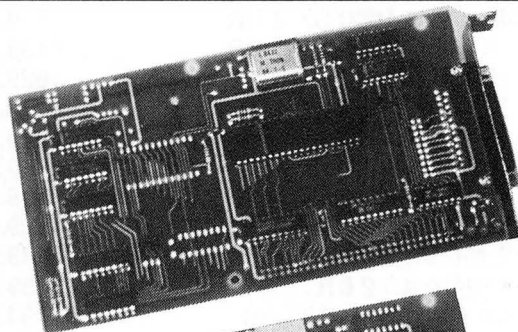
Mounts on a Plus expansion board, and features selectivity between two ports so that you can run two clocks at one time. The Clock Calendar Board gives you perpetual time/date so that you don't have to re-input time and date into your application programs as part of your power up routine. \$85.

RS232C-Clock/Calendar PLUS Option Board

Features options of both of the above boards on just one board. \$170.

Save on the Combination

512K, RS232C-Serial Port, and Clock \$245.
(Includes RAM DISK and PRINTER SPOOLER)



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20 Megabyte Tandy 1000 HARD DRIVE \$550.
(for use with 1 or 2 Disk Drives)

Tandy 1000 Computer System

Tandy 1000 with 640K, RS232 Serial Port, Clock/Calendar, and a
20 Meg Hard Drive \$1450.

Warp Speed, Scotty

Warp Speed Computer Products announces two light pens for Tandy users: the model 90-206, which is directly plug-compatible with the light-pen port on the back interface of the 1000, and the model 90-2074, which is compatible with the 1200 and 3000.

Made of stainless steel, both light pens can perform on any monochrome or color monitor and are shipped with a free software driver for Tandy's DeskMate program. The control software functions as a complete operating system for the pen and contains a file-management program that speeds up DOS file commands. Included on the control software disk is a light-pen driver for the Microsoft Windows program.

The light pen costs \$199.99. A single-pixel resolution converter card is available for \$99.99 to adapt the

1000/1200/3000 models to single-pixel resolution for graphics and computer-aided design applications. Both light pens are available through Tandy's Express Order Hardware service. For more information, contact Warp Speed Computer Products, 5555 S. Inglewood Blvd., Los Angeles, CA 90230, 213-822-0647 or 800-874-4315.

Circle 585 on Reader Service card.

Add Power to dBase

VP-Info is a data-base program compatible with dBase II, dBase III, and dBase III Plus data files and includes true multiuser network support with both record- and file-locking capability. VP-Info contains most dBase commands and functions and has an extended command set designed to offer more control and flexibility to the user.

VP-Info's built-in compiler makes programs execute two

to 10 times faster than dBase. No conversion is necessary for VP-Info to use dBase data files. The program runs on IBM PCs and compatibles with 256K and two disk drives. Its price is \$99.95. Contact Paperback Software International, 2830 Ninth St., Berkeley, CA 94710, 415-644-2116.

Circle 562 on Reader Service card.

New Tools

Newman Computer announces two software packages for the IBM PC and compatibles.

The Newman Utilities are 41 general-purpose tools for manipulating files, displaying directory sizes, finding files, deleting entire directories, moving files between directories, and so on. The program requires MS-DOS or PC-DOS 2.0 or greater, is not copy-protected, and includes a 16-page manual. It costs \$19.95.

EZRun is a menu program that lets you run several pro-

grams with a single keystroke, incorporating passwords if desired, and comes in single- or multiple-user versions priced at \$10 and \$19.95, respectively. The multiple-user version allows separate data directories for each user and logs user time per program.

Both programs include a 15-day, money-back guarantee and are available from Newman Computer, 2 Briar Mills Drive, Bricktown, NJ 08724, 201-458-5169.

Circle 558 on Reader Service card.

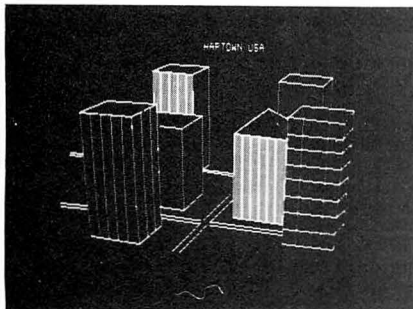
Modems On the Half Card

ProModem 1200B/2, a 1,200-/300-baud, half-card modem that plugs into any expansion slot—including the short slot on an IBM or compatible PC—is available from Prometheus Products.

