

80micro

A WAYNE GREEN PUBLICATION

the magazine for TRS-80* users

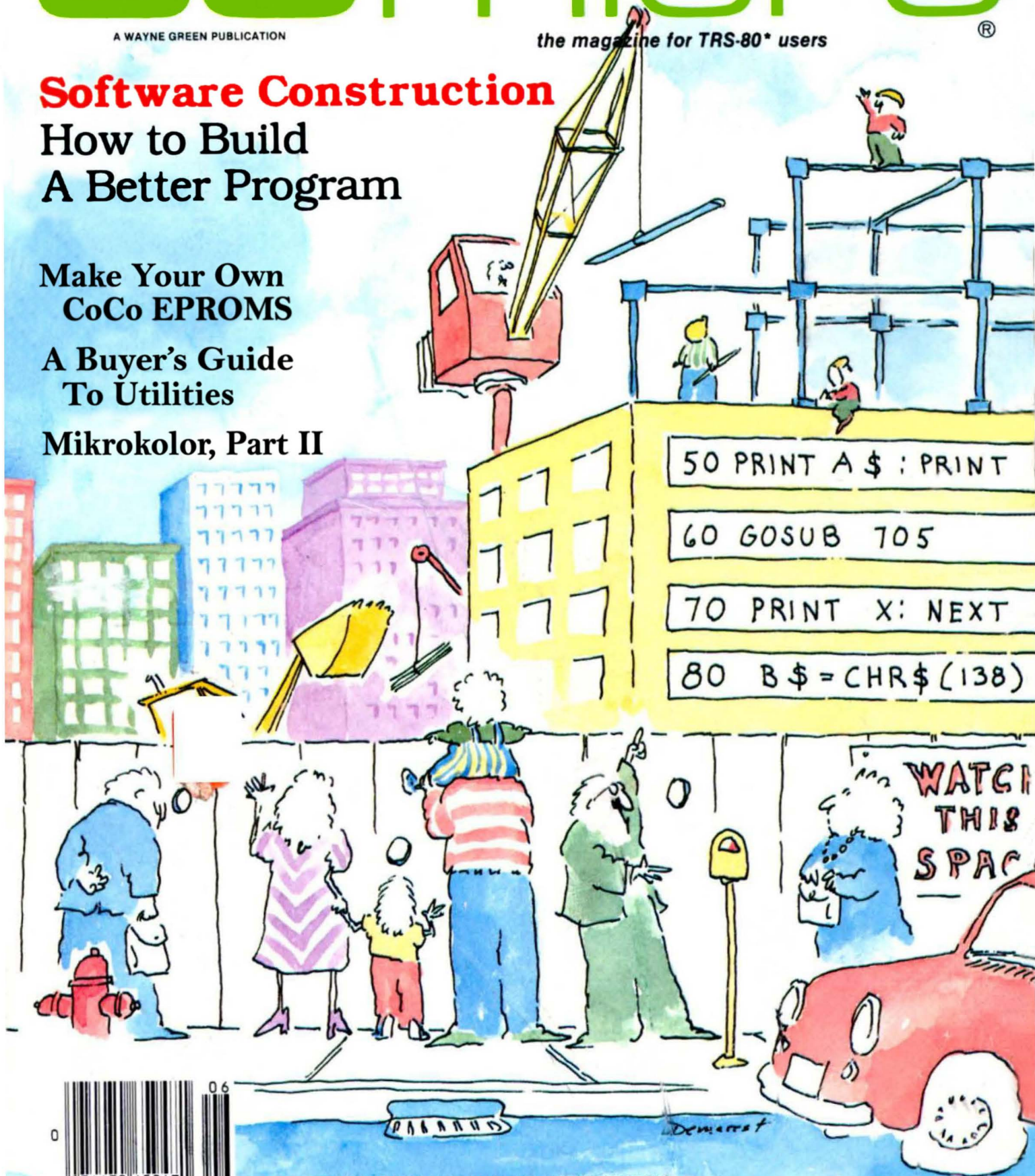
Software Construction

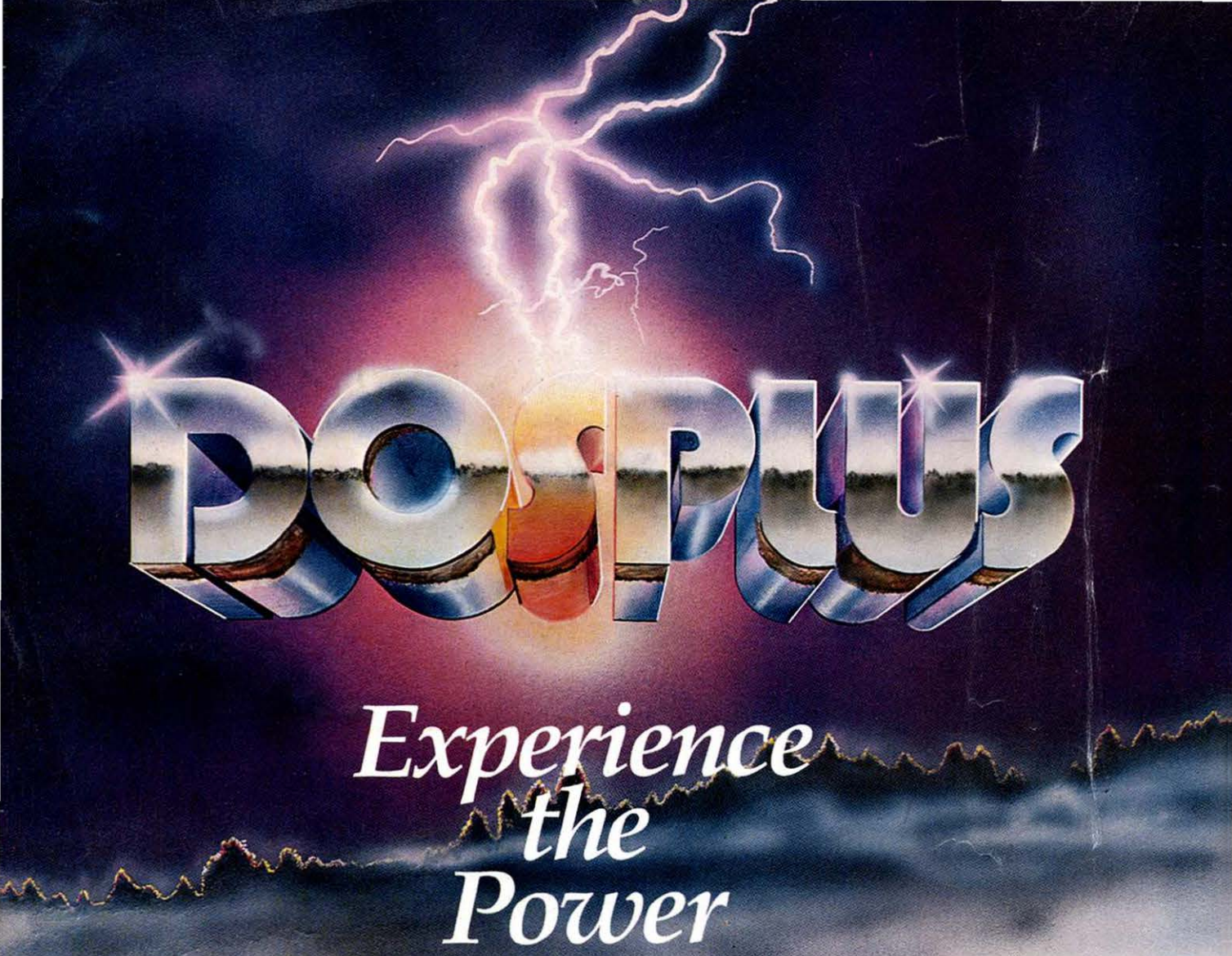
How to Build A Better Program

Make Your Own CoCo EPROMS

A Buyer's Guide To Utilities

Mikrokolor, Part II



A dramatic background image featuring a bright lightning bolt striking a dark, stormy sky over a landscape with a body of water and trees. The scene is illuminated with a mix of purple, blue, and yellow light.

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
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
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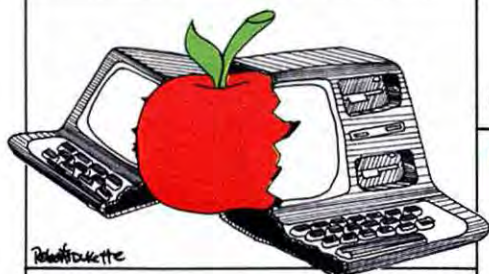
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
 Now Model I and III users can have the best of both worlds. With this emulator, your TRS-80 writes and runs Apple II software.
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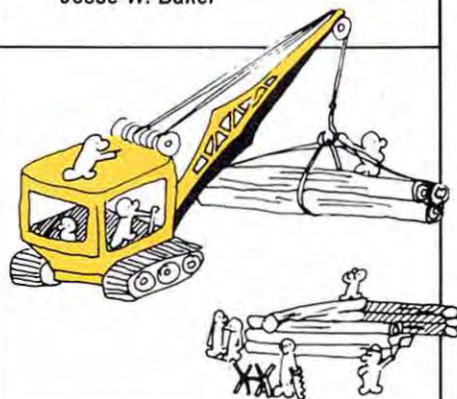
270. Model II Real-World Input/Output

322. Take II


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
Here's another article in the cryptology series. You'll learn how to use letter-frequency distribution to crack ciphertext.
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
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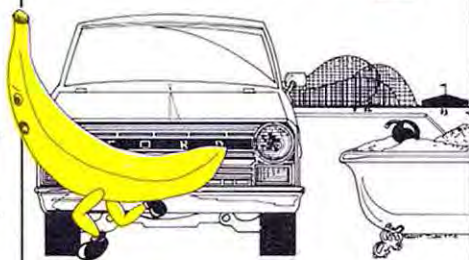
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80 formats its program listings to run 64-character wide, the way they look on your video screen. This accounts for the occasional wrap-around you will notice in our program listings. Don't let it throw you, particularly when entering assembly listings.

Article submissions from our readers are welcomed and encouraged. Inquiries should be addressed to: Submissions Editor, 80 Pine Street, Peterborough, NH 03458. Include an SASE for a copy of our writers' guidelines. Payment for accepted articles is made at a rate of approximately \$50 per printed page; all rights are purchased. Authors of reviews should contact the Review Editor, 80 Pine Street, Peterborough, NH 03458.

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Cover by Chris Demerest

After watching *80-US* magazine cozy up to Radio Shack, I was surprised to see the editor finally turn and bite the hand that has been feeding him. And a vigorous bite it was...opining that Radio Shack has a "stodgy image." He wants them to plunge into a high-priced television battle with Texas Instruments, Apple, Atari, Commodore, and IBM. Oh tsk, tsk.

The Radio Shack decision not to pour millions into a television campaign and fight commercial-for-commercial may be a good one. Remember that the average consumer is unequipped to make a rational decision among the various computers. The fact is that it is often difficult to get experienced professionals to offer any clear guidance when it comes to computer selection. This will remain, for a while, more of a theological matter than one arguable with facts.

Radio Shack has for years depended more on local newspaper ads than national media. I'd say that as long as the bean counters can show they get more sales per invested ad dollar with co-op newspaper ads than they do with almost unmeasurable television ads, they should put their money where it does the most good.

No reputable ad manager is going to embark on a campaign without doing some tests first. With magazines, you try a relatively small direct-mail shot at a few subscribers and get an idea of what percentage you are going to pull. Then you buy your yearly ad contract, investing perhaps \$50,000 or more. A test like this can cost as little as \$500 and save tens of thousands.

Experimenting with television is a lot more expensive. The 30-second commercial can easily cost \$25,000; some go to 10 times that. But the test to measure the impact in one area of the country is not a big deal...and, just as with the magazine ads, is well worth the actual cost before millions are invested in a national campaign.

Most firms make these local area tests first. I'm sure that Radio Shack is trying things like that here and there, looking for some formula that is a winner. Once they have an ad that pulls well for them, they can run it for the country and win big.

But I doubt if, as suggested elsewhere, trying to answer the claims of other manufacturers is appropriate.



Tandy— TV or not TV?

No, you sell your products best if you point out the benefits in your TV ads and get the folks into the stores to shop. If you really have a strong story to sell over other systems, then handle that in computer-oriented magazines—where people turn to make this sort of decision—and via literature in the stores.

Advertising is only a gamble if you don't know what you are doing. If you are working with an expert, you will find him testing every inch of the way before he puts up the big bucks. In that way, he'll know just about what sales a campaign is going to generate before he goes into it. A big outfit like Radio Shack, which does use TV around Christmas time, will use TV when they know it is the best thing to do, and not because some editor is whining for them to blow money.

There is some question about the need for trying to go head to head against T.I., Commodore, Atari, and the other low-end computer firms. I will be surprised if those firms don't knock each other out in a year, with no real winner. If Radio Shack can stand back and let 'em murder each other and aim more at the long haul, it may be the smart move. Of course, this is based on the guess that the el cheapo computers, without adequate information and software support, will go the way of the video game and hula hoop fads. Seems likely to me.

Those Antique Cassettes

The Load-80 programs have been produced in both cassette and disk form for several months. Despite the higher price, the disk sales have been increasing every month. Let's make a try at being reasonable about this whole thing, eh?

The purpose of the Load-80 program dumps is to save you an incredible amount of time typing in the program listings from *80 Micro*. With the Load-80 tapes you can load a good many of the programs from an issue of the magazine. This is a lot better than spending a couple of hours typing in the program and then several more extremely frustrating hours trying to find where you made your typing errors.

Now I'll grant you that getting Load 80 on a disk will allow you to load things a whole lot faster. But you're paying heavily for the convenience with the increased cost of the disk version. It's \$10 more, which is the difference between the cost of a disk and a blank cassette...plus a bit additional because disks are more expensive to duplicate and package than cassettes.

One other factor that many users seem to overlook is the importance of the back-up disk. As soon as you get a disk, you want to make sure that you have a back-up, just in case. Okay, add in the cost of that back-up, too. If you'd bought the cassette version and loaded it onto part of a disk, you could put away the cassette and have it handy should anything blow up. The cassette is easy to store and index, and remarkably safe from the magnetic disasters that hit disks.

One of the favors the Apple people have not done for their users is getting rid of the cassette interface, thus automatically adding from \$5 to \$10 to the cost of every program bought. Radio Shack did a similar disservice to Model II owners. This was even worse because the system uses the even more expensive 8-inch disks.

There may be a market out there for a cassette interface board for the Model II (and for the Apple). It would pay for itself in a short while, first by cutting the cost of program interchange, and second by providing a much lower cost medium for storing data and programs that are not often used. I'd sure hate to put some valuable data on a disk for archive storage. ■

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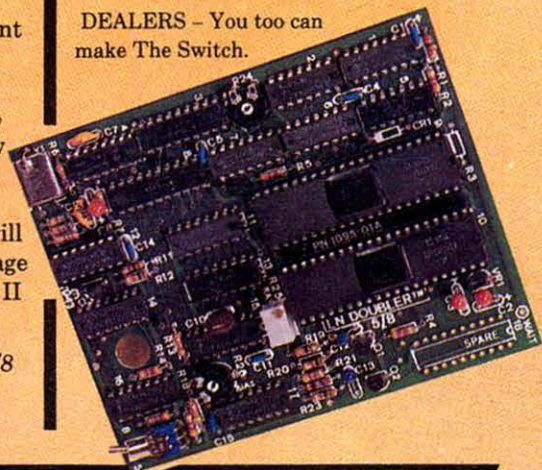
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In a relative sense, microcomputer programming techniques have come a long way since the micro arrived.

But we too often assume that computers and programming did not exist before micros came along, that FOR...NEXT loops, multi-dimensional arrays, and editor/assemblers were devised by and for microcomputer users. The truth is that most programming techniques and languages were developed long before micros made the scene in 1975.

Another truth is that we microcomputerists have spent the last eight years more or less re-inventing the wheel, learning to do on micros what programmers of large computers were doing in the 1950s. This is one reason why mini-computer and mainframe people snickered at micros for so long. They had been using structured programming, subroutines, and arrays for decades and couldn't understand why micro programmers thought such techniques were something new and exotic.

What the mainframers failed to realize was that micros were being acquired by people with no formal training in programming. We learned as we went along, "discovering" concepts and techniques that had been in use for 25 years.

As more people became familiar with the intricacies of computer operation, they used their experience as a base on which to build their knowledge. Features and commands long a part of mainframe applications were adapted to the microcomputer and incorporated as programming options. As a result, today's micro capabilities are more sophisticated and powerful. Today the mainframers have stopped laughing. Micros have come into their own.

The business community is a good barometer of this. Applications formerly the exclusive domain of mainframes and minis, like data base management, accounting functions, production control, and economic modeling can now be effectively handled, albeit on a smaller scale, by micros.

Computing power has moved from the cloistered back rooms of data processing departments into the front office. Chris Christiansen of The Yankee Group, a Boston-based consulting firm, estimates that 4.8 million micros will be used in the office by the end of 1983.

But as micros proliferate in business, are their new-found capabilities utilized

Technology transfer and the micro

to the fullest? Tom Willmott, project manager of International Data Corp.'s Strategies for Office Planning, thinks not. At IDC's 1982 Information Processing Industry Briefing Session, Willmott described the introduction of the microcomputer into the office as hindering information management and upsetting the traditional role of data processing professionals. Management professionals want to take advantage of the processing power of micros, but lack the technical background to do so. As a result, pressure is put on the data processing department to fill this information gap.

DPers find that they not only have to provide the technical know-how to maintain and support conventional large-scale data processing equipment; they now have to provide support for a whole range of new systems, including microcomputers.

So we're at a position where microcomputer technology exists to make versatile computing power available to applications-oriented individuals, but we're at an impasse in transferring that technology to the human operator so it can be used to its full advantage.

A parallel exists between this situation and the personal use of microcomputers. Here, too, the technology exists, but the use of that technology is often hindered by a lack of knowledge.

It's impossible to foretell how the problem of technology transfer will be resolved. Already we have made enormous progress; witness the interest recently generated by the West Coast Computer Faire, the spring Comdex show, and this month's National Computer Conference.

The solution to technology transfer is probably more complex than any of us realize right now, but it might start with user's groups, more conscientious manufacturer support, or magazines like *80 Micro*. ■



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Bar Code Fever

I'd like to see a bar code reader series including:

- A hardware project to adapt the HP-wand reader to the TRS-80 or to build one from scratch.
- Software to support the reader.
- Software and printer specifications to print data or programs in a bar code format.

It would generate great interest if you printed bar code versions of the programs published in the same issue of *80 Micro*.

*Eric A. Ziercher
155 Harford Road
Dryden, NY 13053*

Anyone out there doing any work with bar code readers?—Eds.

For LNW Users

While more programs are becoming available for the LNW-80 all the time, support for LNW's special features is still lacking. One additional source of LNW-80 technical and programming information is available through our user's group's bimonthly newsletter.

Subscriptions to the newsletter are \$12 per year. You can contact the user's group at the address below.

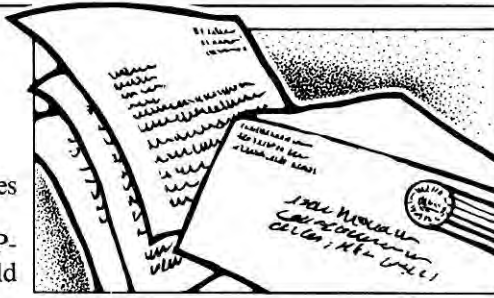
*Jay J. Hokanson
The LNW USER Newsletter
4345 Manchester Road
Grand Island, NE 68801*

Tandy Reliability

We like Tandy equipment. Our company uses a Model 16, and we have found it to be most reliable. Our machine has not had one microsecond of down time in over six months of heavy use. This reliability is a plus in the Model 16's favor that you constantly overlook when you take potshots at Tandy.

Your articles, information, and editorials about Tandy are one-sidedly pejorative. This would be understandable if your differences with that organization were all well-founded; however, not all of them are.

Tandy has been most supportive of our needs. With regard to program and



operating-system updates, software help, and hardware changes, they have done more than any other company to treat us as a valued customer.

I agree that large corporations should be prodded when they display a lack of awareness over product problems. In our experience, Tandy does not fall into this category. On the contrary, we find that they do not neglect their obligations.

I have yet to find better machines than the Model 16 or Daisy Wheel II, a better word processor than Scripsit, or a better customer-service setup than the numbers in Fort Worth! We have product reliability, excellent software, and good technical support.

Such factors are not indicative of a corporation bereft of ethics, as you infer in several articles in the February issue.

*John J. Esak
Nexus Inc.
50 Chuckanut Drive
Oakland, NJ 07436*

Supporting Software

I agree that piracy can be a problem for software producers and distributors. I've written rather complex programs myself, and am aware of the tremendous effort involved in writing and debugging them. With more complex and therefore more expensive programs, the improvement process should never stop.

Herein lies the best software protection available: continuing development, enhancements, and debugging. With these available only to registered owners, the pirate will soon be left behind.

Indeed, the software artist who markets a program of any complexity at more than a nominal price and doesn't provide continuing support deserves to get clobbered. He has abandoned his product in the marketplace. I don't contend that continuing support should be free, but it must occur.

I have a number of programs that are pirated, but anything I'm serious about I buy because I want on-going support. Before I'll buy a program, I usually start with a pirated copy to see how it performs.

Please don't misunderstand me. I am neither supporting nor advocating piracy. I am seeking a way for the customer to determine if software is suitable before, rather than after, a purchase. A 15-minute demonstration and pep talk by a salesman won't do.

The two DOSes I haven't paid for went through anywhere from several days to nearly three weeks of shake-downs before they proved unreliable with my software.

I'm hoping that out of this dilemma will emerge something to protect not only the rights of the software producers and distributors, but the rights of the purchasers as well.

*Richard Torgerson
17 Surrey Lane
Decatur, IL 62526*

AND/OR?

In the February 1983 *Input* (p. 22), William T. Faulkner points out that the XOR function can be emulated in Basic by ANDING two input values with each other's inverse and then ORing their results. This is correct, but I have been using a simpler approach.

When you perform an XOR, you OR the two values and then drop those bits that are set during an AND of the original values. Mr. Faulkner's $C = (A \text{ AND } (\text{NOT } B)) \text{ OR } ((\text{NOT } A) \text{ AND } B)$ can be shortened to $C = (A \text{ OR } B) - (A \text{ AND } B)$.

*David R. Goben
Lecoma Star Rt. Box 30
Rolla, MO 65401*

The Key to Disk Basic

The following modifications to Don Rigg's "Autokey" (*80 Micro*, December 1982, p. 280) allow you to use the program under Model III Disk Basic.

First, delete lines 100-440 of the Assembly listing and enter Program Listing 1. On line 870, replace the Return command with a Jump com-



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mand to 59C8H for TRSDOS, 5F79H for NEWDOS, or 02B8H for LDOS. Insert Program Listing 2 between lines 1120 and 1130.

Mr. Rigg used lines 2790-2810 to custom-design an additional one-key command linked to the Z key. To retain this feature, change line 2790 to read: DEFM '2FORI = 1TOLEN(Z\$) :POKEI + &Hnnnn. In place of the nnnn, use the memory address at which line 2780 assembled.

I also deleted the auto-start routine in lines 2860-2910 because I no longer use a cassette.

Now that you have changed the program, give it the file name DISKEY/CMD and enter the Basic program in Program Listing 3, using the file name DISKEY/BAS. To run DISKEY/CMD in Basic, type RUN "DISKEY/BAS". Line 20 will require changes under operating systems other than Model III TRSDOS.

*Jack Blum
Rt. 1 Box 1025
Orland, CA 95963*

Mr. Rigg's article also contained a Basic version of Autokey. This letter does not modify the program to work with disks.—Eds.

Colorful West Virginia

We have now formed a TRS-80 Color Computer User's Group in the Morgantown-Fairmont West Virginia area. For more information, contact me at the address below or call 304-599-4493.

*Donald G. Barber, Jr.
P.O. Box 295
Granville, WV 26534*

LPVIII Graphics

Many of you would probably like to have your LPVIII print graphics as they appear on the screen. The subroutine in Program Listing 4 will do just that.

The LPRINT statement in line 1000 initializes the printer. You can change the CHR\$(number) in line 1030 to any of the graphic code numbers, from 225-255. The CHR\$(128) in line 1030 prints the required blank spaces.

*Jim Hanson
39723 Aub-Enum Hwy.
Auburn, WA 98002*

```
00100      ORG      41E2H
00110      JP      START      ;Jump to AUTOKEY
00120      ORG      0FCE0H     ;for 32K use 0BCE0H
00130 START LD      A,0C9H
00140      LD      (41E2H),A
```

Program Listing 1

```
01121      CP      10      ;Skip down arrow
01122      RET      Z
```

Program Listing 2

```
10 CLS
20 CMD"L", "DISKEY/CMD"
30 DEFUSR0=&HFCE0 'BCE0 for 32K
40 PRINT "DISKEY IS NOW RUNNING"
50 X=USR(0)
```

Program Listing 3

LNW Bulletin Boards

Two bulletin boards are operational in support of the LNW-80, one at 504-291-4331 and one at 516-924-8115. These bulletin boards contain a listing in download of little-known but important engineering change notices from LNW Research. The service also contains information on new, exciting, and inexpensive graphics software.

With the gradual disappearance of the Model I, I consider the LNW-80 the new frontier with abilities yet to be explored.

*Larry Davidson
P.O. Box 592
Bothell, WA 98011*

Printing Labels

Since the publication of "Making Labels" (80 Micro, Anniversary Issue 1983, p. 240), I have changed several lines of the program to simplify

```
1000 LPRINT CHR$(18);CHR$(10);CHR$(27);CHR$(14);
1010 FOR H = 0 TO 47
1020 FOR W = 0 TO 127
1030 IF POINT(W,H) THEN LPRINT CHR$(255);ELSE LPRINT CHR$(128);
1040 NEXT W
1050 LPRINT ""
1060 NEXT H
```

Program Listing 4

adaptation for printers other than the Heath H-14.

First, delete line 835. Then change line 240 and add line 245 as shown below:

```
240 A$=INKEY$:IF A$="" THEN 240
    ELSE IF A$=CHR$(8)PRINT
    A$;GOSUB 2000:IF BS<1GOTO220
    ELSE GOTO240
245 IF A$<>CHR$(13)THEN
    TS(J)=TS(J)+A$:IF LEN(TS(J))>ML
    THEN TS(J)=""GOTO220 ELSE
    PRINT A$;GOTO240
```

If your printer is not a Heath H-14, modify line 840 to: LPRINT TS(J) and change line 780 to: LPRINT "TEST LINE";J.

Lines 710-750 are specific to the Heath printer in that they set type size and lines per inch; you can delete or change them if you use a different printer.

The statement OUT 251,n is the same as LPRINT CHR\$(n) and is valid only for the Model III. Model I users must change all OUT 251,n statements as above.

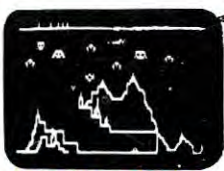
One minor error appears in the original listing. Line 600 (for cassette users) should read T=INP(240):IF T=255 GOTO 1500.

*William A. Nelson
1354 Hackett St.
Beloit, WI 53511*



REAR GUARD

Deadly waves of enemy Cyborg craft attack your fleet from the rear. You are the Mothership's sole defender. You have unlimited firepower but the Cyborgs are swift, nimble attackers. Your abilities are tested hard in this game of lightning fast action and lively sound from Adventure International. Price: B



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PANIK

Trapped at an enemy building site, your fate seems certain. Your laser is empty and evil Mzors are closing in. You'll have to climb ladders and think one step ahead of the various monsters. A challenging game for agile minds. From Fantastic Software with voice (Disk has larger vocabulary). Price: B



SEA DRAGON

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-80 Microcomputing
80 Reviews, Jan '82

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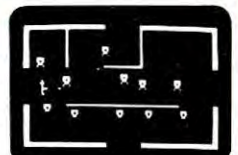
STELLAR ESCORT

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ROBOT ATTACK

Talks without a voice synthesizer, through the cassette port. With just a hand laser in a remote space station, you encounter armed robots. Some march towards you, more wait around corners. Careful, the walls are electrified. Zap as many robots as you dare before escaping to a new section. More robots await you. Price: A



LUNAR LANDER

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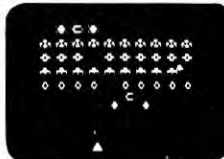
SUPER NOVA

Asteroids float ominously around the screen. You must destroy the asteroids before they destroy you! Big asteroids break into little ones! Your ship will respond to thrust, rotate, hyperspace and fire. Watch out for that saucer with the laser! As reviewed in May 1981 Byte Magazine. Price: A



OUTHOUSE

You are the mighty protector of this small (but important) wooden structure. For reasons unknown, a bizarre gang of miscreants wish to vandalize, loot and otherwise destroy the little "hail moon house." Your patrol craft has lasers and smart bombs to deal with this terror. From SSM with sound. Price: A



GALAXY INVASION

The sound of the klaxon is calling you! Invaders have been spotted warping toward Earth. You shift right and left as you fire your lasers. A few break formation and fly straight at you! You place your finger on the fire button knowing that this shot must connect! With sound effects! Price: A



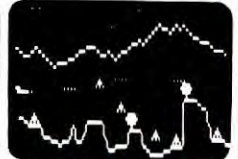
LASER DEFENSE

In this game of ICBM's high-energy lasers and particle beams, you control the U.S. strategic defense satellite system. From your viewpoint high above the globe, you intercept Soviet nuclear missiles in flight and attempt to destroy their scattered missile silos. With sound from MED Systems. Price: B



CHICKEN

Will the chicken cross the road? That's up to you. Can you guide these helpless little chicks across the perilous 10 lane super highway to safety? Or will you bumble, littering the backdrop with a storm of chicken leathers? A humorous yet challenging game of nerves from SSM with sound. Price: A



PENETRATOR

Soar swiftly over jagged landscape, swooping high and low to avoid obstacles and enemy missiles attacks. With miles of wild terrain and tunnels to penetrate, you're well armed with bombs and multiple forward missile capability. From Melbourne House. Features sound, trainer mode and customizing program. Price: C



DEFENSE COMMAND

The invaders are back! Alone, you defend the all important nuclear fuel canisters from the repeated attacks of thieving aliens. Repeatedly. An alien passes your guard, snatches a canister and flies straight off. Quick! You have one last chance to blast him from the sky! With sound and voice. Price: A



BOUNCEOIDS

Huge boulders careen off the walls. You're in the middle in danger of being flattened. Keep your wits about you as you blast these "bounceoids" from the screen. Large ones break into many small ones. Clear a screen, and enter a fast-paced challenge stage with a chance for big bonus points. From the Cornsolt Group. Price: A



SCARFMAN

This incredibly popular game came now runs on your TRS-80! It's eat or be eaten. You run Scarfman around your maze, gobbling up everything in your path. Try to eat it all before nasty monsters devour you. Excellent high speed machine language action game from the Cornsolt Group. With sound. Price: A



ARMORED PATROL

A realistic tank battle simulation. Your view is a 3-D perspective of an alien landscape. Maneuver your T-36 tank to locate and destroy enemy tanks and robots that lay hidden, ready to assault you. Clever graphics create the illusion of movement and dimension. From Adventure International. With sound. Price: B



CATERPILLAR

An arcade favorite! Stop these multi-sectioned crawlers before they creep down through the mushrooms. Zap one and it splits into two smaller bugs, each with its own sense of direction. There are moths and tumble bugs too. It all adds up to lots of fun for kids and adults alike. From Soft Sector Marketing. With sound. Price code: A



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You have to paint the floor white. We give you the paint and brush. Sounds easy? Hah! You'll be confounded by stray dogs, snakes, sloshing buckets of turpentine, even a ravenous "paint eater." A crazy, imaginative new game with ten selectable levels of skill for new or seasoned game players. Lot's of laughs! Price: A

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```

110      ORG      32533      ;(LOAD ADDRESS)
111 MSIZ  LD      HL,32530  ;LOAD MEM SIZE
112      LD      (40B1H),HL ;TOP OF MEMORY POINTER
113      LD      DE,0FECEH ;CALCULATE DISPLACEMENT
114      ADD     HL,DE      ;FOR VARIABLE POINTER
115      LD      (40A0H),HL ;SAVE IT
116      CALL   1B72H      ;SET ALL PTRS & RETURN
117      LD      HL,32565  ;LOAD ENTRY ADDRESS
118      LD      (4174H),HL ;POINT CMD TO ENTRY POINT
119      LD      DE,0FECEH ;CALCULATE DISPLACEMENT
120      ADD     HL,DE      ;FOR VARIABLE POINTER
121      LD      (40A0H),HL ;SAVE IT
122      CALL   1B72H      ;SET ALL PTRS & RETURN
125 CMDIN PUSH   HL        ;SAVE ORIGINAL HL
300 EXIT  JP      301      ;(JUMP L3 ERROR)
1100 LNINT RET    ;INSERT 41C4H INSTRUCTION
1105      RST     38H      ;INSERT 41C5H INSTRUCTION
1106      NOP    ;INSERT 41C6H INSTRUCTION
1180      END     MSIZ     ;SET UP FOR /(ENTER) ACTIVATE
    
```

Program Listing 5

Cassette BASTEP

“BASTEP” by Alan D. Smith (80 Micro, January 1983, p. 352) is excellent for debugging Basic programs. To use the Assembly-language version for a 16K cassette system, renumber line 120 as 125 to make room for new lines.

Then make the changes and additions in Program Listing 5.

BASTEP is now located at the top of 16K memory and can be relocated by changing the addresses in statements 110, 111, and 117 by equal displacement.

By adding 16384 to each address, you

place the program at the top of 32K memory. This allows placement below any other Assembly-language programs that might be stored in memory.

This program also runs on the Model III. Ignore the syntax error that appears after loading the program.

*Robert A. Hood
8218 Tracyton Blvd. NW
Bremerton, WA 98310*

Model 16 Update

While I like seeing coverage of the Model 16, Jim Hawkes' article, “The Model 16” (80 Micro, February 1983, p. 228), has several problems.

The 68020 has 32 data lines, but only 24 address lines. The 68032 will have 32 address lines.

Since I've used a set of stand-alone, 8-inch drives for some time, I believe I am inserting disks in my Model 16 right side up: label at the top outer corner and facing me. The Model II is upside down.

Only the run-time environment of the multi-user operating system will be free. This lets you run turnkey application packages. The development package will include a full C compiler and cost about \$700. It is Xenix, Microsoft's licensed UNIX with extensions. Tandy is not writing their own 16-bit operating system.

Radio Shack has announced that they will sell and support CP/M 3.0, also called CP/M Plus, for the Models II, 12, and 16. This version supports bank-switched RAM for the Z80.

They have not announced support of CP/M-68K, the Digital Research operating system for the 68000 CPU. CP/M-68K is written in C and should be available from a third party.

I have not found a way to emulate four single-sided drives on my two double-sided ones, under either TRSDOS or CP/M.

Multi-user Cobol, as well as Fortran and an expanded-address Basic, will be added to C as Microsoft brings them up. High-level languages will be plentiful under Xenix.

UCSD Pascal and the rest of the p-System Version IV (Fortran, Basic, Lisp) are already up and running on the 68000 in a Model 16.

At this time, I don't know if the expanded card cage in the Model 12 (six

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Gadgets	S76	9963	9963	9963	9963	9963
Hatchets	U09	27	30	33	37	40
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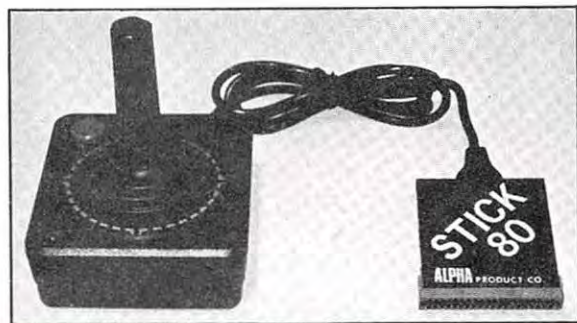
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slots) will fit the Model 16, or be an external option.

Incidentally, the Model 12 cage is accessible to the user through a two-thumbscrew panel in the back that is not sealed. Also, the new keyboard should fit the old II/16 units with a female/female adaptor. The new keyboard has the cable attached, whereas the old had a socket for the cable from the cabinet.

At last we have nonproprietary operating systems and user access.

*Mark P. Fishman
51 Grandview Road
Arlington, MA 02174*

Hawkes Replies

I agree that the phrase "true 32-bit device" is a bit strong as applied to the MC68020. However, I believe that the 68020 would be considered by most as a 32-bit CPU despite having only 16 megabytes of addressable memory.

Second, I think that most 80 Micro readers would agree with my statement

Error Trap

The Color Key (80 Micro, March 1983, p. 34) gave the wrong address for Nelson Software. The corrected version is as follows: 9072 Lyndale Ave. S., Minneapolis, MN 55420, 612-881-2777. For orders only, call 800-328-2737.—Eds.

regarding the insertion of the Model 16 disks.

Also, the article specifically stated that the "CORE" system would be free. Finally, this article was written in September 1982, and at that time little real software was available to report.

*Jim Hawkes
The College of Charleston
Charleston, SC 29424*

Color Save

In Feedback Loop (80 Micro, March

1983, p. 414), Terry Kepner recommends buying a copying utility to CSAVEM a machine-language program on the Color Computer. It is much easier to enter the following commands from the keyboard after you load the program.