The ProModem uses Bell 212A and 103 protocols; is Hayes-command-set compatible; and has auto-answer and

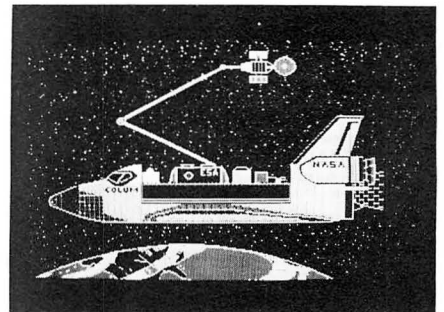
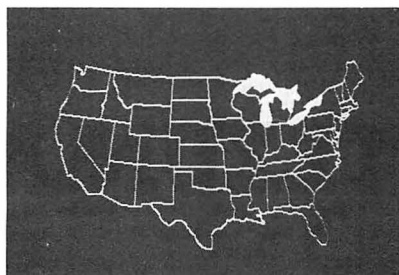
Circle 464 on Reader Service card.

Grafyx Solution™ Save \$100.00
Hi-Resolution Graphics for Mod 4/4D/4P/III



Superior Hardware. The Grafyx Solution provides 153,600 pixel elements which are arranged in a 640 x 240 or on the Model III a 512 x 192 matrix. Hundreds of new business, personal, engineering, and educational applications are now possible. The hi-res display can be shown on top of the standard display containing text, special characters, and block graphics. This simplifies program debugging, text labeling, and upgrading current programs to use graphics. The Grafyx Solution fits completely within any tape or disk based Model 4, 4D, 4P, or III. Installation is easy with the plug-in, clip-on Grafyx Solution board.

Superior Basic. Over 20 commands are added to the Basic language. These commands will set, clear or complement points, lines, boxes, circles, ellipses, or arcs. The hi-res screen can be printed on any of 30 popular printers or saved or loaded to disk without leaving Basic. Areas may be filled in with any of 256 patterns. Sections of the screen may be saved and then put back using any of five logical functions. Labels can be printed in any direction. The viewing area can be changed. The entire screen can be complemented or cleared. Graphics Basic provides dot densities of 640 x 240, 320 x 240, 160 x 240, and 160 x 120, all of which can be used in the same display.



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The Grafyx Solution package is shipped complete for \$199.95 (reduced from \$299.95). The manual only is \$12. Payment may be by check, Visa/MC, or COD. Domestic shipping is free on pre-paid orders. Texas residents add 5 1/2% tax.

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dial, two phone jacks for switching between phone and data, automatic sensing of pulse or tone dial, call-progress detection, and a third serial port. It costs \$349. For more information, contact Prometheus Products, 4545 Cushing Parkway, Fremont, CA 94538, 415-490-2370.

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The new P2400HC modem from Novation provides V.22 BIS compatibility and requires a half-card slot on IBM PC/XT/AT or compatible computers.

This 2,400-baud modem is also available with Microcom's NP error-correction protocol, and you can order it in tandem with Microft Lab's Mite communications software. The P2400HC sells for \$595 from Novation Inc., 20409 Prairie St., Chatsworth, CA 91311, 213-996-5060.

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TRS-80

DOS Enhancements

Direct, from SOTA Computing Systems Ltd., provides TRSDOS 6.2.x users with a variety of DOS enhancements allowing rapid command processing.

When installed as a TRSDOS extended-command interpreter, Direct offers such features as a menu-driven directory and single-key activation of most DOS commands (including listing, copying, removing, renaming, and executing files), a command mode in which users can type in more than one TRSDOS library command on a line, and a file-commenting facility. The screen-saver function blanks the screen whenever the computer has been sitting idle, saving your display from burn-in.

Direct requires a Model 4/4P/4D with at least one disk drive and 64K and costs

\$59.95. For more information, contact SOTA Computing Systems Ltd., 213-1080 Broughton St., Vancouver, British Columbia V6G 2A8, 604-688-5009.