```
<?PEEK(487)*256+PEEK(488)>
<?PEEK(126)*256+PEEK(127)-1>
<?PEEK(157)*256+PEEK(158)>
```

These commands give you the starting address, ending address, and execute address, respectively. Then CSAVEM "Filename", starting address, ending address, execute address.

This method only works with non-auto-execute machine-language programs and it does not work well with a disk system.

*Donald G. Barber, Jr.
P.O. Box 295
Granville, WV 26534*

Model II News

As you are aware, there are many more Model I and Model III systems than there are Model IIs.

However, help is on the way for Model II users, as we have just formed a national Model II user's group. We plan to publish a user directory and a short newsletter. Anyone interested in finding out more about our group should send us a stamped, self-addressed envelope.

*Bob Stewart
National TRS-80 Model II
User's Group
P.O. Box 234
Ada, MI 49301*

Attn: Cincinnati

The Cincinnati TRS-80 User's Group (CINTUG) has been in existence for over three years. We meet on the second Saturday of each month. You can access our bulletin board at 513-791-8208. Send written queries to the address below.

*Carolyn Wiedemann
Vice President
CINTUG
P.O. Box 9145
Cincinnati, OH 45233*

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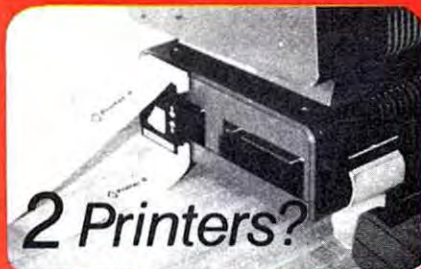
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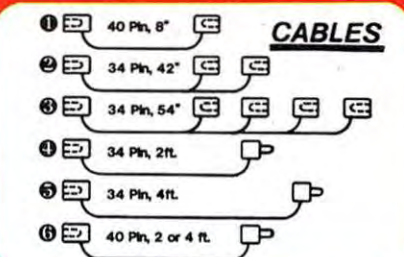
Now Model III users can take advantage of the ALPHA I/O system too. Our new MOD III/I BUS CONVERTER allows most port based Model I accessories (such as our ANALOG-80, INTERFACER 2 and INTERFACER-80) to connect to the Model III bus. MOD III/I BUS CONVERTER, complete with all connectors, only \$39.95.



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GREEN SCREEN WARNING

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

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

Many companies have been manufacturing video filters for years. We are not the first (some think they are), but we have done our homework and we think we manufacture the best Green Screen. Here is why:

- It fits right onto the picture tube like a skin because it is the only **CURVED** screen **MOLDED** exactly to the picture tube curvature. It is cut precisely to cover the exposed area of the picture tube. The fit is such that the static electricity is sufficient to keep it in place! We also include some invisible reusable tape for a more secure fastening.
- The filter material that we use is just right, not too dark nor too light. The result is a really eye pleasing display.
- We are so sure that you will never take your Green screen off that we offer an unconditional money-back guaranty. Try our Green Screen for 14 days. If for any reason you are not delighted with it, return it for a prompt refund.

A last word: We think that companies, like ours, who are selling mainly by mail should list their street address, have a phone number (for questions and orders), accept CODs, not every one likes to send checks to a PO box for the convenience of charging their purchase to major credit cards. How come we are the only green screen people doing it? Order your ALPHA GREEN SCREEN today...\$12.50



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Scarce as Hen's Teeth

Usable programs for the 4K TRS-80 Color Computer are as scarce as hen's teeth. I'd appreciate hearing from anyone who knows where I can find good business and game programs.

*Charles W. Gordon
17B Byron Court
Greenville, SC 29605*

Wanted: Hot Programs

Our volunteer fire company is looking for Model I/III programs to use in planning our fire suppression policy. Any help is appreciated.

*John M. Howey Jr.
538 Walnut St.
Freeland, PA 18224*

Interface Problems

I haven't been able to find an interface or a driver program to let me use my Model 33 Teletype with a TRS-80 Model III. Can someone help me?

*D.A. Kitchen
Box 176
Bushell Park, Saskatchewan
Canada S0H 0N0*

Making the Model I Read

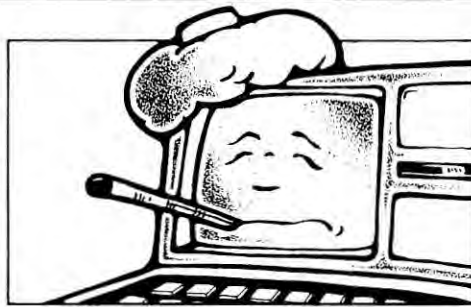
Does anyone know how I can program my Model III to write single-density files that can be read by a Model I?

*David H. Hall
149 Runnymede Road
West Caldwell, NJ 07006*

Making Mountains

I'd like to know more about a mathematical function used to change a flat plane into a fractal surface. In 3-D computer images it is used to make mountains. If you know anything about this function please write to me.

*Carlos Borgarth da Silva
Rua Guilherme Marconi 80
Apt. 504
Rio de Janeiro, Brasil
RJ CEP 20.240*



Looking for help

Any Suggestions?

I'm using the Epson MX-80 to print my club newsletter, but I can't get it to reverse line feed to the top of the column and it's difficult to align the manual setting. Professional word processors can format in multiple columns, but Scripsit isn't up to it. Any suggestions?

*Derek Traylor
88 Grosvenor Drive
Hornchurch, Essex
England RM11 1PW*

I Need a Patch!

I'm unable to use SuperScripsit with double density on my Model I. I hate to go to single density with a long manuscript. Does anyone have a patch that will let me use SuperScripsit with double density?

*Alice Fuchs
10 Evergreen Drive
Lock Haven, PA 17745*

Needs Labels

I'd like to catalog my collection of video cassettes with a data base. My problem is that I can't find a company offering labels on continuous forms that are the size I need. Can anyone help me?

*Brad Corson
c/o Jet Cargo International
P.O. Box 520010
Miami, FL 33152*

Foreign Letters

I own a Model III with a normal keyboard. I'd like to program and print in Turkish. Does anyone know how I can print letters that aren't used in any European language? If so, what kind of printer will I need?

*Eren S. Inonu
111-15, 75 Ave. #2M
Forest Hills, NY 11375*

Needs Address Change

How do I change the address of the Auto-Dial/Answer device found on p. 300 in the 1983 Anniversary Issue to a port other than 254? My LNW-80 uses port 254 for hi-res graphics.

*Barry Bea
61 Hallow Crescent
Rexdale, Ontario
Canada M9W 2V8*

A Good Cause

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*Deanie C. Gross
Executive Director
National Multiple Sclerosis Society
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New Orleans, LA 70119*

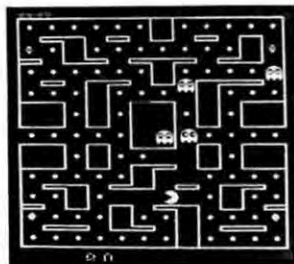
Hi-Res Patches

I own a Model III with the new RS high-resolution graphics, a HIPAD digitizer, and a DMP-29 HILOT plotter. I'm interested in any software that ties all these components into a graphics design and CAD system.

I'm also interested in patches and drivers that bring out high-resolution graphics with Radio Shack's Business Analysis Graphics Pak.

*Doug Landmann
273 Willow Drive
Hartland, WI 53029*

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GHOST GOBBLER

From Spectral Associates, this "Pac" theme game is the best of it's type. Brilliant color, action and sound, just like an arcade gobble your way to glory, but watch for those ghosts! Get in on the wild fun of this game craze now. Tape: \$21.95, Disk: \$25.95

DONKEY KING

DONKEY KING

You simply can not buy a more impressive game for your color computer than this new wonder from Tom Mix. The graphics, sound, and animation are all just astonishing! There are four different graphic screens and each is endless fun. Requires 32K. Tape: \$24.95, Disk: \$27.95



BEST SELLER

GHOST GOBBLER



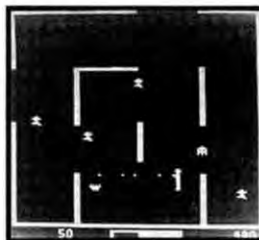
PROTECTORS

There are several good versions of the "Defender" theme available for the CoCo. None, however, rival this one from Tom Mix. No other game matches the detailed graphics and sheer excitement of this top seller. Requires 32K. Tape: \$24.95, Disk: \$27.95



CREATURE FEATURE

From Color Software, comes a lightning swift shoot & dodge the enemy game. It's clever cross between "Robotron" and "Beserk" themes, with bullets flying everywhere. Solid, shoot-em-up-fun. Requires 16K. Tape: \$17.95, Disk: \$19.95



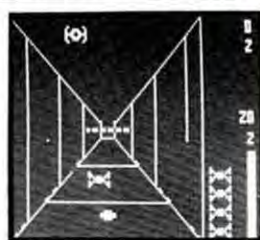
ANDROID ATTACK

Spectral Associates' very well done "Berserk" type game with some interesting added features. Each cassette contains both the 16K and 32K version. The 32K version has voice output! Plenty of action. Tape: \$21.95



FROGGER

Just released by The Cornsoft Group, this is the officially licensed version from Sega, the arcade manufacturer. It has it all! 4 lane super highway, snakes, turtles, logs, alligators, etc. Lots of action and laughs! Requires 16K. Tape: \$19.95



INTERGALACTIC FORCE

Your space fighter roars into the Death Corridor. Lock-on and blast the enemy fighter from the sky. Now try dropping one into Death Star's narrow exhaust vent. It takes skill and guts. Good luck! With "Star Wars" theme song. From Antleo. Tape: \$24.95

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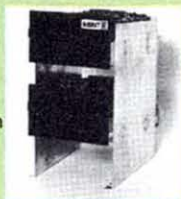
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Found and Fixed

I found and fixed some bugs in my "Outbreak" program (January 1983, p. 216). Most of the problems come from the sound routine, but a bug lives in line 200. To exterminate this problem enter it as: 200 IF X>126 THEN A = -A:X=126:GOTO 170.

If you own a tape system and are having problems with the sound routine, change Z1 = 127 to Z1 = 126 in line 700, or set the memory size to 32000. The sound is improved by changing all the USR(12)'s to USR(0)'s.

If you own a disk system and are having sound routine problems, you should change line 700 to: 700 DEFUSR0 = 32000: Z=32000. You should also change all JJ = USR(12)'s to JJ = USR(0)'s.

Tom Hanson
2120 Birchmont Drive
Bemidji, MN 56601



Patches and fixes

Our Fault

The following program (see Listing 1) was left out of Steven M. Groll's

Program Listing 1

```

9000 GOSUB9990
9010 PRINT"HOW MANY NUMBERS TO BE INPUT?"
9015 INPUT"(10 OR LESS)";F
9020 IFF>10 THEN 9000
9030 PRINT:PRINT"*NUMBERS MUST BE INPUT IN"
9040 PRINT"ORDER FROM SMALLEST TO LARGEST *"
9042 PRINT"*ALL NUMBERS MUST BE SMALLER"
9043 PRINT"THAN 1,000,000*"
9045 FORG=1TOF
9050 PRINT:PRINT"INPUT #";G;": ";
9060 INPUTM(G)
9065 IFM(G)>999999THEN 9000
9070 IFG>=2THEN 9100 'YOU NEED AT LEAST 2 TO COMPARE
9080 NEXT
9090 GOTO9190
9100 IFM(G)>M(G-1)THEN 9080 'MAKE SURE NUMBERS IN ORDER
9110 GOSUB9990:PRINT"THE NUMBERS MUST BE INPUT IN"
9120 PRINT"ORDER FROM SMALLEST TO LARGEST"
9130 FORX=1TO 2000:NEXT:GOSUB9990
9140 GOTO9045
9190 CLS
9200 FORG=1TOF-1
9210 Q=INT(M(G+1)/M(G)) 'Q=QUOTIENT
9220 R=M(G+1)-(M(G)*Q) 'R=REMAINDER
9230 IFR=0THEN 9300
9240 M(G+1)=M(G):M(G)=R 'REASSIGN VALUES
9260 GOTO9210
9300 IFF=F-1THEN 9400 'LAST ONE?
9305 M(G+1)=M(G) 'OLD DIVISOR BECOMES NEW DIVIDEND
9310 NEXT
9400 GOSUB9990:PRINT"GCD = ";M(G)
9500 PRINT:PRINT:PRINT:PRINT"DO YOU WISH TO CONTINUE?"
9505 PRINT"Y=YES N=NO"
9510 INPUTA$:IFA$="Y"THEN9000ELSEEND
9990 CLS:PRINTCHR$(23):RETURN
10050 '-----
10060 ' EUCLIDEAN ALGORITHM
10070 ' COMPLETED 5/19/81
10080 ' STEVEN M. GROLL
    
```

"The 2,000-Year-Old Algorithm" article (March 1983, p. 332). The line numbers mentioned in the first column on p. 333 refer to this program listing.—Eds.

The Judge's Decision

Figure 1 in my "Judge 80" article (January 1983, p. 221) is incorrect. The correct pinouts to IC4 are, from top to bottom:

IN	OUT
3	4
1	2
13	12
5	6
11	10
9	8

Also, the correct identification for IC2 in the IC list is:

IC1,2	74LS367
IC3	74LS08
IC4	74LS04

Stuart A. Cole
Rt. 5, #1 Five Oaks Lane
Gulfport, MS 39503

Directory Patches

Although the code in Carl Anderson's "Easier Directory" (December 1982, p. 32) assembled with no errors, the program produces nondescript garbage. The problem is not with the code, but with TRSDOS 1.3. Radio Shack released TRSDOS 1.3 with several errors and then published patches for some of them in the October 1981 issue of *TRS-80 Microcomputer News*. The problem is found in the I/O call to display the directory. The following two patches correct this anomalous I/O call.

PATCH * 10 (ADD=4E2E, FIND=CD3E4B, CHG=CD8A50)
PATCH * 10 (ADD=508A, FIND=4469736B, CHG=4FC33E4B)

James A. Calloway
645 Tarreyton
Ruston, LA 71270

Better Music

The "Dual-Voice Music Synthesizer" by Lee Morgenstern (1983 Anniversary Issue, p. 253) bombs on the Model I with an OV error at line 1160. To correct this, change line 1160 to read: 1160 READ Q:POKE X-1+P,Q:NEXT and

change line 1030 to: 1030 CLS: CLEAR
500:DEFINT A-Z.

After doing this, insert line 1055 which reads: 1055 M\$=STRING\$(152,0). Line 1055 is exactly the same as line 1110, but don't delete line 1110. This changes the starting address of M\$ to 32464 instead of 32616.

Paul F. Smith
305 S. Warmister Road
Hatboro, PA 19040

Fire One!

I found an error in David Edick's "Space Duel" program for the Model III (August 1982, p. 260). To let your spaceship fire, change line 123 to: IF A\$="C" THEN 1000.

Mari Ascolese
115 Ave Maria
San Antonio, TX 78216

Sorting Problem O.K.

There's an error in Bill Barden's "Assembly-Language Primer" program listing (1983 Anniversary Issue, p. 16) that prevents the last element from being sorted. The eighth data element in line 101 of Program Listing 3 should be changed from 254 to 255.—Eds.

Turtle Problems

Larry Brackney's "TRS-Turtle" program (February 1983, p. 116) has a bug under its shell. To get rid of it, change line 250 to: 250 L\$(W)=B:W=W+1:T\$(B)=B.—Eds.

It's an Arrow!

There's a typo in the correction to Delmer Hinrichs' "Practical Regression Analysis" program in the February 1983 Debug column (p. 30). In line 2830, between the DZ and 3 there should be an up-arrow instead of a parenthesis. Otherwise it is correct.

Oh, well. You know what they say: "...and these bugs have smaller bugs upon their backs to byte them..."—Eds.

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332



This column is a little different from my previous offerings. Instead of discussing how to include machine-language routines in Basic programs, I will explain the ultimate Basic interface: how to change Basic itself. I hadn't planned to delve into this topic for several months, but the one change explained here makes a lot of other programming much simpler.

I have always been aggravated by the lack of a proper Restore command in Radio Shack's Basic. Restore should set the read pointer to any data table in a program. In a large program with data statements for subroutines as well as the main line of the program, you must often Restore to the beginning of the program and then include dummy, time-wasting reads until the correct data table is found. Saving and reloading the read pointer with PEEKs and POKEs helps only if the program reads the same data table more than once.

After examining ROM, I developed a modification meeting all my requirements. Restore works as it always did until a line number is added—then it works the way I want it to. My modification supports tape or disk systems and operates under all disk operating systems. The patch works so well I have added it to my copy of NEWDOS80 2.0.

I will explain how to add this Restore patch to your operating system. In future columns, I will feel free to include the patch in my programs.

Patching Basic

How do you alter Basic? Depending on what you want to do, the process is fairly simple. Several exits from ROM to low memory let you interrupt and expand the normal process of Level II Basic. Disk Basic uses most of these exits, so the biggest difficulty in adding more Basic features is identifying the appropriate exit.

The execution phase of every Basic command starts at ROM location 1D5AH, where the first machine instruction is an RST 10H. An RST, or restart, is a 1-byte call to a frequently-used subroutine instead of a normal 3-byte call sequence. When a restart is performed, the Z80 processor pushes the next address (1D5BH in this case)

Changing the Basic language

onto the stack and then passes control to the RST address.

The instruction at 0010H is JP 4003H. The normal instruction at 4003H is JP 1D78H. As Basic begins to execute each new instruction, control jumps from 1D5AH to 0010H to 4003H to 1D78H—a circuitous route to jump ahead 30 bytes in memory. Several other routines in Basic also use RST 10H to call the subroutine at 1D78H, which gets the next character from the current command line or line of Basic, does some simple testing, sets the status flags according to the value found, and returns control to the calling routine. RST 10H is probably used dozens of times each second a Basic program runs.

An important point to remember is that 4003H is in RAM. You can put a new address for the JP instruction there and patch in your own routine. As long as your patch knows which ROM routine called it, it interrupts that routine and adds new features to Basic. Because the stack points back to the original caller, your routine merely has to examine the first two values on the stack to know whether it should interrupt.

With that in mind, and with the help of other ROM routines, I wrote Program Listing 1. The heart of the program, lines 580-950, uses only 48 bytes of memory and is completely relocatable. The first part of the program, lines 350-530, is a short routine that finds the top of unprotected memory, places the main program there, protects it, and correctly patches the interpreter exit at 4004H.

The main program works by testing the stack to see if RST 10H was called by the execution routine at 1D5BH. If that test fails, control is returned to normal interpreter flow in line 650; otherwise, you must make additional tests.

Lines 690-750 test to see if the next executable command is the token for the Restore verb. Again, if that test fails, control returns to normal program flow. When a Restore verb is found, lines 790-820 determine if it is followed by a numeric value. If not, the normal Restore routine is invoked. But when a numeric value does follow the verb, the final (and most important) part of the program is used.

Line 870 calls a ROM routine that translates the numeric value following the Restore verb into a line number and places the line number in the DE register pair. Then line 890 calls another ROM routine placing the address of the line in the HL register pair.

Finally, in line 910, the resulting address is placed in the read pointer at 40FFH—the objective all along. Then the stack and the HL buffer are tidied up and control passes back to the Basic interpreter as if nothing happened. The interpreter doesn't know it was interrupted by a new routine.

Using the New Restore

If you plan to use the new Restore with Disk Basic, you must first make one crucial test to be sure it works. Go to Disk Basic and run the following:

```
PRINT PEEK(&H4004); PEEK(&H4005)
```

If your computer does not respond with the values 120 and 129, your operating system is already patched into the RST 10H RAM exit. Use Debug to find the value stored in 4004H and 4005H (remember that the address is stored in least significant byte/most significant byte, LSB/MSB, order). Use that new value for the exit equate in line 290. The program documents other necessary changes.

Assemble Listing 1 as either a /CMD file or a system tape. Run the program and try the short test in Program Listing 2 (with a disk system, run Listing 1 before going to Disk Basic). If the

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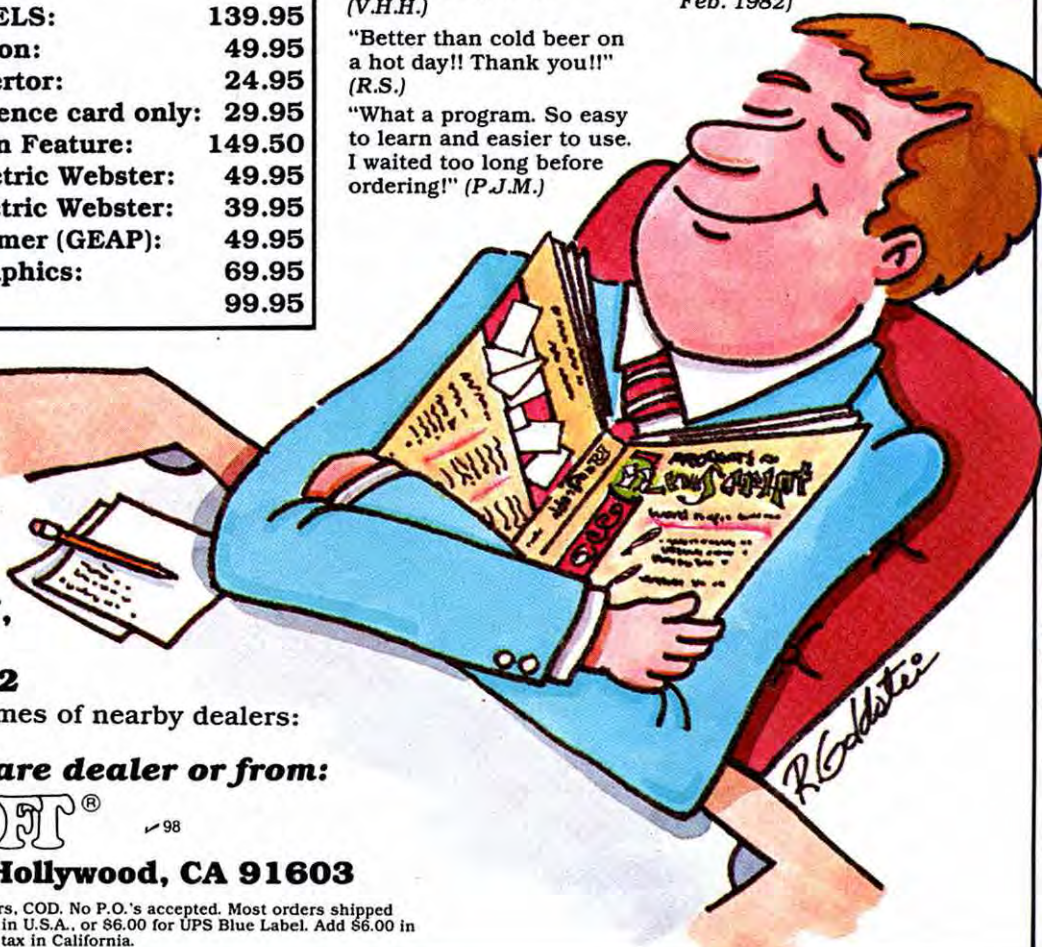
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```

00100 ;*****
00110 ;*
00120 ;* RESTORE/PATCH *
00130 ;*
00140 ;* Adds, in both Level II and Disk *
00150 ;* Basic, a variation of RESTORE *
00160 ;* to allow the new syntax *
00170 ;* RESTORE nnnnn to reset the READ *
00180 ;* pointer to any line (nnnnn) in *
00190 ;* the Basic program *
00200 ;*
00210 ;*****
00220 ;
00230 ;This version works as either a /CMD file
00240 ;or a system tape
00250 ;
1D78 00260 EXIT EQU 1D78H ;NORMAL RST10H JUMP
40A0 00270 STRING EQU 40A0H ;STRING ARFA POINTER
4049 00280 HIMEM EQU 4049H ;TOP OF MEM POINTER
00290 ; This HIMEM value for Mod.I Disk
00300 ; Use 4411H for Mod.III Disk
00310 ; Use 40B1H for Level II
00320 ;
7000 00330 ORG 7000H ;WILL FIT 16K-48K
7000 2A4940 00340 LD HL,(HIMEM) ;GET CURRENT MEM. TOP
7003 013000 00350 LD BC,30H ;PROGRAM LENGTH
7006 AF 00360 XOR A ;RESET CARRY FLAG
7007 ED42 00370 SBC HL,BC ;PROGRAM DESTINATION
7009 E5 00380 PUSH HL ;TRANSFER IT TO
700A D1 00390 POP DE ; DE REGISTER
700B 220440 00400 LD (4004H),HL ;PATCH RST10H VECTOR
700E 2B 00410 DEC HL ;DROP COUNT
700F 224940 00420 LD (HIMEM),HL ;SET NEW MEM. TOP
7012 C5 00430 PUSH BC ;SAVE PROGRAM LENGTH
7013 01CEFF 00440 LD BC,-50 ;STRING SPACE
7016 09 00450 ADD HL,BC ;NEW STR. SPACE ADDR.
7017 22A040 00460 LD (STRING),HL ;CHANGE POINTER
701A C1 00470 POP BC ;GET BACK PRG. LENGTH
701B 212370 00480 LD HL,START ;HL=>BEG. OF MAIN PROG.
701E EDB0 00490 LDIR ;TRANSFER PROGRAM
7020 C32D40 00500 JP 402DH ;RETURN TO DOS READY
00510 ; NOTE -- In Level II, use JP 06CCH
00520 ;
00530 ;*** MAIN PROGRAM -- This is the part that is saved
00540 ; in protected high memory
00550 ;
00560 ;First, test if RST10H called by Basic execution driver
00570 ;
7023 E3 00580 START EX (SP),HL ;GET TOP OF STACK
7024 7D 00590 LD A,L ;GET LSB OF STACK VALUE
7025 FE5B 00600 CP 5BH ; AND TEST IT
7027 2003 00610 JR NZ,NO ;GO IF NOT 5BH
7029 7C 00620 LD A,H ;GET MSB OF STACK VALUE
702A FE1D 00630 CP 1DH ; AND TEST IT
702C E3 00640 NO EX (SP),HL ;STACK & HL RESTORED
702D C2781D 00650 JP NZ,EXIT ;GO IF NOT CORRECT CALLER
00660 ;
00670 ;Now test for RESTORE token
00680 ;
7030 CD781D 00690 CALL 1D78H ;GET NEXT VALUE IN REG. A
7033 FE90 00700 CP 90H ;RESTORE TOKEN?
7035 2804 00710 JR Z,YES ;GO IF TOKEN FOUND
7037 2B 00720 DEC HL ;ELSE CORRECT POINTER
7038 C3781D 00730 JP EXIT ;NOW LET BASIC WORK
00740 ;
00750 ;RESTORE token found -- now check for line
00760 ; number following it
00770 ;
703B CD781D 00780 YES CALL 1D78H ;IS NEXT VALUE NUMERIC?
703E 3803 00790 JR C,YES2 ;GO IF IT IS
7040 C3911D 00800 JP 1D91H ;ELSE TO NORMAL RESTORE
00810 ;
00820 ;RESTORE token followed by a numeral -- assume it is
00830 ; a line number, otherwise UNDEFINED LINE # error
00840 ;
7043 CD5A1E 00850 YES2 CALL 1E5AH ;GET LINE # IN DE
7046 E5 00860 PUSH HL ;SAVE POINTER
7047 CDC81E 00870 CALL 1EC6H ;GET LINE ADDR. IN HL
704A 2B 00880 DEC HL ;GO BACK ONE SPACE
704B 22FF40 00890 LD (40FFH),HL ;PUT IT INTO READ POINTER
704E E1 00900 POP HL ;GET POINTER
704F 2B 00910 DEC HL ;CORRECT POINTER
7050 C3781D 00920 JP EXIT ;BACK TO BASIC EXEC.
7000 00930 END 7000H
00000 TOTAL ERRORS

```

Program Listing 1

number anywhere the old RESTORE is used except as part of an If...Then statement. If...Then has its own syntax checks and reports RESTORE 400 as a syntax error. Also, if you use a renumbering utility, you'll probably find that it won't correct line numbers

"If the screen fills with asterisks, everything is working perfectly."

after RESTORE because it won't expect any. You will have to reset the line values yourself.

Making It Permanent

If you find the Restore patch useful, make it a permanent part of your operating system and a standard part of Disk Basic. I've successfully included it in both NEWDOS80 2.0 for the Model I and TRSDOS 1.3 for the Model III; you can add it to other Disk Basics using the same techniques.

Be sure that you work with a scratch copy of your operating system, never with the original or your primary backup. Also, keep careful records of your work. You might want to change the patch next week or next year, and without those records you'll have trouble.

Your first job is to find room in Disk Basic and in memory to patch in the new code. Most operating system writers include patch space in their major programs to allow for future updates and corrections.

I will start with NEWDOS80 2.0. Figure 1a shows the Superzap dump of BASIC/CMD's relative sectors 14D and 15D (as they are on my original copy of NEWDOS80). Sector 15 is composed almost entirely of zero bytes—a strong indication that it is zap space. In order to test whether this space is useful for patches and zaps, you need to know where in memory it loads.

Load Basic and perform as many Disk Basic functions as you can, includ-

screen fills with asterisks, everything is working perfectly. If you get an error message, or if any zeros appear on the screen, examine Listing 2 first, and then check Listing 1.

The syntax for the new Restore com-

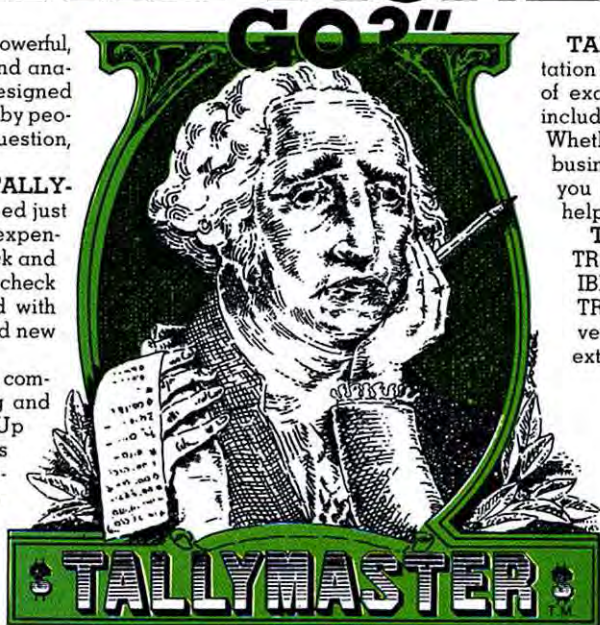
mand is exactly what you expect. If you wish to read a block of data starting in line 400, enter RESTORE 400 or RESTORE400. RESTORE without a line number works as it always has, and you can use RESTORE followed by a line

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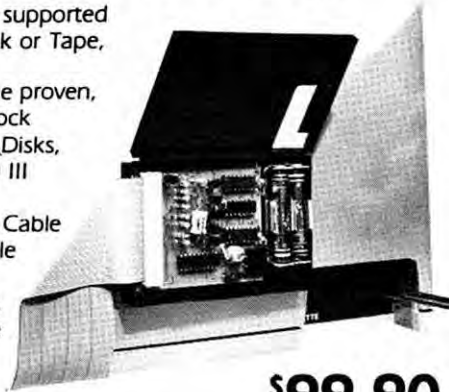
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Relative sectors 0EH & 0FH (14D & 15D) of BASIC/CMD in NEWDOS 80 v.2 (Model I) before modifications:

DRV	00	D977	BEC2	C957	7022	B140	11CE	FF19	22A0	.w...Wp".e....".
0	10	4021	5C67	CD67	4421	FEFF	22A2	4021	CA64	@l\g.gDl...".@l.d
0H	20	22A7	4021	6943	CBBE	3A6C	43CB	773E	C928	".@liC...:lC.w>.(
	30	067C	3221	643E	C332	1243	21BB	6711	5241	.|2ld>.2.Cl.g.RA
DRS	40	0193	00F3	EDB0	3E03	3289	5F21	BE66	3134	.....>.2..l.f14
99	50	65FB	B728	1108	ED4B	C564	3600	0B23	78B1	e...(...K.d6..#x.
63H	60	20F8	083D	20EF	3600	2322	A440	112C	0119	...=.6.#".@...~
	70	EB2A	B140	DFDA	C957	CD4D	1B21	0000	7EFE	*.e...W.M.l...~
	80	2A20	1701	0000	2AA4	4071	2370	2100	00CD	*...*.e.gDl...".@l.d
	90	5A1B	21E9	5422	5E65	1804	FE0D	2806	2189	Z.l.T"~e...(...l
A0	6522	0552	C319	1AE1	2133	0022	0552	C521	e".R...l3".R.l	
B0	AC65	CD67	44ED	5B5E	652A	A740	1AFE	0D77	.e.gD.[^e*.e...w	
FRS	C0	1323	20F8	AF55	2BC3	7903	1D1B	1F03	0100	.#.....+y.....
14	D0	C965	0000	0000	2A2A	237E	FE3D	C9C5	CDE1	e.....**#".=.....
EH	E0	6179	C1C9	ED5B	C564	C900	0000	0000	0000	ay...[.d...}.[.+
F0	0000	0000	0000	0000	0000	0000	0000	0000	0000	.....x...x...x...x
DRV	00	0000	0000	0000	0000	0000	0000	0000	0000	.....
0	10	0000	0000	0000	0000	0000	0000	0000	0000	.....
0H	20	0000	0000	0000	0000	0000	0000	0000	0000	.....
	30	0000	0000	0000	0000	0000	0000	0000	0000	.....
DRS	40	0000	0000	0000	0000	0000	0000	0000	0000	.....
100	50	0000	0000	0000	0000	0000	0000	0000	0000	.....
64H	60	0000	0000	0000	0000	0000	0000	0000	0000	.....
	70	0000	0000	0000	0000	0000	0000	0000	0000	.....
	80	0000	0000	0000	0000	0000	0000	0000	0000	.....
	90	0000	0000	0000	0000	0000	0000	0000	0000	.....
A0	0000	0000	0000	0000	0000	0000	0000	0000	0000	.....
B0	0000	0000	0000	0000	0000	0000	0000	0000	0000	.....
FRS	C0	0000	0000	0000	0000	0000	0000	0000	0000	.....
15	D0	012A	C766	0000	0000	0000	0000	0000	0000	.....
EH	E0	0000	0000	0000	0000	0000	0000	0000	0000	.....
F0	0000	0000	0000	0000	0000	0000	0100	0440	BC66	.....

Figure 1a

ing loading and writing files, defining functions, and using the extended line-editing capabilities of the DOS. Finally,

use Debug to see if the space is still set to all zero bytes. If it is, you can assume the space is safe to use.

Relative sectors 0EH & 0FH (14D & 15D) of BASIC/CMD in NEWDOS 80 v.2 (Model I) after modifications (changes are underlined>):

DRV	00	D977	BEC2	C957	7022	B140	11CE	FF19	22A0	.w...Wp".e....".
0	10	4021	5C67	CD67	4421	FEFF	22A2	4021	CA64	@l\g.gDl...".@l.d
0H	20	22A7	4021	6943	CBBE	3A6C	43CB	773E	C928	".@liC...:lC.w>.(
	30	067C	3221	643E	C332	1243	21BB	6711	5241	.|2ld>.2.Cl.g.RA
DRS	40	0193	00F3	EDB0	3E03	3289	5F21	BE66	3134	.....>.2..l.f14
99	50	65FB	B728	1108	ED4B	C564	3600	0B23	78B1	e...(...K.d6..#x.
63H	60	20F8	083D	20EF	3600	2322	A440	112C	0119	...=.6.#".@...~
	70	EB2A	B140	DFDA	C957	CD4D	1B21	0000	7EFE	*.e...W.M.l...~
	80	2A20	1701	0000	2AA4	4071	2370	2100	00CD	*...*.e.gDl...".@l.d
	90	5A1B	21E9	5422	5E65	1804	FE0D	2806	2189	Z.l.T"~e...(...l
A0	6522	0552	C319	1AE1	2133	0022	0552	C521	e".R...l3".R.l	
B0	AC65	CD67	44ED	5B5E	652A	A740	1AFE	0D77	.e.gD.[^e*.e...w	
FRS	C0	1323	20F8	AF55	2BC3	7903	1D1B	1F03	01FA	.#.....+y.....
14	D0	C965	0000	0000	2A2A	237E	FE3D	C9C5	CDE1	e.....**#".=.....
EH	E0	6179	C1C9	ED5B	C564	C900	<u>E37D</u>	<u>FE5B</u>	<u>2003</u>	ay...[.d...}.[.+
F0	0000	0000	0000	0000	0000	0000	<u>FE90</u>	<u>2804</u>	<u>2BC3</u>	|.....x...x...x...x
DRV	00	<u>781D</u>	<u>CD78</u>	<u>1D38</u>	<u>03C3</u>	<u>911D</u>	<u>CD5A</u>	<u>1FE5</u>	<u>CDC8</u>	x...x.8.....Z....
0	10	<u>1E2B</u>	<u>22FF</u>	<u>40E1</u>	<u>2BC3</u>	<u>781D</u>	0000	0000	0000	.+".e.+x.....
0H	20	0000	0000	0000	0000	0000	0000	0000	0000	.....
	30	0000	0000	0000	0000	0000	0000	0000	0000	.....
DRS	40	0000	0000	0000	0000	0000	0000	0000	0000	.....
100	50	0000	0000	0000	0000	0000	0000	0000	0000	.....
64H	60	0000	0000	0000	0000	0000	0000	0000	0000	.....
	70	0000	0000	0000	0000	0000	0000	0000	0000	.....
	80	0000	0000	0000	0000	0000	0000	0000	0000	.....
	90	0000	0000	0000	0000	0000	0000	0000	0000	.....
A0	0000	0000	0000	0000	0000	0000	0000	0000	0000	.....
B0	0000	0000	0000	0000	0000	0000	0000	0000	0000	.....
FRS	C0	0000	0000	0000	0000	0000	0104	0440	E165	.....e.e
15	D0	012A	C766	0000	0000	0000	0000	0000	0000	.....
EH	E0	0000	0000	0000	0000	0000	0000	0000	0000	.....
F0	0000	0000	0000	0000	0000	0000	0000	0100	BC66	.....f

Figure 1b

To find the load address of the code in the sector, scan through the entire sector looking for a 01 byte. This could be a data value, a file load marker signaling that a section of code is to be loaded, or a machine-language instruction to load register pair BC with the following 2 bytes.

If the 01 is a file load marker, it is followed by a 1-byte value indicating how many bytes are to be loaded (00=256). If you start counting from the first byte after the count indicator, the count ends on the last byte before the next file load marker (which could be on the next sector). In sector 14, the file loading marker is at relative byte 0CEH and is followed by a count of 256 (or 00).

The 2 bytes after the load marker and load count indicate the memory load address of the subsequent data. (These 2 bytes are in LSB/MSB order.) The 2 bytes at D0 and D1 indicate the load address of 65C9H. In the area of this address, make sure that Basic won't write over the zeros.

Now to install the patch. Two different patch sections are needed—one to place the code in memory and a second to place the code's address at 4004H. The 256 bytes that would have been loaded at 65C9H must be broken into two smaller pieces. You need 6 bytes of disk space to patch the RST 10H exit, so the first job is to change the load count at relative byte CFH to FAH.

The actual code is inserted on the disk starting at relative byte EAH. By using the load address of 65C9H and counting forward, you can easily calculate that this code starts at 65E1H when loaded into memory. The program code spans from the end of sector 14 to the beginning of sector 15.

Now, load the new RST 10H exit address by starting at relative byte CAH of sector 15. First, place the 01 load code on the disk followed by a 04-count byte. Then the RST 10H exit address in LSB/MSB format and the address that the main code section has in memory are zapped onto the disk. When you finish, the two sectors should look like those in Fig. 1b. Notice the change at byte CFH of sector 14; the other changes are easy to see.

Changing TRSDOS 1.3

To patch the Disk Basic in TRSDOS 1.3 (Model III), use the File Patch utility of Debug. However, Basic's password

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```

1  |*****|
2  |*      |
3  |*      TEST Program for      |
4  |*      RESTORE Patch        |
5  |*      |
6  |*****|
7  |
10 |CLS
20 |FOR I = 0 TO 1023
30 |RESTORE 90
40 |READ AS
50 |PRINT AS;
60 |NEXT I
70 |GOTO 70
80 |DATA 0
90 |DATA *
    
```

Program Listing 2

PATCH *5 (ADD = 52ED, FIND = BE, CHG = 00)

TRSDOS Basic doesn't appear to have patch space, but room exists at the end of the file. In the directory, the end of the file is marked as the end of the 20th sector, but that sector actually ends at relative byte B9H. You can use the rest of the space without changing the directory. Also, about 300 bytes of empty space exist in memory between the end of Basic and the beginning of the Basic program (this increases when file space is reserved). Use this space for patching.

Figure 2a shows the last sector of Basic as it appears in Debug. To get to it, enter Debug from DOS Ready, then press F and answer the prompt with BASIC/CMD. Use the + key to move to sector 14H. At byte B6, you will see 0202 4D61. The first 02 is a file-loading code instructing the system to stop load-

ing bytes into memory and to now find a transfer address (address where a program begins). The second 02 indicates that 2 bytes are used for the address. The 4D61 tells the system to jump to 614DH and start processing from there.

Move the transfer address instructions toward the end of the disk to make room for the Restore patch. The modification is shown in Fig. 2b. Starting at relative byte B6, a 01 load code and 32 (hex) count byte are entered, followed by a load address of DD64 (64DDH). Then the 48 bytes of modification are entered. At relative byte E9, another 01 load code and a 04 count are entered, followed by the address of the RST 10H exit and the new address to be patched there. Finally, starting at relative byte EF, the transfer code of 02 02 4D 61, that was originally at byte B6, is put back in. After you hit enter, the modification will be part of your copy of TRSDOS.

normally keeps you from viewing or altering it. Before you start altering Basic, disable the password check in the File Patch utility by applying the following patch from TRSDOS READY:

PATCH *5 (ADD = 52EB, FIND = CB, CHG = 36)

Final Comments

Run Listing 2 after modifying your operating system to be sure that you installed the modification properly. Any erratic operation will indicate a misplaced byte somewhere on the disk.

As of this writing, I have used a modified NEWDOS80 2.0 disk for over six months without any problems, but I can't guarantee that you won't have any. I tested the TRSDOS 1.3 modification, but, since I don't normally work with a Model III, I can only say that it looks trouble-free. If you have problems with the modification routine being overwritten, let me know.

Finally, let me offer one warning about the Restore modification. If you return to DOS from Basic without a reboot, the modification will still be in place and functioning. If you then execute either a library function or a CMD program that overwrites the memory area where the patch resides, and if DOS or that program subsequently uses a RST 10H command, you will have problems. The computer is likely to lock up or reboot. To prevent this, reboot every time you leave Basic to run the culprit program.

Comments and suggestions about *The Next Step* are always welcome. If you would like a personal reply, please include a SASE with your letter. You can write to me in care of *80 Micro* or through e-mail on CompuServe where my PPN is 72165,735. ■

Sector 14H (20D) of BASIC/CMD in TRSDOS 1.3 (Model III) before modifications:

```

001400 FE21 3805 7723 1318 F636 00EB 18DA D7FE .18.w#...6.....
001410 4DF5 2805 FE46 C297 19D7 CF3A F128 3332 M.(.F.....:(32
001420 EC63 AF32 6E42 7ECD 5A1E FE56 2004 0186 .c.2nB~.Z..V....
001430 5864 326E 4223 7AB7 C2F0 617B FE10 D2F0 Xd2nB#z...a{....
001440 61F5 3E2A 32E4 63F1 E5CD 1E62 3600 2322 a.>*2.c...b6.#"
001450 A440 E1C3 1264 32ED 63CD 5A1E B7CA 9719 .@...d2.c.z.....
001460 E5FD E121 AFC9 22E9 5CCD 9762 21D5 C522 ...l...".\..bl..."
001470 E95C FDE5 E1C3 1264 3AEC 63B7 2010 3E2A .\.....d:c...>*
001480 32E4 633E 03CD 1E62 3600 2322 A440 3AED 2.c>...b6.#".@:
001490 63B7 200D 2A11 4411 FAFD DF38 01EB CD9F c...*.D...8....
0014A0 6221 F063 7EB7 CA91 62CD E562 2119 1AE5 bl.c~...b..bl...
0014B0 21F0 63C3 B35B 0202 4D61 E5E5 E5E5 E5E5 l.c...[..Ma.....
0014C0 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 .....
0014D0 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 .....
0014E0 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 .....
0014F0 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 .....
    
```

Figure 2a

Sector 14H (20D) of BASIC/CMD in TRSDOS 1.3 (Model III) after modifications (changes are underlined):

```

001400 FE21 3805 7723 1318 F636 00EB 18DA D7FE .18.w#...6.....
001410 4DF5 2805 FE46 C297 19D7 CF3A F128 3332 M.(.F.....:(32
001420 EC63 AF32 6E42 7ECD 5A1E FE56 2004 0186 .c.2nB~.Z..V....
001430 5864 326E 4223 7AB7 C2F0 617B FE10 D2F0 Xd2nB#z...a{....
001440 61F5 3E2A 32E4 63F1 E5CD 1E62 3600 2322 a.>*2.c...b6.#"
001450 A440 E1C3 1264 32ED 63CD 5A1E B7CA 9719 .@...d2.c.z.....
001460 E5FD E121 AFC9 22E9 5CCD 9762 21D5 C522 ...l...".\..bl..."
001470 E95C FDE5 E1C3 1264 3AEC 63B7 2010 3E2A .\.....d:c...>*
001480 32E4 633E 03CD 1E62 3600 2322 A440 3AED 2.c>...b6.#".@:
001490 63B7 200D 2A11 4411 FAFD DF38 01EB CD9F c...*.D...8....
0014A0 6221 F063 7EB7 CA91 62CD E562 2119 1AE5 bl.c~...b..bl...
0014B0 21F0 63C3 B35B 0132 DD64 E37D FE5B 2003 l.c...[.2.d.}.[.
0014C0 7CFE 1DE3 C278 1DCD 781D FE90 2804 2BC3 :...x.x.x...(+.
0014D0 781D CD78 1D38 03C3 911D CD5A 1EE5 CDC8 .....8.....Z...
0014E0 1E2B 22FF 40E1 2BC3 781D 0104 0440 DD64 +".@.+x....@.d
0014F0 0202 4D61 E5E5 E5E5 E5E5 E5E5 E5E5 E5E5 ..Ma.....
    