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Check Your Drive

Dymek's R.I.D. (Recording Interchange Diagnostic) is a group of software routines that checks a disk drive's health in less than a minute.

The R.I.D. disk performs a comprehensive pass-fail determination of seven critical drive factors that affect disk interchangeability: disk speed, noise tolerance, proper write/read and track alignment, positioner backlash (hysteresis), clamping or eccentricity, and crosstalk erasure.

The R.I.D. disk is available for 5 1/4-inch drives in 48- or 96-track-per-inch formats for the IBM PC, XT, and Radio Shack TRS-80 systems. It costs \$34.95 from Dymek Corp., 1851 Zanker Road,

San Jose, CA 95112, 408-947-8700.

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Spellbound provides spelling practice for students. It lets parents and teachers create a disk file of words displayed on screen one at a time, with prompts asking the student to spell each word. Letters typed by the student appear on the screen below the selected word.

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Spellbound is not copy-protected. It runs on the Models III and 4 and sells for \$14.95 from Roberts Information Systems Inc., 152 W. 4th, P.O. Box 666, Prineville, OR 97754, 503-447-6275.

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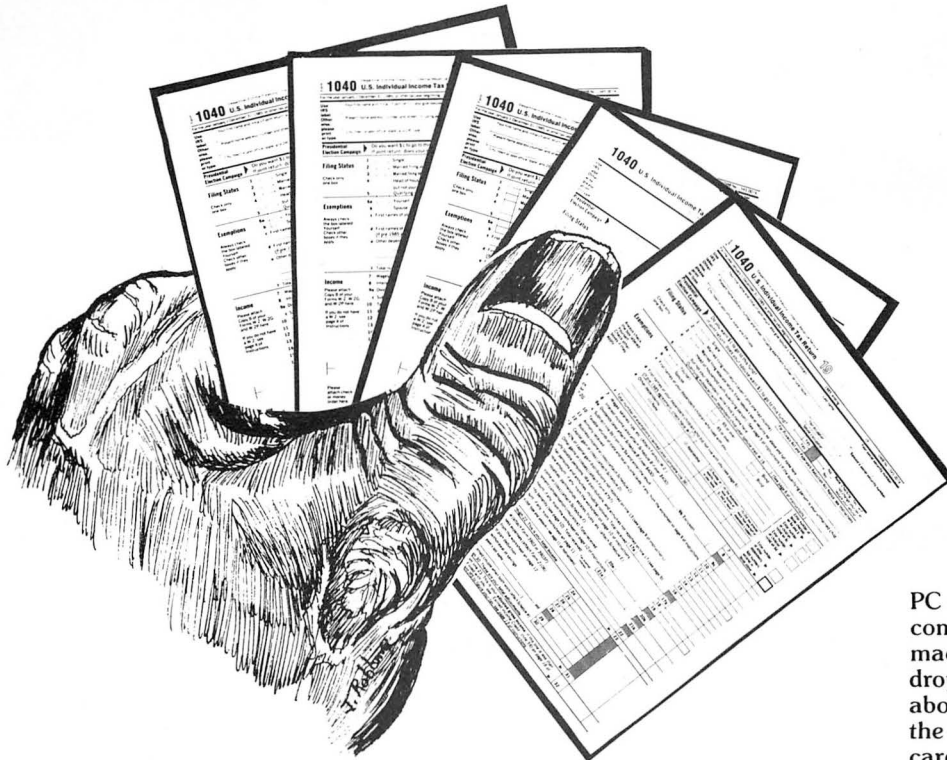


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This program works on the Models I and III and the Color Computer; it sells for \$25. For further information on Banner, contact B. Erickson Software, P.O. Box 11099, Chicago, IL 60611, 312-276-9712.

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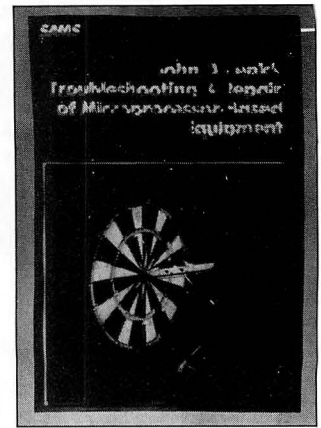
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Etc.

Read and Repair

Howard W. Sams & Co. has published *John D. Lenk's*



Howard W. Sams & Co. offers a 250-page manual for troubleshooting microprocessors.

Troubleshooting and Repair of Microprocessor-Based Equipment, a 250-page manual containing general procedures, techniques and tips for troubleshooting equipment containing microprocessors.

The text provides a simplified, practical system of troubleshooting, including numerous "tricks" that can be effective in diagnosing, isolating, and locating faults in circuits.

Topics covered include test equipment, troubleshooting the gate and IC, stimulus-response testing, current-flow analysis, using the logic analyzer, and flip-flop and register troubleshooting. The book sells for \$21.95 from Howard W. Sams & Co., 4300 W. 62nd St., Indianapolis, IN 46268, 800-428-7267.

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ROMping With the 100

Portable Computer Support Group announces the Business Analyst, a snap-in ROM chip designed to give the Model 100 the capabilities of a Hewlett-Packard HP12C financial calculator, formulating what-if analyses, break-even studies, and printing amortization schedules and other reports.

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Circle 574 on Reader Service card.

Mims the Word

A practical guide to integrated circuit (IC) applications, the *Engineer's Notebook*, by Forrest M. Mims III, illustrates pin diagrams and application circuits for more than 125 ICs commonly used in industry, both linear and digital. Previously published by Radio Shack, the manual is based on the best-selling author's laboratory notebooks.

This completely revised third edition covers digital ICs (MOS/CMOS and TTL/LS); gate packages, RAMs, and sequential and combinational logic; diagrams for voltage regulators, operational amplifiers, timers, phase-locked loops, voltage/data conversion, sound-effects chips, and optoisolators; and other hardware matters.

Engineer's Notebook costs \$15.95 in paperback and is available from the McGraw-Hill Book Co., 1221 Avenue of the Americas, New York, NY 10020, 212-512-3493.

Circle 579 on Reader Service card.

C Language Compiled

Virtual Systems Inc. has released Microbench C, a new C compiler for the Intel 8086 family of microprocessors.

The compiler implements the complete C language as defined by Kernighan and Ritchie, including structure, union, and bit-field constructs. The run-time libraries supplied contain a standard set of utility and I/O functions based on the Unix Version 7 library. A separate library contains ROM-based applications.

Microbench C sells for \$500, including a 90-page user's guide and three-month warranty. For more information, contact Virtual Systems Inc., 1500 Newell Ave., Suite 406, Walnut Creek, CA 94596, 415-935-4944.

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Low-Cost Letter Quality

The Printronic P1013 printer, featuring an ultra-small print tip, provides letter quality in a compact, desktop machine. Draft mode operates at 134 lines-per-minute (lpm) and letter-quality mode at 47 lpm.

With its tractor- and friction-feed features, the printer handles two- or three-part forms and cut sheets and can print IBM block graphics in draft or letter-quality modes. Special character sets and icons produce logos, and all IBM-compatible software is supported. The P1013 emulates the IBM Proprinter/Epson LQ1500 and Diablo 630 with its plug-in cartridges. It sells for \$795 from Printronic, 17500 Cartwright Road, P.O. Box 19559, Irvine, CA 92713-9559, 714-863-1900.

Circle 582 on Reader Service card.

HARDWARE

MODEMS, PRINTERS, TERMINALS. Distributor pricing to end users and dealers—FREE SHIPPING CALL 1-800-833-2600 for catalog. In Ohio call 513-531-8866.

CONVERSION SERVICES

Media Conversion for Tandy Models to over 500 systems including Mag-tape, Micro Computers, Mini Computers, Word Processors and Type-setters. Pivar Computing Services, Inc., 165 Arlington Hgts. Rd., Number 80, Buffalo Grove, IL 60089. 312-459-6010.

NEWSLETTERS

One Thousand Newsletter specifically for your Tandy 1000. 12 monthly issues for \$15.00 or \$3.00 for sample issue. One Thousand 2153-A Muren Blvd. Belleville, IL 62221. (618)277-3526.

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RESULTS

Thanks very much for convincing us to run a classified ad in 80 Micro—It's working great! KJM Development, CT.