```

Figure 2b

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This edition of *The Color Key* is a mixed bag. I'm giving myself some slack time in which to evaluate your reactions to the column, and I have a couple of unrelated topics I'd like to discuss.

Color Keyboard

Slowly but surely, the world is depriving me of some favorite gripes. For the past month or so I've had the pleasure of using a real keyboard on my Color Computer.

The hardware in question is a classy 57-key unit marketed by the Micronix Corp. (#7 Gibraltar Square, St. Charles, MO 63301). It's a direct plug-in replacement for the standard calculator-style keyboard, assuming you have a Series E or earlier motherboard.

Series F keyboards attach in a different manner, so if you have a late-model CoCo you might want to contact Robert Brooks at Micronix to express your interest.

I've done a complete review of the keyboard for our sister publication, *HOT CoCo* (June 1983, p. 16). All I want to say here is that the keyboard works perfectly, allowing me to get maximum efficiency from my modest typing ability.

Micronix has relocated some keys to make room for four function keys (programming to be implemented later), but otherwise there is little for the user to relearn.

The Micronix keyboard sells for \$79.95, so it isn't an impulse purchase. Nevertheless, it beats the effort required to wire up and install a bare keyboard on your own. Check it out if you're into word processing in a big way.

Word Processing Progress

My enthusiasm for Howard Cohen's Telewriter (Cognitec, 704 Nob Ave., Del Mar, CA 92014) is well-known. I'm writing this column with the latest version, Telewriter 64, and it's a beauty. The product has had a prolonged gestation period, but what finally emerged was worth the wait.

Several new features have been added to my old friend, bringing it up to date with some of the other word processors that have appeared since my May 1982 review (*80 Micro*, p. 208). It is now possible to right-justify text, giving your

A collection of CoCo updates

correspondence a much more professional appearance. You can hyphenate and designate nonbreakable spaces, too.

Another welcome feature is the ability to change the position of page breaks. Have you ever prepared a thoroughly professional letter, only to have it print out with all the text on the first page and "Sincerely yours" at the top of the second?

A new command, clear-V (clear is the Telewriter control key), causes the cursor to advance through the text one page at a time so you can check page breaks. Blank lines can be added or deleted to reposition page breaks if need be, and you can mark the breaks with a nonprinting character.

The whole formatting process is aided by Telewriter's new-found ability to display three different text densities on the screen. In addition to the standard 24 51-character lines, you now have the option of going to either 64 or 85 characters.

Neither is of much use for the writing process unless you have a wideband video monitor, but the high-density formats can be handy for checking the appearance of finished material before committing it to print.

Telewriter now has user-adjustable tabs. The stops are first defined in an embedded command line that must be the first entry in the text file. The clear-enter combination advances the cursor to the next tab position from any point in the text. Previous versions of the program had predefined stops every eight

spaces, unsuitable for either paragraph indentation or the composition of tabular material.

I'd like to mention two more of the many new features: the ability to generate ASCII text files, and the program's increased text capacity.

ASCII files take longer to read and write, and occupy more tape or disk space, than Telewriter's usual compressed binary files. However, ASCII is a necessity if you want to run your material through a spelling checker.

I have been using Peter Stark's Spell 'N Fix (Star-Kits, P.O. Box 209, Mt. Kisco, NY 10549) for some time; ASCII conversions have been handled by a Basic program named Convert that came with the original disk version of Telewriter.

Unfortunately, the combination does not treat Telewriter's embedded command lines properly, so a text file that has been converted to ASCII, corrected, and converted back to binary for printing will generally have to be reformatted first.

Telewriter 64 has remedied that by including a new conversion routine whose output survives everything that Spell 'N Fix and I can throw at it. One peculiarity should be noted, though: When the ASCII version of a file is listed on the screen, Telewriter 64 prefixes embedded commands with a spurious lower-case k. Ignore it; when the file is read back into memory the command lines are in their proper form.

Finally, the size of the text buffer has increased. The disk version makes almost 25K of RAM available in a "64K" machine, in contrast to the 18K available under the old v2.0. The cassette version of the new program frees almost 40K.

Before you can realize this capacity, the computer must be capable of addressing all 64K of RAM. The modification is the same as the one you would perform to use FLEX, but Telewriter itself does not require the alternative operating system. And that brings me to my next topic.

The New Breed

I detect an interesting trend: People are writing software that takes advantage of the 64K CoCo modification without requiring FLEX or any other

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operating system.

The programs typically contain loader routines that change the memory map to the all-RAM configuration, patch in any required portions of the Basic ROMs, and take off. The usual result is more user-available RAM.

Although my own experience with 64K word processors is limited to Telewriter 64, I should at least mention the existence of another: Text Pro II (Cer-Comp, 5566 Ricochet Ave., Las Vegas, NV 89110).

I assume that this program unfolds the CoCo memory map in the usual way, although one item on the specification sheet catches my eye: the size of the text buffer. This weighs a hefty 54K, which makes me curious as to what's left in the program.

I've been using a couple of other 64K packages recently. Spectrum Projects (93-15 86th Ave., Woodhaven, NY 11421) has produced a trio of handy utilities on a single disk: 40K, which copies the Extended Color Basic ROM to high memory, freeing an additional 8K for user programs; Spool64, which

employs the unused 32K as a print spooler; and Romcrack, which allows you to make disk copies of most Radio Shack ROM packs.

The extra RAM liberated by the 40K program is available to the Basic programmer, as well as to the machine-language expert. Free memory varies from 31015 bytes with four graphics pages to 35623 bytes with a single page reserved. In all other respects, the computer plays as usual.

Spool64 performs high-speed relocation of text to the unused 32K; it is subsequently dumped to the printer. This frees the RAM normally addressed by Basic so that other tasks can be undertaken while printing proceeds at its own relatively slow speed.

Spooling is normally accomplished with outboard hardware. Spool64 provides a viable, minimum-cost alternative. It does require a printer capable of accepting data at 1200 baud, which leaves out my Line Printer VII. Thus I haven't been able to use the program myself.

Romcrack, the third utility, allows

you to make disk copies of ROM programs up to 8K in length, without needing the start, finish, and transfer addresses. You can even copy programs written in position-dependent code. For example, I've used the utility to add a copy of Project Nebula to my games disk.

Once you have transferred the ROM packs, you have eliminated a potential source of damage to the computer's cartridge connection. This can be worthwhile. Disk Basic's card-edge connector is a weak point of the whole Color Computer system, and repeated switching between the disk controller and a ROM cartridge might reduce system reliability.

It might be argued that Romcrack can make pirated copies of cartridge programs. In fact, programs for locating and changing position-dependent code segments have already appeared in print.

I prefer to think of the program as a convenience for the individual whose system has grown through the acquisition of a disk drive, and who wants to have most of his software on one

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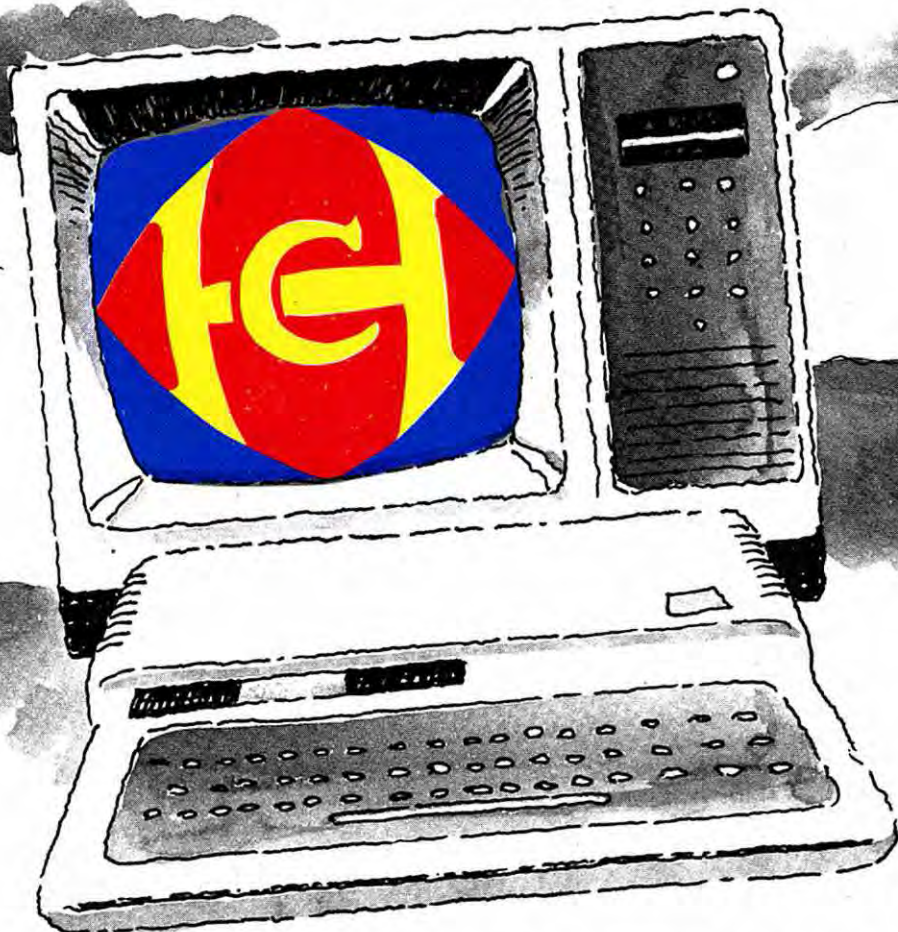
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medium. Piracy is going to exist for a long time, Romcrack or no.

Spectrum Projects' utility disk is reasonably priced at \$21.95.

Another new program intended to capitalize on 64K of addressable RAM has made an appearance. It's a data-file manager called Disk Data Handler, or DDH, and it comes from Mel Hefter at Custom Software Engineering (807 Minutemen Causeway, Cocoa Beach, FL 32931). I've only taken a quick look through the documentation, but DDH looks fairly potent.

It is used to construct and manipulate data files of various types and offers a screen editor, fast sorting/selection capabilities, and flexible report formatting. DDH is also used to construct files that are further manipulated by Basic programs.

It takes time to wring out a data-management program, so the complete report on DDH will have to wait. The point I want to make now is that the Color Computer is being treated as an honest 64K machine by applications software authors.

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That's as it should be. Color Basic is fine for your own programming, but commercial applications programs should not be limited to 23K of RAM when it's so easy to free up additional memory. Maybe some combination of FLEX, OS-9, and stand-alone programs like Telewriter and DDH will finally do the job for the Color Computer.

The Shack's blessing in the form of its own official 64K machine won't hurt, either.

Good Deals

You don't need to spend a bundle to get something worthwhile for the Color Computer. There are some good low-cost products, especially if you occasionally get out of computer stores.

For example, a recent trip to a local cooking-supply outlet produced a large clear acrylic stand, intended to hold cookbooks at a convenient angle. It now sits atop my computer, holding up magazines and notepads while I type into the machine. It handles a 500-page magazine with ease, it lets me see a complete double-page spread at one time, and it cost all of \$5.

I've previously gone on at some length about C.C. File, the \$7 program that Bill Dye produces (Trans Tek, 194 Lockwood Lane, Bloomingdale, IL 60108). It's an electronic notebook, or memo pad, or something; all I know is that it's an extremely convenient way to store unformatted information, and I use it to record anything that doesn't deserve the full data-base treatment.

Not that Dye is the only one turning out inexpensive software. Eigen Systems (Box 10234, Austin, TX 78766) has a couple of attractive items: The Stripper and Disk Timer.

The Stripper (\$7.95) is a utility that increases the efficiency of Basic programs by deleting remarks and unnecessary spaces, and by packing multiple statements onto a single program line. The idea is to save an archival copy of each of your programs, complete with explanatory remarks and the use of spaces to increase readability.

This code isn't used at run time, however. Instead, the Stripper is used to produce a tighter, faster-running version. You can always go back to the original if it becomes necessary to modify the program or to explain it to someone.

Disk Timer (\$6.95) is a software

tachometer. It takes ten one-second averages of disk speed and displays the individual readings and the high, low, and overall averages. A disk must be present in the specified drive.

The numbers can be helpful. Floppy drives are specified at 300 rpm, with a typical tolerance of ± 4 rpm; however, my Radio Shack Drive 1 starts acting flaky above 302 rpm, and it does drift upward over a period of several weeks. My guess is that the separation between recorded sectors becomes too small for reliable I/O well before the rated tolerance is exceeded.

Removing the drive's case reveals the likely culprit: a cheap speed-control potentiometer on the motor-control board. It's a little plastic job, quite possibly susceptible to drift. I have used Disk Timer as a real-time tachometer while adjusting the potentiometer; it makes things simple.

I've added a couple of lines to Disk Timer's Basic code to display the spread between high and low speed values, expressed as a percentage of the average. I find this a useful measure of drive stability. The modification is

```
65 XX=AT*(HI-LW)*100/AV
66 PRINT "SPREAD=";
PRINT USING "#.####", XX;
PRINT "%"
```

The MPI drive I use as drive zero doesn't have the speed-control problem.

One More Wish

Color Computer disk-system owners learn quickly how important it is to keep the drive-controller contacts clean. I use a squirt of contact cleaner on a cotton swab to remove oxides from the controller's card-edge connector. That avoids the destructive, abrasive action of the usual pencil-eraser treatment.

The connector inside the computer's case uses gold-plated contacts and doesn't need much attention. A gold-plated connector that could be soldered to the disk-controller card would prevent oxidation at that critical press-fit connection inside the cartridge slot.

I know that someone makes a similar product for Model I connectors. Now that I have a good keyboard maybe I'll make this my new crusade. ■

Scott Norman welcomes reader response to the Color Key. Write c/o 80 Micro, 80 Pine St., Peterborough, NH 03458.

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- Transfers old files over to our system. ← **LOOK!**
- Zip order is "sub-alphabetized."
- Less than 5 digit zips have leading 0's appended.
- Supports 9 digit zips, **Canadian zips**, and foreign abbrev.
- Backup data disks are easily updated as entries are created, edited, or sorted...extremely useful!!
- Optional reversal of names about commas. This permits disk storage in last-name-first order to facilitate meaningful alph. order while the printout will be in "natural" order.
- Permits telephone, account, and/or serial numbers, etc.
- Prints on envelopes or on labels, 1, 2, 3 or 4 across.
- Test label/envelope printing lets you make horizontal and vertical adjustments with ease.
- Master printout of your list in several formats (not just a re-hash of the labels)...extremely useful.
- Selective printing by specific zips or by zip range.
- Editing is simple and fast...direct access or automatic search...Batch transfer of edited entries to backup disks.
- Optionally provides for duplicate labels to be printed.
- Deleted entries have "holes" on disk filled automatically and alph. order is still maintained!
- System adjusts to any DOS.
- Our automatic repeat feature allows often used names/addresses to be entered with a single key stroke.
- Load and "scroll"/edit through entries on disk.
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- All 0's in address labels are replaced by easier to read Ø's.
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- Each disk entry automatically "remembers" how many mailings have been made for that particular entry...Can be tied in with purge/select.
- Extensive assortment of extra cost options for customized master list printout (in addition to the standard one mentioned above), transfer of entries between disks, summary reports, and "publisher's" type multiple list label printouts.
- Continuing **expert** support just a phone call away. You will be able to discuss your problems/modifications with the authors.
- Hardware requirements: 32K, printer and 1 or 2 drives.

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- Selectable tabing, test printing, and paging.
- Allows regular or legal size pages.
- Greetings are selectable by codes on mailing list. Options include Mr./Mrs., First/Last Name, global, or user defined.

SIGN (Supplied on tape, can be transferred to disk) \$19.95

Produce large (reduced 50% here) attention getting signs.

```

SSSSSSSS  TTTTTTTTT  00000000  PPPPPPPPP  LL  00000000  00000000  XX  JJ
SS  SS  TTTTTTTTT  00  00  PP  PP  LL  00  00  00  00  00  XX  JJ
SS  TT  00  00  PP  PP  LL  00  00  00  00  00  XX  JJ
SSSSSSSS  TT  00  00  PPPPPPPPP  =====  LL  00  00  00  00  00  XX  JJ
SSSSSSSS  TT  00  00  PPPPPPPPP  LL  00  00  00  00  00  XX  JJ
SS  TT  00  00  PP  LL  00  00  00  00  00  XX  JJ
SS  SS  TT  00  00  PP  LL  00  00  00  00  00  XX  JJ
SSSSSSSS  TT  00000000  PP  LLLLLLLLL  00000000  00000000  XX  JJ
    
```

SUPER CALENDAR (Supplied on tape only) \$19.95

Prints out calendars of individual months of years ranging from 1583 to any time in the future. Standard banker's holidays are noted..Additionally prints out large "graphics" type wall calendars with memos under each day...Use as a planning calendar with optional disk storage...Requires 16K and a printer.

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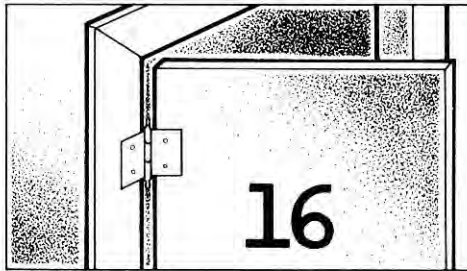
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Drive errors and other bugs

Mr. Jim Girardi of Ocean City, MNJ, wrote a Model II program using a CP/M system from the Software House (P.O. Box 16020, Fort Worth, TX 76133). He wanted to make his program available for customers with Model 16 computers. With the Mod 16 in the Model II mode, the CP/M disk refused to recognize the second disk drive (drive 1). Every time the program tried to access the drive, a "drive not ready" error occurred.

The CP/M manufacturers already had the problem fixed. Mr. Girardi just sent them \$25 and his licensed CP/M disk, and they returned a Model 16 version.

They plan to offer a Model 16 CP/M version that uses double-sided disks and the MC68000 microprocessor.

You'll also find this "drive not ready" error when you use Model II TRSDOS on the Model 16 in the Model II mode; in particular, you'll find it when you do a back-up or format on the second drive.

Model II drives rotate constantly, so they're always up to speed. If after about 20 seconds the disks are not accessed on the Model 16, they are programmed to stop rotating. This saves wear and tear on disks, but the drives

take 8/10 of a second to reach the proper speed. If the computer tries to access a disk too quickly, it is signalled that the drive is not ready.

To get around this problem, copy your programs onto the latest version of Model II TRSDOS (TRSDOS 2.0b), using FCOPY. Or, you could simply copy the THINLINE utility over to your old disk. Regardless of the method used, you ultimately have to run THINLINE from the TRSDOS Ready mode. This tells the computer to wait until the disk drives are up to speed before attempting

a read or write.

The TRSDOS 16 Drive command lets you set parameters to access different types of drives. This DOS command makes THINLINE and its opposite function, UNTHIN, unnecessary. Of course, if you set up the drives in the Model 16 mode and then reboot to the Model II mode, the parameters are not saved.

Engineering Literature

Motorola, maker of the MC68000 microprocessor, offers a large selection of application notes, data sheets, and other hardware-related publications. We picked up a free document on the technical aspects of the MC68000.

They also have hundreds of bulletins and pamphlets on topics such as A to D and D to A conversion, CMOS devices, memories, microprocessors, interfacing, instrumentation and control, phase locked loops, power supplies, and rf signal design.

For more information, contact Motorola's Literature Distribution Center, P.O. Box 20924, Phoenix, AZ 85036. Ask for their "Technical Literature in Inventory" directory and their "Application Note and Engineering Bulletin Catalog" number CTG3R14. ■

Assembly-Language Corner

A typographical error appeared in the February Assembly-language corner. Somehow we managed to leave a space out of a critical line.

The problem is an odd-address, trap-error message that does not show up during the assembly. The last few lines of the listing shown appear as follows.

```
MESSAGE      TEXT      '80 MICRO'
SVC BLOCK    DATAB     13
              RDATA    32,0
              END       BEGIN
```

A space should be included inside the quoted text so that it reads:

```
MESSAGE TEXT      '80 MICRO '
```

All instructions for the MC68000

must fall on an even-numbered memory address, because it's a 16-bit microprocessor and instructions are one word (2 bytes) long.

The instruction SVC BLOCK RDATA 32,0 begins on an odd address because of the uneven number of bytes in the message section. The message text '80 MICRO' has an even number of characters, but the following byte, an ASCII 13 carriage return, places the next instruction on an odd address.

There are two other ways to fix the problem. An extra byte of memory could be reserved ahead of the SVC BLOCK by adding another DATAB 13 statement.

Mr. Jacob Heskes of Rockville Centre, NY, solved the problem by

simply switching the message section behind the SVC BLOCK.

More Bugs

One problem with new equipment is bugs in hardware, software, or documentation.

Page 142 of the Model 16 owner's manual contains a misprint. It shows data on the CLOSEF supervisor routine. Near the top of the page is the identifying supervisor call: 133. But later on that same page, a sample program uses 265 in the EQUW instruction. 133 is actually the identifying supervisor number.

The next problems all fall under the OPEN supervisor routine section beginning on p. 177 in the manual.

First, the manual describes some-

thing called a "user attribute byte." This is a number used to identify a file within your program. On p. 178 it states "you can use zero or any number from 32-255 for this value. TRSDOS will not examine this user attribute...." Both statements are incorrect.

When we tried the number zero as a user attribute, the file became password-protected. The computer must make up its own password and protect the file. Of course, the file is valueless since there is no way to know the password. And since this password protection is activated, the disk operating system must be examining that byte.

One final major error exists in the open routine. The following excerpt is from an example showing how to use the open supervisor routine. It appears on p. 179 of the owner's manual.

```
MOVW @A1,#WRITE ACCESS
MOVW 1@A1,#RECORD LENGTH
MOVW 2@A1,#FIXED FILE
```

```
MOVW 3@A1,#OPEN ONLY IF EXISTS
MOVW 4@A1,#USER ATTRIB
```

Line 4@a1,#USER ATTRIB should read 4@A1,#USER ATTRIB with a capital "A" for the address register.

The real problem is in the MOVW (move a word) instructions. We were unable to get the sample program to work. Since only a single byte needs to be loaded under each of the five Move instructions, we changed the W's to B's (to indicate a byte operation) and the program ran fine.