MS-DOS

Productivity Software SOFT-TRAIN, 326 S. Abel St., Milpitas, CA 95035. (408) 263-6670.

COMPILED BASIC

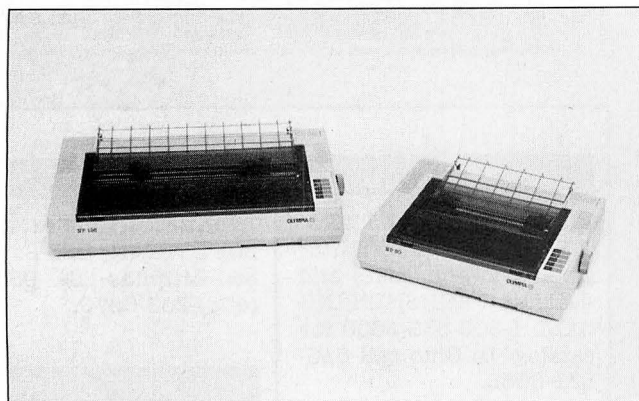
FINALLY! A Subroutine Library for Compiled BASIC. Load directories into arrays, WINDOWING, Graphics pie and bar charts, special string functions; 130 more routines to add power to Microsoft QuickBASIC or IBM BASIC Compiler 2.0. 30 Day Money-Back Guarantee. VISA/MC/Check/MO FINALLY! is only \$99.00 + \$4.00 S&H or FINALLY! and QuickBASIC \$148.00 + \$6.00 S&H. KOMPUTERWERK, INC., Dept 80, 851 Parkview Blvd., Pittsburgh, PA 15215. ORDERS 1-800-423-3400 INFO. 412-782-0384.

BUSINESS OPPORTUNITIES

Personal Computer Owners Can Earn \$1000 to \$5000 monthly selling simple services performed by their computer. Work at home in spare time. Get free list of 100 best services to offer. Write: C.I.L.C.S., PO Box 60369, San Diego, CA 92106-8369.

SERVICES

Get the attention you deserve. Reach over 100,000 readers with news of your product or service. Classified ads in 80 Micro get results. Write to 80 Micro Classifieds, c/o MCSS, 11 Northeastern Blvd., Suite 210, Nashua, NH 03062.



Olympia's new dot-matrix printers feature four print pitches and operate at 200 characters-per-second.

Two Dot-Matrix Printers

Olympia USA introduces two new dot-matrix printers, the Olympia NP 80 and NP 136. The NP 80 (\$549) is an 80-column printer with a 200-character-per-second (cps) print speed in draft mode and 40 cps in near-letter-quality (NLQ) mode. It features 10-inch paper width, four print pitches, proportional spacing, and enhancements such as bold, expanded, compressed, and italic characters. There are eight resident international character sets as well as

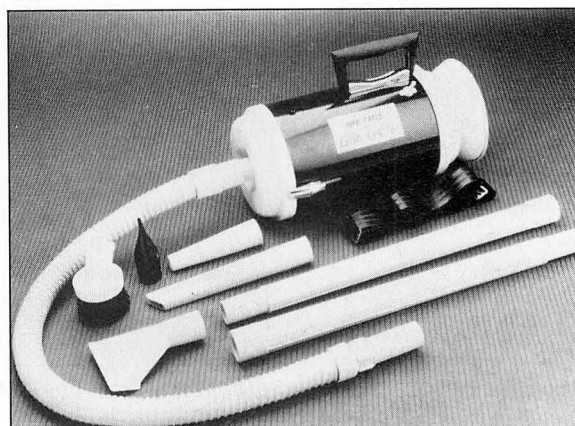
download capability for 95 characters.

The NP 80 is equipped with a 7,000-character buffer and built-in forms tractor, as well as automatic sheet feeding. The NP 136 (\$699) also has a 136-column print line and 16-inch paper width.

Both NP-series printers have an Epson and IBM graphics command set and a built-in parallel Centronics interface. A serial RS-232C interface is available as an option. Contact Olympia USA Inc., Box 22, Somerville, NJ 08876-0022, 201-722-7000.

Circle 581 on Reader Service card.

DIFFERENT TRACK



Metro Data-Vac promotes good digital hygiene.