```
MOVB @A1,#WRITE ACCESS
MOVB 1@A1,#RECORD LENGTH
MOVB 2@A1,#FIXED FILE
MOVB 3@A1,#OPEN ONLY IF EXISTS
MOVB 4@A1,#USER ATTRIB
```

We invite you to send us any comments, ideas, or errors you encounter. We will try to duplicate errors and report them to other unsuspecting programmers. ■

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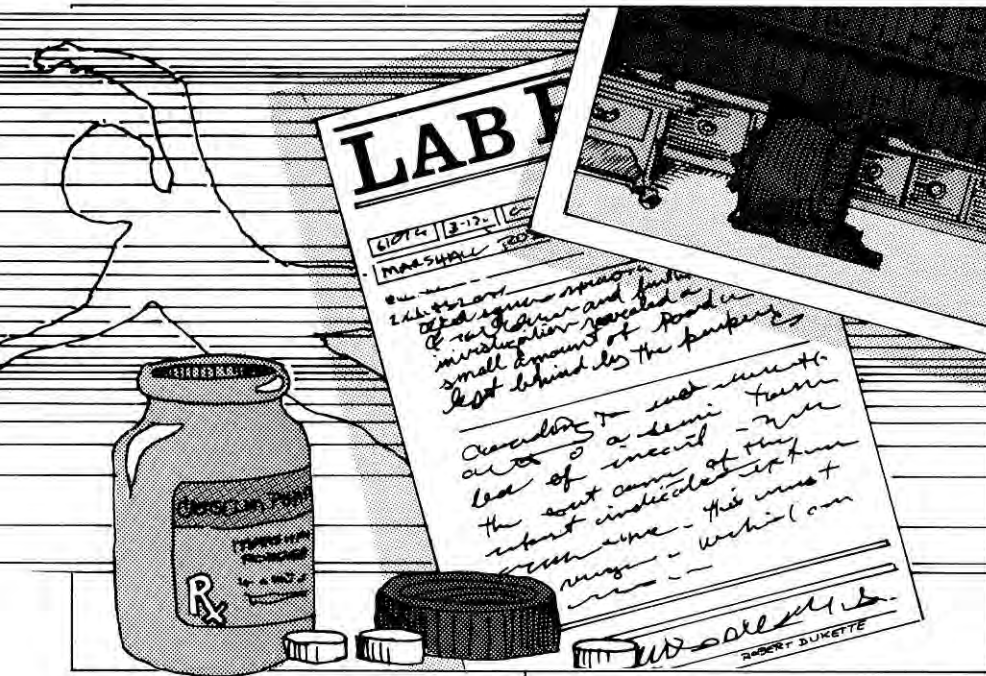
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Bel Case
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★★★★½

Deadline
Infocore Inc.
 55 Wheeler St.
 Cambridge, MA 02138
 Model III, 32K, one disk
 \$49.95

by Eric Grevstad
 80 Micro staff

Poor Marshall Robner. His wife is cheating on him with a ski instructor. His son George is an irresponsible wastrel, running up huge gambling debts when he's not lying around listening to records; in fact, Robner was planning to write George out of his will. His business partner, Baxter, is selling the company to a greedy conglomerate, over Robner's dead body.

Literally. One or more of the above suspects, or perhaps Robner's secretary or gardener or housekeeper, murdered him, cleverly leaving his body in a locked room with a fatal overdose of antidepressant pills, prescribed after he'd threatened suicide, in his stomach. Marshall Robner's troubles may be over, but yours are just beginning.

This is the premise of *Deadline*, the wittiest, most thoughtful, and most rewarding adventure yet. Apple and IBM magazines and journals like *The New York Times* have raved about the game since its debut last fall; the TRS-80 version, finally in distribution,

is worth the wait.

Deadline's documentation alone is more fun than many adventures. Besides meeting your own character (a master detective, summoned by the family lawyer), you're given a full dossier on the case: coroner's and lab reports, photo of the library with overturned chair and chalk outline of Robner's body, plastic packet of pills found at the scene, and transcripts of interviews with the suspects. Your predecessors, intimidated by that pesky locked door, are ready to call it suicide and close the file.

You have 12 hours—8:00 a.m. to 8:00 p.m.—to roam the Robner mansion and crack the case. Arrest someone and a letter from headquarters purveys the result. In my attempts so far, the D.A. has refused to indict due to lack of evidence; better sleuths will obtain a trial and conviction. Move too slowly and the Chief Inspector escorts you to the door.

Deadline comes on a TRSDOS disk and lets you save games in progress on another disk. You can also make a transcript of your investigation if a printer's on line, an excellent feature. The top line of the display shows your current location and the time, which ticks away at about one minute per move. You can't examine a room and be done with it, either; the foyer that's empty at 8:30 will not be vacant at 10:52.

You're free to wander the house and grounds to search for evidence; you're

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

aided by the indispensable Sergeant Duffy, who materializes from nowhere and whisks off to the lab when you want to analyze something ("His efficiency and quiet dedication impress you quite a bit"). Most of all, you're obliged to talk with the suspects. They range from charming to surly, and you'll find they lie through their teeth.

This interaction is carried out in the most natural, challenging prose in the adventure genre. *Deadline* uses complete sentences, as does the celebrated *Zork* series. In handling objects, "Examine the red herrings carefully" and "Put the pencil, the teacup, and the sugar bowl on the desk" are allowed. In quizzing suspects, "Mr. Baxter, tell me about the merger" and "Mrs. Robner, where is the new will?" are standard practice.

My one complaint about *Deadline's* vocabulary is, I suppose, that it isn't infinite. When I try something other than "Tell me about" or "Where is," the program interrupts with "Detectives are expected to know how to conduct a proper interrogation." No one will tell me whether Robner was right-handed, and I haven't been able to prompt

suspects who exclaim "Murder? But how do you know it was murder? I'm sure—" and then break off.

Even if your sentences are accepted, you'll soon be gnashing your teeth in gleeful frustration. The suspects are as cool a bunch as ever stonewalled Sherlock. They walked past me, brushed their hair, or lay down while I stood, ignored, in the bathroom or bedroom. They were never shocked into confession when I showed them bits of evidence ("Have you nothing better to do than pick up every object in the house and show it to me?").

The game taunts you as Jack the Ripper did Scotland Yard. One window, you're told, is too dirty to see through; when you retort "Wipe window," Deadline comments "Think you're clever, don't you?" and says it can't be cleaned that easily. Try something impossible ("Take bed" or "Get Mr. Baxter") and other adventures say "You can't do that." Deadline replies "Surely you jest."

In fact, part of the fun of Deadline is trying stupid moves for the sake of seeing the answers. Look under a bed, examine a toilet, try to kiss or molest a suspect or steal the silverware, or climb onto a dresser and jump off ("Wheeee!"), and you'll find Interlogic's Marc Blank ("Principal Architect," if you read the house's cornerstone) has anticipated you.

All adventures are to some extent interactive, letting you do certain things depending on whether you have certain objects. Deadline tops them all. Not only does the game know what you're totting, even if you forget ("You must be crazy, carrying that ladder inside the house!"), but the same suspect will answer the same question differently, depending on what you've discovered before asking.

In addition to different endings (carrying the Inspector Clouseau persona to the limit, I accidentally killed myself several times), the documentation hints that Deadline supports different solutions—if you find the right evidence, you can make a case against and convict several people. This should keep even competent detectives busy until summer; Witness, Infocom's second mystery, is due then.

In the meantime, I'd be happy to convict anybody, or even to get on the murderer's nerves and be killed. That would mean I'm getting warm. ■

★ ★ ★ ★

MicroTerm
Micro Systems Software Inc.
4301-18 Oak Circle
Boca Raton, FL 33431
\$79.95

by **G. Michael Vose**

MicroTerm, or MTerm, is a terminal program for the Models I/III (and the IBM PC) from the folks who gave the world DOSPLUS. With MTerm and a modem, you can tune your computer into the network nation; information services like CompuServe and BSR After Dark, or one of hundreds of bulletin boards, are within your reach.

MTerm supports a range of baud rates, from 110 baud to 19.2 kilobaud. It supports automatic telephone dialing and macro-keys, which store often-used phrases or keystroke sequences.

MTerm also provides user-definable translation tables that filter printer output to translate ASCII control codes for your printer.

MTerm stores the data it captures on disk or it loads a file from disk and transmits that file to an information service or other computer.

The Features

Among MTerm's primary features is its adjustable RS-232 parameters. These parameters include baud rate, number of bits-per-data word, number of stop bits, and parity. Adjusting these parameters is simple; select "Set RS-232 parameters" and type in any new settings, or press enter to leave a current setting unchanged. The default MTerm setting for RS-232 communications is 300 baud, 7-bit words, 1 stop bit and even parity.

MTerm has two principal modes, the terminal mode, signified by a blinking dash (hyphen), and the command mode, identified by a full screen menu.

The MTerm command menu lets you change a number of settings for special communications, including your own screen's echo (duplex), elimination of carriage returns or line feeds, or putting your printer on-line to print all incoming and outgoing communications. You can change these settings with a single key.

These features are similar to many terminal programs. Where MTerm rises

above the crowd is in its ability to assign frequently used phrases and keystrokes to single keys (called *macro-keys*), and its ability to store up to 10 telephone numbers for modems with an auto-dial function.

MTerm's macro-keys are useful for storing sign-on or log-on messages. For example, when you access CompuServe, your identification number and password are requested. With MTerm, you can assign this information to macro-keys to streamline your log-on—with the added plus that you don't have to remember your user number or password.

MTerm stores from one to 64 characters for each macro-key and 10 macro-keys are available.

Similarly, you can store telephone numbers that are called with single keystrokes, greatly simplifying the dialing process for your auto-dial modem.

Printer Support

One question you should always ask before purchasing a software product is, "Will it work with my printer?" With MTerm, the answer is yes. Even more important, however, is MTerm's ability to take advantage of your printer's special features.

MTerm takes care of special-feature support by providing user-definable translation tables through which all files are sent to the printer. These translation tables replace the control codes of one printer or software package with the codes required by your printer. For example, if your printer uses an ASCII 0EH to engage its double-wide print mode, you can build a translation table that converts the code used by a word-processing package or another printer to 0EH so that your printer prints in the desired mode.

Setting up MTerm's translation tables for your printer is straightforward. You'll need your printer manual to find the codes it uses and you'll need to know the printer control codes used by the program to be translated. With this information, building tables is a snap.

Utilities

MTerm comes with two utilities to transfer non-ASCII files (XFER/CMD) and to convert a file into ASCII for use with MTerm (FILECONV/CMD). These utilities enhance the power of

MTerm without complicating the main program.

The Acid Test

Using MTerm is a real pleasure. The program is fast and its screen displays are easy to understand. Its adjustable Electronic Industries Association (EIA) RS-232 communications port settings make it versatile and powerful.

Running MTerm on my TRS-80 Model III proved that the Radio Shack and IBM versions are virtually identical. I did experience some serious bit-dropping at 9,600 baud while using my Model III as a terminal hooked to a single-board computer running an Intel

*“Using MTERM
is a real pleasure.”*

8088 microprocessor. Dropping the baud rate to 4,800 alleviated the problem. I suspect MTerm had trouble sending the XOFF character to the attached computer in time to halt transmission while MTerm cleared the TRS-80 capture buffer. Another terminal program I tested under this configuration (Super-

term) dropped more bits than MTerm.

With typical Micro Systems Software elan, MTerm's documentation is broken down into short, easy-to-understand chapters and sections that are written in a breezy, conversational style. The technical information is segregated from the user information so you can learn how to use MTerm without getting bogged down in the details of how it works.

The glossary at the end of the MTerm manual defines about 80 computer terms including *glitch*, labelled, “an unwanted and annoying defect . . . in a program or . . . data file.” Fortunately, glitch doesn't apply to MTerm. ■

★ ★ ★ ½

Bable Terror

Funsoft Inc.
28611 Canwood
Agoura, CA 91301
Model I or III
\$19.95 cassette, 16K
\$24.95 disk, 32K

by Lynne Patnode
80 Micro staff

Bable Terror is an arcade-style game in the Pac-Man tradition. A high-quality maze generator and the luck required to score well are its distinguishing features.

The Basics

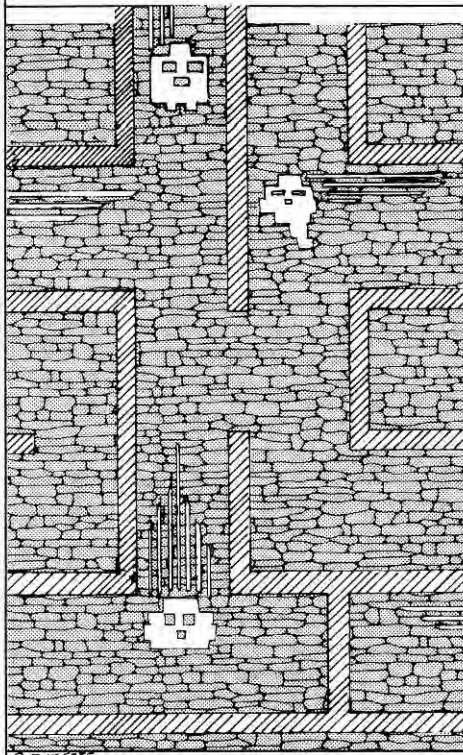
Bable Terror takes place in a castle inhabited by hostile servants who have built a labyrinth to thwart their master's return from the Crusades. Dangerous creatures and bables randomly roam the maze's passages.

As the hero of Bable Terror you play a knight: an anxiety-ridden bumpy being with eyes that look fearfully ahead as you move through the maze via the arrow keys or a joystick. While you see the entire maze at the game's outset, throughout the game you see only a small portion of the maze; this twist adds to your anxiety.

Your life's mission is to slay bables and gather the ten twinkling treasure crosses scattered throughout the maze. Each cross you gather is worth 30 permanent points and up to a maximum of 300 temporary bonus points. The higher your permanent score, the fewer bo-

nus points you acquire with each cross.

The bonus points are credited to an on-screen timer that counts down to zero. They give you the power to slay



ables, horrible munching creatures that become harmless and toothless as long as you have time on the board.

Each bable you slay adds 100 points to your permanent score. If you gather all ten crosses without meeting sudden death, you receive a new maze and any remaining bonus points as part of your permanent score. You also receive a new knight at every 1,000-point mark.

In addition to bables, your antagonists include two types of evil creatures: a ghost and a horned, disembodied head that looks like a demon or a dragon. These are invincible and always deadly.

Tricks of the Trade

Each game allows you three drinks of a potion that makes you invisible. In a tight spot, you quaff the potion and disappear by hitting the space bar.

Thereafter, hitting the space bar gives you a brief look at the entire maze, highlighting the locations of any remaining treasure crosses.

The most frightening parts of any maze are the long straightaways. Since your view of the maze is truncated, enemies can suddenly appear in your path and catch you unprepared.

The Best and the Worst

Bable Terror's best feature is its maze generator. After dozens of games, I've yet to see two identical mazes. All of them are complex and challenging.

This seemingly endless variety of mazes gives the game its fascination. Unfortunately, you are not allowed to finish the maze if you're slain by one of the evil creatures. This might be frustrating to anyone who enjoys a puzzle for its own sake.

Sometimes Bable Terror is annoyingly repetitive. You might be trapped by a series of creatures that you must dodge one at a time in exactly the same manner. You can get quite bad-tempered repeating the same sequence of movements over three square inches while the rest of the maze goes unexplored.

Continues on p. 45

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—Dennis Kitz, 80 Microcomputing; 12/82

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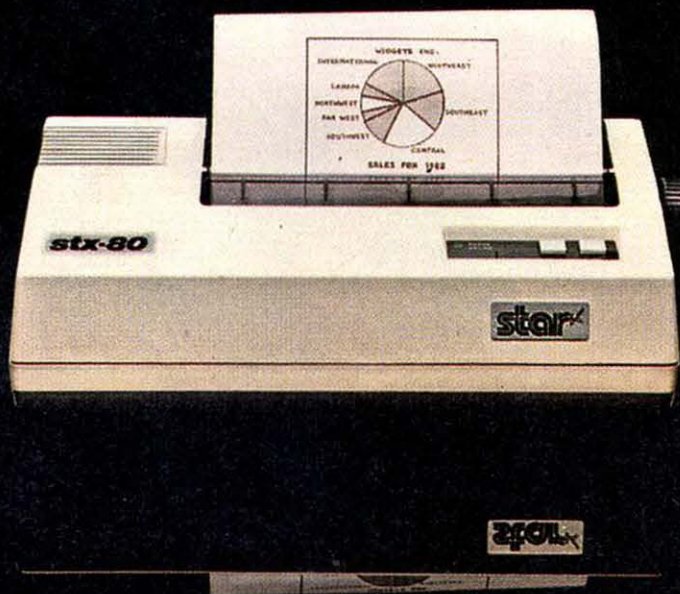
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Continued from p. 42

The game's most questionable aspect is its high incidence of luck. Because the creatures move randomly, you become at the mercy of chance once you become familiar with the game. It soon becomes difficult to discern any improvement in your ability to fend off evil creatures.

Features

The disk version of Bable Terror contains a permanent top-ten scoreboard, a nice feature in any video game. You can also freeze the action.

Bable Terror comes with sound that includes the usual loading and welcome noises and a special sound during maze

“This is a video game for existentialists. Death is dealt randomly, regardless of your ability or just deserts. If you take satisfaction in pitting yourself against the inequities of luck, you’ll enjoy the game.”

generation. These are little more than background distractions.

Other noises are more useful: You are signaled when you run out of bonus points and when you accumulate 1,000 permanent points. Once you recognize these two sounds, you can concentrate on the maze and ignore the point displays.

Finale

This is a video game for existentialists. Death is dealt randomly, regardless of your ability or just deserts. If you take satisfaction in pitting yourself against the inequities of luck, you’ll enjoy the game. If you’re frustrated by the daily repetitions of life, you’ll enjoy it only until it becomes all too familiar.

Bable Terror is an addictive, well-designed game. Just make sure you’re the right personality type for battling bables. ■

```

PS(J):LC=      :J=J+1:JM=  1:LA=  +LG+1
730 PR  T@LB,CHR$(143);:LB=LC:

                                LIST
                                716 PRINT@489,"edit";:RETURN
                                720 LG=LEN(AS):AS=RIGHT (AS,LG-F):F 0:

650 CLS:LA=0:PRINT"
XT 'PRINT PHONE LIST

670 IF J<1 OR LC<0 THEN J=1:RETURN:ELSE 680
680 PRINT@LB,CHR$(143);          LC,CHR$(138);:
    LG=1 'SPEAK WHOLE LIST

                                'CURSOR HANDLING
                                B=LC:RETUR
LEN(AS):BS=LEF$T$(AS,1):
THEN BS  :GOTO620:ELSE
IC*64:AS=  (AS,LG-1)
I=1 06 :IF AS=CS( )
    
```

ROBERT DUARTE

★★★

Color Pilot
Tandy/Radio Shack
Fort Worth, TX 76102
Color Computer
\$59.95 cassette
\$79.95 disk

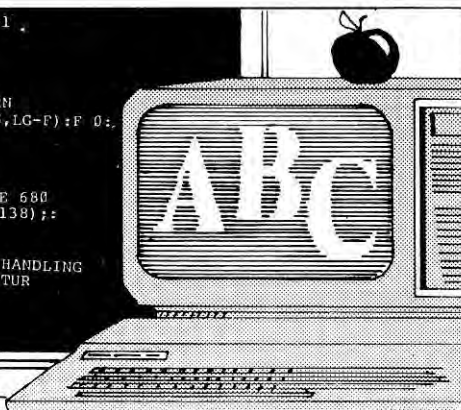
by Carlos Calle

Color Pilot is a language designed to help you write teaching programs. Pilot stands for Programmed Inquiry, Learning, or Teaching. The original Pilot was developed in the early 1970s at the University of California at San Francisco. The latest standard Pilot, called Common Pilot, was developed by George Gerhold and Larry Kheriatry at Western Washington University.

Color Pilot is based on this standard but includes special extensions and features to take advantage of the Color Computer's graphics. Nevertheless, most programs written in Common Pilot run on Color Pilot.

Color Pilot has 16 statements and eight graphics commands with five statement modifiers. Table 1 lists the Color Pilot statements. Each of the five statement modifiers can be used with any statement to change its operation. Digit conditioners determine whether an instruction is executed.

Color Pilot allows high-resolution graphics (256 by 191 pixels) in four colors. The normal characters (24 lines by 32 characters) are not regular Color Computer characters, but a new set drawn on the graphics screen. The 96



Symbol	Name	Description	Comments
R	Remark	R:any remark text	Ignored by Pilot
T	Type	T:text	Types to screen
:	Continue Text	:continue text	Continuation line of a Type statement
M	Match	M:pattern	Matches answer
A	Accept	A:answer text	Inputs answer
J	Jump	J:label J:@	Program jump to label or to last Accept executed
U	Use	U:label	Subroutine call
E	End	E:	Return from subroutine
W	Wait	W:number	Number of tenths of second to pause
X	Execute	X:VARIABLES	VARIABLE\$ is executed
N	Newchar	N:number, HEX	Defines new characters
C	Compute	C:expression	Provides for calculations
D	DIM	D:VARIABLE\$	Reserves string space
SS	Sound Start	SS:	Turns on and off cassette tape and plays through TV speaker
SH	Sound Halt	SH:	Controls video tape or video disk
V	Video	V:variable	Graphics commands
G	Graphics	G:list	

Table 1. Color Pilot Statements

ASCII characters with full upper- and lowercase allow text and graphics on the screen simultaneously. A double-size text of 16 characters by 12 lines is also available. Shift/zero turns on and off the shift lock. Pilot supports true lowercase characters with descenders. Once you're in lowercase mode, the shift key produces uppercase characters.

Color Pilot Modes

After loading Pilot and executing the machine-language program you are in Command mode, signified by the prompt Pilot:. Eight commands are available in this mode:

- L: Load a Pilot program from cassette or disk.
- S: Save a program on cassette or disk.
- R: Run a program in memory.
- E: Enter Edit mode.
- P: Print program in memory.
- I: Enter Immediate mode.
- Shift/clear: Clear program area.
- Break: Enter Command mode from Run, Enter, or Immediate modes.

Three other modes are available:

- Immediate mode executes any Pilot statement immediately. This mode is useful when writing programs since you can enter it from the Edit mode by pressing the break key. Then type your statement and see exactly what it does.

“Color Pilot allows high-resolution graphics (256 by 191 pixels) in four colors.”

This option is essential for any kind of graphics.

- Run mode executes a Pilot program. Pressing break stops the execution and returns you to Command mode.
- Edit mode allows you to write Pilot programs. You can exit to Immediate

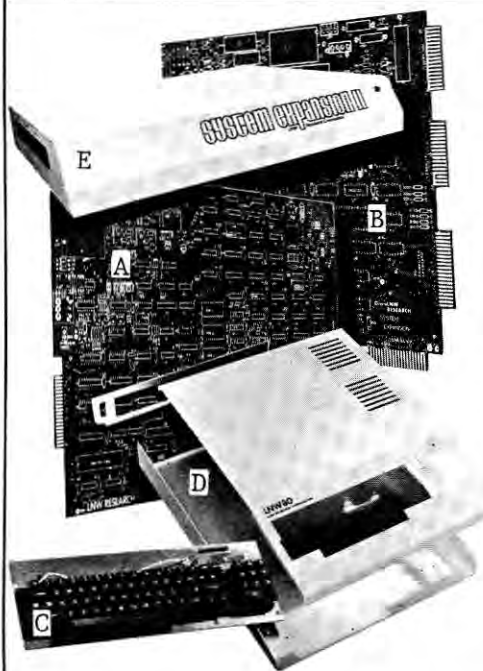
mode to try out any feature and return to Edit mode without disturbing your program.

The Editor

Color Pilot provides a fairly good screen editor. Immediately after you enter the Edit mode by pressing E from Command mode, the screen blanks and the cursor appears at the lower left corner. If no Pilot program exists in memory, the cursor is all you see and the computer is ready to accept program statements. If there is a program in memory, only the first line appears at the bottom of the screen, with the cursor immediately below the first character. You can change the line or scroll through the text line by line or all at once.

By pressing shift in combination with any one of the four arrow keys you can scroll up, down, left, or right. However, the up and down arrow commands are backwards—Shift/up-arrow takes the cursor down through the text. You should interpret this command as bringing *text* up instead. Even the man-

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ual instructions are backwards on this point (p. 32).

The editor is vastly superior to the Extended Color Basic editor. It is not a true screen editor, however, because it handles instructions that fit only on a single line.

Drawbacks

Color Pilot is far from perfect. Take, for example, the Sound command. The statement SS, sound start, turns on the cassette tape and plays the recorded sound through the TV set, explains the manual. SH (sound halt) does the opposite. And that's all the sound provided. The Color Computer's impressive sound capabilities are unused.

Using eight graphics commands, you can draw triangles, squares, rectangles, little houses, small cars, even little people if you're artistically inclined. You can fill enclosed areas with colors and draw lines with different colors, too.

But Color Pilot doesn't even know joysticks exist! Say you want to draw a nice triangle somewhere in the middle of the screen. You must type the following command:

G:E,D120,150,L80,100,L160,100,L120,150

This determines the starting point (Dx,y = D120,150) and the lengths of the three sides (Lx,y, where (x,y) are the coordinates of the end point of each line). The third side must go back to the initial point. Three joystick motions and four hits of the joystick fire button would accomplish the same thing faster and without calculations.

Another annoyance: In Immediate mode, the cursor is left at the end of the line after a command is executed. Since this isn't true in Edit mode, where you are most of the time, it is difficult to remember to bring down the cursor before entering another command. The first character entered is always chopped off.

The manual is well-written and assumes you know nothing. However, it doesn't have an index.

Although there are no Motor On-Off, Audio On-Off commands in Color Pilot, the sound commands SS and SH set the cassette motor and the audio output on and off. You can use them in the Immediate mode to avoid pulling the plugs on the cassette deck to position the tape before loading or saving a program.

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“Using eight graphics commands, you can draw triangles, squares, rectangles, little houses, small cars, even little people if you're artistically inclined.”

Conclusions

Color Pilot is suitable for teaching when you have complete control of the computers. It would be difficult to set

up in a computer laboratory for students to use unattended because the program has to be loaded into memory for the lessons to run. ■

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Review in 80 Microcomputing

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SEE PAGE 43



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REVIEWS

★★★

Everything You Always Wanted to Know About Home Computers
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\$8.98

by Eric Grevstad
80 Micro staff

If you have any doubt that computers have entered the mainstream, listen to this: that durable commercial couple, Steve Allen and Jayne Meadows, offering a 40-minute guide to RAM, ROM, and Basic on Donna Summer's old label, Casablanca. Forget *Time's* Machine of the Year cover story. If the micro rates an Allen/Meadows album, it's safe to say it's come out of the closet.

While the album jacket says "Steve and Jayne answer those important questions about the home computer," the answers really belong to Arnold Friedman, a teacher in the Great Neck and Bayside, NY schools and author of the album text.

The text, slightly changed in the recording script, is supplied in a handy booklet, which also contains a glossary ("All the words and terms you'll need to understand and speak the 'computer language' ") and one of those useless keyboard diagrams to practice on.

The glossary is quite good, though vague on topics like the difference between compilers and interpreters. The keyboard diagram, "set up just like a real home computer keyboard," features up and left but no down or right arrows, as well as the familiar plus, minus, semicolon, asterisk, and equals-over-color keys.

Side one of the album sets the tone early. After a recording of a rocket-launch countdown and some jazzy elevator music, Allen declares "Welcome to the computer age. Welcome to the 21st century!" Meadows establishes the level of repartee with "What? It's already here? I must have overslept."

The narration continues in this vein through an overview of computer theory (the four sections: input, memory, central processing, and output) and

applications. For the most part, Meadows plays the ingenue, confessing "I thought computers were huge, complex, expensive machines run by Ph.D.s in white coats" and wondering whether software has something to do with ladies' lingerie.

Allen explains the difference between instructions and equipment with the old saw "If you can kick it, it's hardware." The phrase "booting a disk" never comes up.

After Allen's patient definitions of words like "byte" and "RAM" ("Have you ever been bitten by a ram, Steve?" "No, Jayne, just by the computer bug"), the two proceed to list standard reasons for micro ownership—financial management, inventories of books or recipes, education, word processing, data-bank access, games, and so on.

Meadows reassures listeners that

"Allen explains the difference between instructions and equipment with the old saw 'If you can kick it, it's hardware.' "

"You don't have to buy all your software," mentioning user's groups and clubs that offer it "at practically giveaway prices, sometimes just for the cost of a blank tape." This would seem to be a hearty endorsement of software piracy.

Side one ends with a brief comparison of the types of micros available. The phrase "color computer" is used generically, though the album photos show Allen visiting a CoCo-owning family.

Such a machine seems to be the pair's choice—they dismiss \$100, membrane-keyboard models as useful only for people who spill things on them, and Meadows says that a \$200 unit looks "like a pretty good deal, when you realize that prices for computers alone can go up to several thousand dollars."

Side two, accompanied by background noises of clicking recorder buttons and computer keys, combines more explanation—"Stripped of all the gobbledygook, when you get right

down to it, a computer is simply nothing more than an enormous number of switches that are contained in the chips—with some elementary programming exercises.

An imaginary datebook program introduces the mechanics of loading and running; from there, Allen and Meadows dip a toe in the ocean of Basic, cautioning listeners not to mistake Basic for English (“Beginners in programming frequently confuse the two languages, which thoroughly confuses the computer”).

The sample programs are traced step by step, with care to explain the difference between 10 PRINT “2+3=” and 20 PRINT 2+3, but it’s beyond the scope of the album to give any kind of meaningful introduction. By the end, Allen and Meadows have added Input to Print statements and written a Fahren-

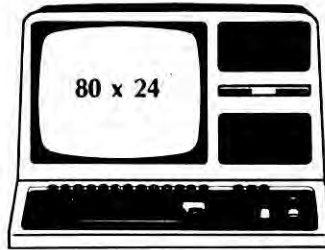
“I could wish for Stiller and Meara, but Allen and Meadows’ amiable expertise makes the album a painless introduction.”

heit-to-Celsius program, but side two leaves a decidedly skimpy impression.

Compared to computer guides in bookstores, *Everything You Always Wanted* is a novelty item. It’s less intimidating, but less thorough; it seems aimed at an adult or middle-aged audience rather than the mass market. Too, it’s hard to skip back and reread sections of an LP. It might be easier to buy the cassette and sit by the rewind button.

But these shortcomings aren’t Allen and Meadows’ fault. Their jokes are creaky—“A home financial program can keep track of food, utilities, and charge accounts.” “I’d like to know more about your charge accounts, Jayne”—and their asides and chuckles are no doubt part of the script, but the two veteran professionals run through the material without a hitch.

I could wish for Stiller and Meara, but Allen and Meadows’ amiable expertise makes the album a painless introduction. ■



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★★★★

TRSDOS 2.3 Decoded & Other Mysteries

James Lee Favour
IJG Inc.
1953 West 11th St.
Upland, CA 91786
Softcover, 304 pp.
\$29.95

by **John B. Harrell, III**

The TRS-80 Information Series, published by IJG Inc., is among the many superior publications now available documenting the Model I's hardware and software. James Favour has followed his superior work, *Microsoft Basic Decoded & Other Mysteries*, with Volume VI, *TRSDOS 2.3 Decoded & Other Mysteries*. This book disassembles TRSDOS and explains each line of coding clearly and concisely.

TRSDOS 2.3 Decoded guides any programmer through TRSDOS's internal operations. You need no programming experience to understand or use this reference, but you must understand the basic architecture of a computer and have some experience in Assembly-language programming.

TRSDOS 2.3 Decoded consists of ten chapters covering various topics related to the disk operating system and its Model I implementation. Two appendices cover the data structures used by the operating system and Assembly listings of each operating system overlay, complete with comments.

The experienced reader can skip the chapters covering basic organization of the computer and generalizations on operating systems. A practiced programmer can read the remaining chapters in any order. Though much of the specific source code is not applicable to users with more sophisticated operating systems, many of the topics are valid for all operating systems and provide excellent insight into systems programming.

The first chapter, a thorough description of Model I hardware, illustrates the use of the Z80 microprocessor in the TRS-80 environment. It discusses input/output operations and explains the memory-mapped addresses where required. The last part of the chapter discusses operating systems in broad terms as a preview to succeeding

chapters.

The second chapter provides a general introduction to TRSDOS. It describes the functions and assigned memory addresses for the core-resident nucleus. A discussion of each system's overlay files provides the reader with a complete overview of the operating system prior to delving into the complex internal structures. One of the key data structures for any operating system is the disk directory, and chapter 2 provides its format.

The heart of TRSDOS is the SYS0/SYS file. It contains TRSDOS's nucleus and is always core-resident after

“TRSDOS 2.3 Decoded guides any programmer through TRSDOS's internal operations. You need no programming experience to understand or use this reference, but you must understand the basic architecture of a computer. . . .”

you load the system. Mr. Favour describes how the ROM routines and the boot loader contained in BOOT/SYS load the nucleus. He uses hexadecimal addresses to bracket his description of short code segments.

Where applicable, particularly important code segments are reproduced. Mr. Favour uses this style throughout the book for emphasis.

A large section of the third chapter describes interrupt processing on the Model I. Mr. Favour explains file operations and the disk file manager as part of the nucleus system. He includes an excellent description of managing file space on disk. Next comes a thorough explanation of the disk file loader and overlay loader, and the format of load (CMD) files.

Mr. Favour considers SYS1/SYS the brain of TRSDOS. In chapter 4, he explains how the command-line interpreter reads and executes commands

for the system, then loads and executes the appropriate system command or user file. SYS1/SYS does this by working in harmony with SYS6/SYS to execute all standard TRSDOS commands.

Most interesting is the discussion of the function calls to SYS1/SYS that move character strings and validate them as file names, add a three-character extension to a file name, and parse parameter lists. This extremely powerful feature allows the programmer to pass complex parameters to his routines that the system interprets prior to execution.

Chapter 5 details the operation of SYS2/SYS, part of the TRSDOS file management system. The book presents many examples of disassembled coding to discuss the operations of Open and Init processing related to disk files. SYS2/SYS also contains the source code to determine the encoded value for passwords. As directory space is limited for a single file entry, it might be necessary to create an extension (overflow) entry linked to the file primary directory entry. Chapter 5 discusses the code for this SYS2/SYS function in detail.

To complete the discussion of the file management procedures, chapter 6 presents the details of SYS3/SYS. This system overlay contains the code to process disk file Close and Kill requests.

The nucleus calls system overlay SYS4/SYS whenever the system routines detect any error condition, and it can be invoked whenever user programs detect similar errors. SYS4/SYS provides the code necessary to interpret these error codes and to display comprehensible error messages.

Mr. Favour points out a facility in SYS4/SYS that is not used by TRSDOS; it provides detailed error processing during debugging. SYS4/SYS is interesting because its unique data structure provides full error messages. This technique demonstrates a good method of text compression and is not limited to Assembly language.

Chapter 8 is devoted to Debug (SYS5/SYS), a machine-language monitor overlay integrated into TRSDOS. This overlay provides many useful examples of good programming techniques. The design objective was to keep the overlay small and within the bounds of the system overlay buffer. The techniques involved are valuable.

The book describes SYS6/SYS as the only overlay to load in the memory

Continues on p. 53

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Continued from p. 50

region above 5200H. It contains the coding necessary to perform the bulk of TRSDOS's commands. Chapter 9 clearly describes the many differences between SYS6/SYS and the other system overlays. This is the longest chapter in the book, with many comments on SYS6/SYS functions. It's interesting to study routines you've wanted to modify for your own use.

The last chapter details the operation of the boot loader contained in the read-only memory and on the system disk as BOOT/SYS. Mr. Favour paces you through the system functions from the time you press reset until the time SYS1/SYS reads the first command.

Mr. Favour describes BOOT/SYS as the only core-image program in TRSDOS. This means that sector zero of track zero is read into memory and executed as it exists on disk, unlike the other programs that require a system loader to read them into memory. This is incorrect. Sector zero is also a loader-format file. When you execute it with the command BOOT/SYS.WHO and depress the 2 and 6 keys while loading, it displays the proprietary notice from Tandy.

The NOP (00H) and CP (FEH) instructions located in the first 2 bytes of the sector are cleverly disguised loader codes that cause the system loader to skip the boot loader and go to sector 1 to continue.

Appendix I contains a clear and concise representation of all data structures used in TRSDOS. All entries in the nucleus module (SYS0/SYS) and the appropriate calling sequences are also listed. A nice feature of this appendix is the cross-reference showing all references from one overlay to another.

Appendix II provides the full source code to TRSDOS, complete with comments. The source code is in assembler output format, fully ready for reassembly if the industrious programmer wants to make changes to the system. This feature alone justifies the book's cost.

Mr. Favour's book has one additional benefit: It identifies many errors that exist in TRSDOS 2.3. With this book and a disk file editor, you can make patches to correct these mistakes or add additional features yourself.

TRSDOS 2.3 Decoded is a valuable addition to the TRS-80 Information Series. I highly recommend it for the Model I owner's reference library. ■

★ ★ ★

Plus Explained
Crest Software
 2132 Crestview Drive
 Durango, CO 81301
 \$12

by Wynne Keller

Crest Software's *Plus Explained* details the finer nuances of the sometimes confusing Profile III+ documentation.

The manual is daisy-wheel printed on yellow paper. The pages are numbered and punched to correspond with the Radio Shack version of the Profile III+ documentation. You insert each Crest page adjacent to the proper Radio Shack page. If you recall, however, Profile III+ is available from another company as well. My version of the data base came from The small Computer Company, and the page numbering is different. It would have been useful if Crest had included both sets of page numbers.

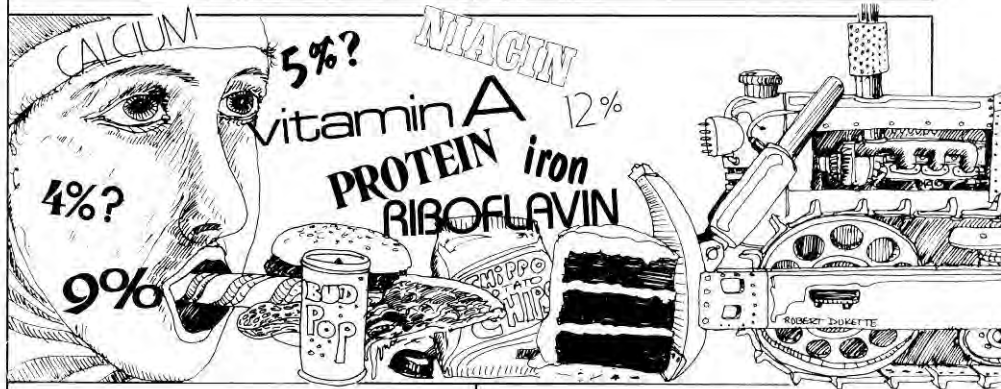
As I first read the Crest manual, I was irritated by the colloquial grammar

and puns. Further along, though, the relaxed style began to appeal to me. Leave staid text to standard documentation; an explanatory manual is allowed a light touch.

There are two potential users of this manual: those who didn't understand the original Profile III+ manual, and those who understood it but want to know more. Crest's manual meets the needs of the first group. If data bases in general, and Profile in particular, leave you confused, *Plus Explained* will help a great deal. The second group won't obtain as much benefit from the Crest manual, but at \$12, it's still informative and worth the price.

The package also includes two flow-chart posters. The posters are available separately for \$2. They are nicely designed, but are most useful when used along with the manual. I recommend that you purchase the whole package, not just the posters, if you need help with Profile.

A final suggestion: the Radio Shack TRS-80 *Microcomputer News* has been running a series of Profile III+ articles that may be useful to you. They begin with the October 1982 (Vol. 4, No. 9) issue. ■



★ ★ ★ ★ ★

Nodvill Diet Program
Nodvill Software
 24 Nod Road
 Ridgefield, CT 06877
 TRSDOS 1.3
 \$69.95 disk

Stephen F. Tomajczyk
 80 Micro staff

Do you eat to live? Or do you live to eat? If you're either an athlete or an active individual, you probably live to

eat—and eat a lot. But did you ever wonder whether you're getting all the vitamins, minerals, and calories your active body needs?

The Nodvill Diet Program, a unique dietary software program from Nodvill Software, can help you.

First Things First

The Nodvill Diet Program totals the nutritive values of all the foods you eat during a given period of time and determines whether you've met your Recommended Daily Allowance (RDA) of nutrition. The program uses TRSDOS Version 1.3 and comes on disk without

an operating system.

Before you can use the program, you have to back up or copy the programs and data files on your own working disk. Use the utility program on your operating system disk. Nodvill Software recommends that you use two disk drives. It's not necessary, but it saves you from formatting several disks for a one-disk-drive unit.

The Nodvill Diet Program consists of six separate program modules: Main Menu, RDA Chart, Food List, Meal Menu, Daily Menu, and Grocery List. The display for each program is divided into two sections: an information-display area in the upper portion of the screen, and a control-option prompt in the lower section.

The information area displays the information and data for whatever program module you select and the control area lets you perform specific functions. Each program allows you to display existing data, add new information to a file, or edit a record that requires corrections or modifications.

RDA Chart

This is probably the most important of the five diet-oriented programs. All the other programs directly or indirectly refer to this RDA chart for comparative information.

The program menu prompts you for your name, sex, age, weight, height, and energy level. You can roughly determine the latter from an energy expenditure chart in the back of the manual. The chart lists the calories you burn during different activities. For example, walking 3 1/4 miles in an hour burns off 300 calories, and playing an hour's worth of tennis burns 420 calories. Select your normal activity and enter it into the RDA chart.

After you enter this personal information, the program displays how many units of niacin, iron, calcium, phosphorus, protein, calories, and vitamins A, B1, B2, and C that your body requires on a daily basis. With this information, you can modify your diet so you receive the nutrients your body needs.

One pleasing program feature is its taking into account whether a woman is pregnant or lactating. These are important factors since both conditions have a marked effect on a woman's body chemistry nutritive needs. I'm only surprised that the software didn't consider menstruation as well. This would seem to play a more important role in determining a woman's dietary needs each month, especially her mineral requirements.

Food List

Pizza, beer, potato chips, sponge cake, brownies, peanuts, and pecan pie all make one's stomach growl in hunger and anticipation. But are these tempting morsels good for you? Before you chow down next, why not consult the Food List program?

The program consists of 734 individual foods. For each item, the program provides a complete nutritional breakdown, including the amount of calories, vitamins, and minerals it contains, and how much protein, fat, carbohydrates, water, and fatty acids are



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continue to next page

One year old and a proven success! LOG for the TRS-80 (R) is still the only program on the market that addresses one very obvious problem: Despite data-base managers, word processors, and a dozen brands of spreadsheets, the fact is that most of the information people handle on a day-to-day basis just won't fit into fields, files, and codes.

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Yes! LOG supports hardcopy to your lineprinter.
Yes! All commands are single keystroke (no modes to remember).
Yes! You can access LOG while BASIC is running.
Yes! It really works!

People are using LOG to store address lists, programming notes, diaries, personnel files, recipes, record collections, and a hundred other uses. Think up your own applications. You'll probably use it every day.

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present. What more could you ask?

Well, let me tell you. The program scans and displays all 734 food entries one at a time if you are trying to decide what to eat, or it searches out a particular item on the list at your request. The program has entries for all five basic food groups, plus a special junk-food data file.

If you can't find a certain food item, the program lets you add it to the list. Enter the measure and the nutritional values, both found on the food label. If you've come across an unusual measure for the food, such as grams or sticks, an equivalency chart in the back of the manual translates it into a common measure.

Meal Menu

Now that you know your daily nutritional needs and are aware of the nutritive value of your favorite foods, you can use the Meal Menu to put together the perfect meal for yourself, be it breakfast, lunch, dinner, or a snack.

You can enter up to ten individual

food items for each meal. As you enter each item, the program displays the cumulative amount of nutrients and calories of the meal. This allows you to alter either the food item or its quantity in order to meet your individual caloric and nutritive requirements.

Planning a meal is easy. You can either use the computer to search the food list for a specific item and enter its record number, or you can search the food list by food group, going through each until you find something that whets your appetite.

After selecting, say, chicken, enter how much you plan to serve or eat and the computer determines its caloric and nutrient value.

Each meal is labeled with a record number and meal type (breakfast, lunch, and so on) so you can easily refer to it and change it if necessary.

Daily Menus

The Daily Menu helps you plan meals for an entire week on a day-to-day basis. Each daily menu displays the

meals you've selected and the percentage of your daily vitamin, mineral, protein, calorie, carbohydrate, fat, and fatty acid requirements. Obviously, you aim for 100 percent in each category.

This program works closely with the Meal List. In fact, all entries you make for this program must first be entered on the Meal List program. If you're planning a menu, first make certain that the meal exists on the Meal List.

Each daily menu is found by its record number, the weekday, or your name. If you're undecided as to what to eat tomorrow, search through your entire menu file by the weekday to see what menus you've had in the past. Once you find a menu that makes your stomach growl, stop the computer scan and enter it for your present menu.

Grocery List

Now for the icing on the cake: Nodvill Software provides a grocery list program with their package. The program scans and displays each daily menu for the present week meal by meal. As you

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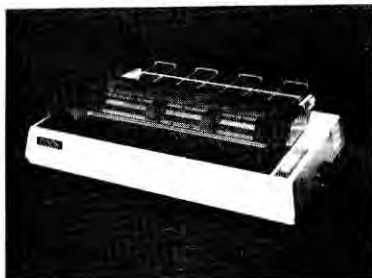


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- DAISY WRITERS CALL

EPSON PRINTERS

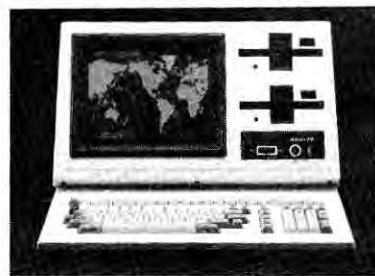


- EPSON FX-80 NEW CALL
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Continues on p. 61

review the meal list, check your refrigerator and cabinets for the food items listed. If you don't have the required items, enter its record number.

When you've finished reviewing the menu, the screen displays a grocery list of the items you need to buy. The next time you go to the store, print this list out and take it with you. You'll never have to worry about forgetting to buy something again!

Extras

Nodvill Software recognizes that this dietary program is only as good as the person using it. An individual unfamiliar with nutrition might actually harm himself by accidentally designing meals of little nutritive value.

In order to prevent this, they include a Meal and Menu Planning section in their manual to guide the user in proper

meal planning. They also provide dieting tips, a list of food sources with additional nutrients, and an example of an average day's diet.

"One word of warning: The Nodvill Diet programs are not planned for those with special health or nutrition problems."

Whether you're a serious athlete, a weekend recreationist, or an individual concerned with your health, this program is ideal for tracking and analyzing

your eating habits. Each program comes with sample data for you to follow. You can change these to suit your eating habits and adapt them to your nutritional needs.

One word of warning: The Nodvill Diet programs are not planned for those with special health or nutrition problems. If you are in this category, consult your physician before using the programs.

Although many might balk at the program's \$69.95 price, let me assure you that it is worth every penny, thrice over! Not only will you be pleased with it, you'll feel secure in knowing that your body receives all the vitamins, minerals, and calories that it needs on a daily basis.

This professional and detailed program is the Cadillac of dietary software. ■

★★★★★

D-92 Printer
Data Impact Products Inc.
 745 Atlantic Ave.
 Boston, MA 02111
 \$399.95

by Terry Kepner

What would you think of a printer that gives you six programmable

printing modes, six different printing pitches, six or eight lines per vertical inch spacing, an 800-character buffer, data processing (7 by 9) and correspondence quality (11 by 9) print modes, selectable unidirectional or bidirectional printhead movement, 100-characters-per-second print speed, and costs only \$399.95?

The D-92 has all these features and more. The printer is small, only 17

inches wide by 9.75 inches deep by 6.5 inches high, but in that small space it delivers a lot of power. The print speed is impressive, especially when you consider that the Radio Shack DMP 100, also \$399.95, is rated at 30 cps.

With this high speed you get the full upper/lowercase 96-character ASCII set, with descenders and underline. The character modes are as impressive as the speed. The data-processing mode is good enough to be compared to the correspondence-quality modes of other printers.

The six programmable printing fonts are actually two sets of three fonts, one set in the data-processing mode and the other set in the correspondence-quality mode. Each set contains: a standard font (one-pass), an enhanced font (two-pass), and an expanded font (each character double-width).

Similarly, the six pitches are two sets of three: 10, 12, and 16.5 characters per inch. One set is in standard mode and the other is in expanded mode (double-size characters that produce 5, 6, and 8.25 characters per inch). See Table 1 for six pitches available (40, 48, 66, 80, 96, and 132) and a sample of the enhanced printing.

The character buffer's capacity is 800 characters (about ten lines of print), so it lets your program operate at higher efficiency than nonbuffered printers. The printer prints the characters as you fill the buffer.



The D-92 Dual Mode Printer

New Release

Now supports Mailing Lists, Form Letters, "ZAP-PROCESSING", and 18 more printer drivers.



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- Supports proportional space right-margin justifying on Centronics 737, 739, Radio Shack Line Printer IV, Daisy Wheel II, Grafrax Plus, NEC PC-8023A-C, Spinwriter 5510, 5515, 5520, 5525, C. Itoh Prowriter 8510, Starwriter FP-1500, F-10, and Diablo 630.
- Powerful Mailing List and Mail-Merge capabilities for personalizing standard legal documents and Form Letters, handling infinite number of data records per run, infinite number of data fields per data record, and data fields as large as up to 1000 characters each.
- Brand new feature called "ZAP-PROCESSING", allows you to display and edit any type of data or program file in "ZAP" (byte-hexidecimal) format.
- Any character or symbol your printer can print, even dot graphics, can be used in mid-line printing with the Special Character feature.
- Written in fast Z80 machine language with type-ahead key-stroke buffering for speed typing.
- Single key-stroke control of all editing functions for ease of use.
- Continuous on-screen display of word count, line count, and free memory count.
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- Search, Replace, and Global Search and Replace.
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- User-definable linespacing, sheet size, top, bottom, left, and right margins.
- Move blocks of text and copy blocks of text from disk, to disk, and within the text.
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- Print-previewing formats text, inserts headers, automatically numbers pages, etc. on the screen without printing it on paper.
- Page by page pausing capability for sheet fed printers.
- Supports both parallel and serial printers.
- Printer control code access.
- Works with NEWDOS, NEWDOS80, TRSDOS, MULTIDOS, LDOS, and DOSPLUS - Single or Double Density.
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If you fill the buffer, your computer waits for the printer to print a character before it sends another. As long as you don't fill the buffer before the printer can print all the characters you send, your computer operates at full speed without waiting for the printer to finish before going to the next part of your program.

One odd but intriguing feature of the printer is its built-in serial and parallel interfaces. Only one of them is connected, depending on whether you order a serial or parallel printer.

As a further oddity, the manual warns you that changing the configuration of your printer from serial to parallel, or vice versa, voids the factory warranty, but then it tells you how to do it! The RS-232 option supports baud rates of 110, 150, 300, 600, or 1200 baud. Higher baud rates are optional.

The printer has three front panel controls: Single Line Feed, Form Feed, and Printer Select/Deselect. A self test mode comes with the line feed and form feed switches. In addition to these switches, you have an on/off switch and a form size selection switch that allows you to select any number of lines per page as a form. Software can override the form size switch.

These are all standard features. The character fonts, printing modes, pitches, underline, form length, uni- or bidirectional print head movement, carriage return, line feed, form feed, and line density (6 lpi or 8 lpi) features are all available through software control.

The printer is well-designed. The print ribbon is accessible without removing the cover. A single row of DIP switches inside the printer controls the RS-232 controls, self-test mode, and printer line feed/carriage return response. You remove four screws and lift the cover to get at them.

One disadvantage of the printer is the lack of a paper platen knob. You have to use the line feed or form feed switches to advance the paper. Form feed advances the paper five lines per second. However, you can feed paper from the bottom, back, or top of the printer.

The manual is the printer's biggest failing. Its instructions are incomplete. It does describe how to use the standard features, but the descriptions of how to use dot-addressable graphics are poor. The manual does not contain even one example of a graphics command and

what it prints.

From a hardware point of view, the manual is exceptional, giving thorough descriptions of how to connect the RS-232 port to your printer (including hardwiring the printer to match your computer's nonstandard RS-232 port), directions to maintain and troubleshoot the printer, several real pictures of the inside of the printer with important parts identified, and a parts layout drawing of the printed-circuit board.

The documentation needs a short summary page of the various control codes and the effect they have on the printer.

If you want more than the standard features, you can get a tractor feed mechanism for \$50, dot-addressable graphics with four plot densities from 33.3 to 66.6 dots per inch for \$30 (graphics requires the tractor feed option), a switch at the back of the printer to select either 7-by-11 character fonts for \$20, a 2K memory buffer for \$35, a serial port for \$60 (parallel is standard), a cut-sheet feeding tray for \$45, remote printer control (Control X, Control Y) for \$20, a sound cover for \$30, and optional X-on/X-off serial buffer control

for \$60.

A completely configured printer costs \$749.95, but a printer with dot graphics, tractor feed, and sound cover (what the average user wants) costs only \$509.95. These prices don't include the cost of a cable (\$30-\$40) or extra ribbon cartridges (\$14.95, with a print life of five million characters).

The dot-addressable graphics are straightforward: Each line of graphics is 512 dots wide by six dots high. Set the printer to graphics mode, send 512 bytes of graphics data, and watch the printer print. The top dot is the least significant byte of each column.

Recently, the options for the D-92 were on sale for 25 percent off list, a substantial discount. If you're interested in this printer, check with Data Impact Products to see if the discount is still available, or if the prices have changed.

What I liked best about this printer is that 60 seconds after I opened the box the printer was connected to my computer and printing merrily away. After seeing and reviewing many printers, this is the one I'll buy for my personal use. ■