Clean Up Your Act

The Metro Data-Vac is a portable vacuum cleaner/blower for cleaning and maintaining computers and other office equipment. Blow away those paper particles from printers, eliminate dust from disk drives, and use the soft-bristle brush to wipe your keyboard clean. The Data-Vac features the Air Pinpointer, an attachment only millimeters wide for super-fine spot cleaning, along with a 19-inch flexible hose, crevice tool, reusable vacuum bags, and a shoulder strap.

The Data-Vac costs \$60 from Metropolitan Vacuum Cleaner Co. Inc., 1 Ramapo Ave., P.O. Box 149, Suffern, NY 10901, 914-357-1600.

Circle 580 on Reader Service card.

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TRY-O-TAX 13 federal schedules \$42.99 Models III/4, MSDOS COCO, 1008 Alton Circle, Florence, SC 29501. 803-662-9500.

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Cormail. Print mailing labels, merged mail, business file cards, assets, totals from files in Deskmate on 1000, 2000. \$30 CORWIN SOFTWARE, 10066 W. Mawman, Waukegan, IL 60086-2431. 312-623-4114.

MODEL III ASSISTED INDEXING S.A.S.E. for details. BRIAN HARNEY, R2 Louvl Rd., Frankfort, KY 40601.

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Precision Division

Steve Krattiger (Valencia, CA) wrote that while the Basic statement $N\# = 3/7$ comes up wrong, $N\# = 3\#/7\#$ does not. Several others demonstrated that the CDBL function converts single-precision and integer values correctly. In fact, there are as many ways to ensure the accuracy of arithmetic as there are to lose it. The hard part is remembering that precautions are necessary. Steve also pointed out the hazard of Input $N\#$, which requires you to enter the identifier ($\#$) from the keyboard. Still, I can think of at least one way to protect even that case. Can you?

'Rithmetic

A surprising number of you extended greater-than-double precision division *ad nauseam*. That didn't impress our judges, who knew any number of places were possible, and it missed the point, which was to fill a data field designed for 20 places.

D. A. Wood (Ottawa, OH) took me to task for asking you to round off the decimal. (Although rounding isn't very scientific, banks do it anyway.) About half of you who rounded forgot how final 9's carry rounding to the left. Ed Driver (Lima, OH) advised that, with input in the integer range, four consecutive 9's are the most you'll see.

With a couple of exceptions, your routines mimicked the manual method of long division by assembling the quotient from left to right one digit at a time, then reversing direction to round. And you were about equally divided between those who put the digits in an array and those who built a string for the answer.

T-shirts go to four of you this month. Though it isn't the briefest of those that used an array, the program submitted by T. J. Reibold of Superior, WI (Program Listing 1) is interesting in its use of the MOD operator, integer division, and the Print Using command. T. J. also added a trap to prevent an overflow error on input, and took advantage of GW-Basic's Erase command to get rid of the array before looping back to the beginning. In other Basics, you have to protect the DIM statement by keeping it physically outside the loop.

David Obritschkewitsch (Milwaukie, OR) provided a clear example of the string method (Program Listing 2). David, too, used integer division (\backslash), which wasn't

available in TRS Basics until the Model 4. If your Basic doesn't support While...Wend, use For...Next with a negative step in the rounding routines.

Howard Knoebel (Urbana, IL) used a string, $Q\$(1,0)$, to hold the "regular" quotient, and another, $Q\$(1,1)$, for the "carry incremented" quotient. His final Print statement (Program Listing 3) selects between them based on the value of the 21st place and avoids the need to reverse direction to round. Howard also reminded me that the INT functions can be omitted for Models I, III, and 100. Where the program stores the result of arithmetic in an integer variable, the INT function is implied in those Basics.

The most singular solution, however, came from Gregory Ubbert of Manhattan, KS. His method (Program Listing 4) uses no loops and stuffs the entire operation into a function.

Order in the Sort

I don't have room again this month to tell you about the one-line spreadsheet contest—look for it in a future issue. Meanwhile, I want your favorite sort of sort routine(s). You don't *have* to show me something I've never seen. (I've been to Tijuana.) A variation on the bubble, Shell, or any other will do, as long as it fits into one line of Basic code.

Our test program will generate a randomly ordered list of words in $A\$(S\%)$. Then it will go to your routine with $GO-SUB 1000$, which will put the list into ascending alphabetical order. Please number your entry accordingly. You may use line 1010 for the Return and for the ends of loops, if necessary, but line 1010 may be no more than 32 ASCII characters long. Because of the differences in clock speeds and Basics, swiftness will not be a prime consideration, and we'll make appropriate allowances. As always, your cleverness and wit will impress us the most. If you want to try an indexed sort, we'll accept indexing of $A\$(S\%)$ on the integer array $A\%(S\%)$. And as always:

1. Write your solution(s) in any TRS or Tandy Basic, except Pocket Computer Basic.
2. This month's entries must reach us by December 15, 1986. This doesn't give everyone the same amount of time, we know, and we apologize to our overseas readers especially.
3. This month's winners will appear in the March 1987 issue.
4. Employees of CW Communications are not eligible.
5. Send your entry to: 80 Micro, Fine Lines, 80 Pine St., Peterborough, NH 03458. We will not be able to return entries.
6. Specify your T-shirt size. ■

Contact Harry Bee at P.O. Box 567, Cornish, ME 04020.

Program Listing 1. T. J. Reibold's array method for GW-Basic.

```
0 ON ERROR GOTO 2:INPUT "A numerator";N#:INPUT "A denominator";D#:IF N#>=D# OR
N#<= 0 OR D#<=0 THEN 0
1 PRINT " ";DIM N%(21):FOR I%=1 TO 21:N%(I%)=INT(10*N%/D%):N%=10*N%-D#*N%(I%):NE
XT:C%=-1*(N%(21)>4):I%=20:WHILE C#>0:NN%=N%(I%)+1:N%(I%)=NN% MOD 10:C%=NN%\10:I%
=I%-1:WEND:FOR I%=1 TO 20:PRINT USING "#";N%(I%);NEXT:PRINT:ERASE N#:GOTO 0
2 IF ERR=6 THEN PRINT "Less than 32768":RESUME 0 ELSE ON ERROR GOTO 0
```

End

Program Listing 2. David Obritschkewitsch's string method.

```
1 DEFINT D,T:WHILE NOT(D>N# AND D>0 AND N#>0):INPUT "A numerator";N#:INPUT "A d
enominator";D:WEND
2 N=N#*B$:=" ":FOR X=1 TO 20:N=N*10:T=INT(N/D):N=N-T*D:B$=B$+RIGHT$(STR$(T),1):NE
XT:T=INT(N*2/D):WHILE T=1:T2=VAL(MID$(B$,X,1))+T:MID$(B$,X)=RIGHT$(STR$(T2),1):T
=T2\10:X=X-1:WEND:PRINT B$
```

End

Program Listing 3. Howard Knoebel's "look-ahead" rounding.

```
0 INPUT "A NUMERATOR";N#:INPUT "A DENOMINATOR";D#:IF N#>=D# OR N#<= 0 OR D#<=0 THEN 0
1 Q$(1,0)="THE QUOTIENT: 0.":FOR I=1 TO 20:Q%=INT(10*N%/D%):N%=10*N%-Q#*D%:PRINT Q
$(- (Q#<9),0);:FOR J=0 TO 1:Q$(1,J)=Q$(- (Q#>8),J)+RIGHT$(STR$(Q#+J),1):NEXT:PRINT P
RINT Q$(1,-(4<INT(10*N%/D%))):RUN
```

End

Program Listing 4. Gregory Ubbert's highly functional division.

```
0 INPUT "A NUMERATOR";N#: INPUT "A DENOMINATOR";D#: IF N#>=D# OR N#<= 0 OR D#<=0 THEN
0
1 DEF FNQ$(N#,D%) = MID$(STR$(CDBL(N#)/D#+1D-15),3,11)+MID$(STR$(CDBL(VAL(RIGHT$(
STR$(1E5-VAL(RIGHT$(STR$(INT(INT(1D10*N#/D#)*D#)),5))),5)))/D#+15D-11),4,10):PRI
NT N# "/" D# = " FNQ$(N#,D%)
```

End

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