```

80 CHAR
! "#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~"

40 CHAR
! "#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~"

96 CHAR
! "#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~"

48 CHAR
! "#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~"

132 CHAR
! "#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~"

66 CHAR
! "#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~"
ENHANCE PRINT

! "#$%&'()*+,-./0123456789:;<=>?
@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_
`abcdefghijklmnopqrstuvwxyz{|}~"
    
```

Table 1

★ ★ ★ ★ ★

Telewriter 64

Cognitec

704 Nob Ave.

Del Mar, CA 92014

Color Computer, 64K

\$49.95 cassette, \$59.95 disk

(Discounts available when upgrading from earlier versions)

By Scott L. Norman

Telewriter 64, the latest version of Howard Cohen's powerful word processor, exemplifies the third wave of Color Computer software. It takes advantage of the CoCo's ability to disregard Color Basic ROMs and address 64K of RAM. It's also a stand-alone program; it senses the amount of memory available, and requires no other operating system to set the memory map to 64K.

I have been using Telewriter almost since its inception. I reviewed version 1.0, the original cassette rendition (*80 Micro*, May 1982, p. 208). By the time the review appeared in print, I had acquired a disk drive and moved on to version 2.0, which became my most-used program. Cognitec has eliminated almost all of the few remaining deficiencies with Telewriter 64.

Upgrading from 32K to 64K gives the user more memory in which to store text. The text buffer doesn't double in size, though (at least not in a disk system), because Telewriter 64 is considerably larger than its predecessors. Many new features have been added, enough to make a re-examination worthwhile.

I'll skip over most of the features common to previous versions of the program. If you are curious but completely unfamiliar with Telewriter, you should know that it is a complete package for preparing and editing text, and for formatting the resulting material for printing.

It features a full-screen editor, high-density text displays with character sets defined in software, and a set of commands that you can embed in the text for real-time control of print parameters like margins, line lengths, and character fonts.

The embedded commands take the form of uppercase letters, sometimes followed by numbers. Since the Color Computer has no separate control key,

Telewriter identifies them as commands rather than text through the clear/period (.) combination.

This causes the control character ^, an upward caret, to appear on the screen when you enter embedded commands. For brevity, the key sequence clear/.x will be represented by ^ X in this review.

Refer to my earlier review for further details of Telewriter's basic operation. I want to concentrate on Telewriter 64's new features. I'll refer to the package as TW64, from now on. Also, I'm going to consider only the disk version, based on my experience.

Important Enhancements

If the computer has a good 64K RAM aboard, TW64 gives the user just under 25K of text buffer in the disk version and 40K with cassettes. This is certainly a worthwhile improvement over

"Cognitec has eliminated almost all of the few remaining deficiencies with Telewriter 64."

the 18K or so provided by earlier versions in a 32K computer, but in a way it's the least of the program's enhancements.

Of greater significance are other features including optional right justification of printed text, high-density screen formats for checking the appearance of text before printing, page-break finders for avoiding awkward-looking printouts, tab stops, and an additional utility program for ASCII file I/O (input/output).

Aligned, or justified, right margins improve the appearance of almost any prose. Formal business correspondence, school reports, and manuscripts certainly look better that way. Earlier versions of Telewriter could not add spaces to a printed line in order to square up the right margins, but TW64 incorporates this feature with a single command.

Like its predecessors, TW64 has three screen menus: Main, Format, and Disk

I/O. One of the new format options is called justify. Like everything else on this menu, it is a numerical parameter that you can alter from the keyboard. The default value is zero, or no justification.

To square up the right margins, type J/1/enter. This is standard Telewriter procedure: The first letter of the option generates a blinking cursor in the appropriate place on the menu, and entering the new numerical value completes the update cycle.

I timed TW64 printing single pages with and without justification, and didn't see any significant difference. However, my Line Printer VII runs at a miserable 600 baud; a faster printer might reveal whether or not the justification process has any measurable effect on speed. In any case, the screen display as TW64 pads a line with blanks is entertaining enough to make up for any slight time loss.

Sometimes you might want to protect a block of text from justification. You can insert the new embedded command ^; before and after the text that you do not want justified.

Even if you don't use justification, this command is useful for keeping a series of short lines, set flush against the left margin, from being merged into a single line by TW64's alignment command. Earlier versions of the program required that you indent each unaligned line two spaces and precede it with a \.

Only the final printout is justified by this option. The video still exhibits ragged right margins. The new high-density text options make the display itself much more useful for general formatting than ever before.

Line and Page Options

Telewriter previously offered a 24-line by 51-character video format. TW64 adds two options: 64 or 85 characters per line. These normally use their own three-pixel-wide character set. You can toggle back to the standard four-pixel-wide character set by entering clear/;. However, this is marginal for 64-character lines and almost useless for anything longer.

The high-density options aren't much good for text entry and proofreading unless you have a good video monitor and a baseband output modification for your computer. Their value lies in checking the formatting of printed

Televriter-64™

the Color Computer Word Processor

- 3 display formats: 51/64/85 columns × 24 lines
- True lower case characters
- User-friendly full-screen editor
- Right justification
- Easy hyphenation
- Drives any printer
- Embedded format and control codes
- Runs in 16K, 32K, or 64K
- Menu-driven disk and cassette I/O
- No hardware modifications required

THE ORIGINAL

Simply stated, Televriter is the most powerful word processor you can buy for the TRS-80 Color Computer. The original Televriter has received rave reviews in every major Color Computer and TRS-80 magazine, as well as enthusiastic praise from thousands of satisfied owners. And rightly so.

The standard Color Computer display of 32 characters by 16 lines without lower case is simply inadequate for serious word processing. The checkerboard letters and tiny lines give you no feel for how your writing looks or reads. Televriter gives the Color Computer a 51 column by 24 line screen display with *true lower case characters*. So a Televriter screen looks like a printed page, with a good chunk of text on screen at one time. In fact, more on screen text than you'd get with Apple II, Atari, TI, Vic or TRS-80 Model III.

On top of that, the sophisticated Televriter full-screen editor is so simple to use, it makes writing fun. With single-letter mnemonic commands, and menu-driven I/O and formatting, Televriter surpasses all others for user friendliness and pure power.

Televriter's chain printing feature means that the size of your text is never limited by the amount of memory you have, and Televriter's advanced cassette handler gives you a powerful word processor without the major additional cost of a disk.

...one of the best programs for the Color Computer I have seen...

— Color Computer News, Jan. 1982

TELEWRITER-64

But now we've added more power to Televriter. Not just bells and whistles, but major features that give you total control over your writing. We call this new supercharged version Televriter-64. For two reasons.

64K COMPATIBLE

Televriter-64 runs fully in any Color Computer — 16K, 32K, or 64K, with or without Extended Basic, with disk or cassette or both. It automatically configures itself to take optimum advantage of all available memory. That means that when you upgrade your memory, the Televriter-64 text buffer grows accordingly. In a 64K cassette based system, for example, you get about 40K of memory to store text. So you don't need disk or FLEX to put all your 64K to work immediately.

64 COLUMNS (AND 85!)

Besides the original 51 column screen, Televriter-64 now gives you 2 additional high-density displays: 64 × 24 and 85 × 24! Both high density modes provide all the standard Televriter editing capabilities, and you can switch instantly to any of the 3 formats with a single control key command.

The 51 × 24 display is clear and crisp on the screen. The two high density modes are more crowded and less easily readable, but they are perfect for showing you the exact layout of your printed page, *all on the screen at one time*. Compare this with cumbersome "windows" that show you only fragments at a time and don't even allow editing.

RIGHT JUSTIFICATION & HYPHENATION

One outstanding advantage of the full-width screen display is that you can now set the screen width to match the width of your printed page, so that "what you see is what you get." This makes exact alignment of columns possible and it makes hyphenation simple.

Since short lines are the reason for the large spaces often found in standard right justified text, and since hyphenation is the most effective way to eliminate short lines, Televriter-64 can now promise you some of the best looking right justification you can get on the Color Computer.

FEATURES & SPECIFICATIONS:

Printing and formatting: Drives any printer (LPV7/VIII, DMP-100/200, Epson, Okidata, Centronics, NEC, C. Itoh, Smith-Corona, Terminet, etc).

Embedded control codes give full dynamic access to intelligent printer features like: underlining, subscript, superscript, variable font and type size, dot-graphics, etc.

Dynamic (embedded) format controls for: top, bottom, and left margins; line length, lines per page, line spacing, new page, change page numbering, conditional new page, enable/disable justification.

Menu-driven control of these parameters, as well as: pause at page bottom, page numbering, baud rate (so you can run your printer at top speed), and Epson font. "Typewriter" feature sends typed lines directly to your printer, and Direct mode sends control codes right from the keyboard. Special Epson driver simplifies use with MX-80.

Supports single and multi-line headers and automatic centering. Print or save all or any section of the text buffer. Chain print any number of files from cassette or disk.

File and I/O Features: ASCII format files — create and edit BASIC, Assembly, Pascal, and C programs, Smart Terminal files (for uploading or downloading), even text files from other word processors. Compatible with spelling checkers (like Spell 'n Fix).

Cassette verify command for sure saves. Cassette auto-retry means you type a load command only once no matter where you are in the tape.

Read in, save, partial save, and append files with disk and/or cassette. For disk: print directory with free space to screen or printer, kill and rename files, set default drive. Easily customized to the number of drives in the system.

Editing features: Fast, full-screen editor with wordwrap, block copy, block move, block delete, line delete, global search and replace (or delete), wild card search, fast auto-repeat cursor, fast scrolling, cursor up, down, right, left, begin line, end line, top of text, bottom of text; page forward, page backward, align text, tabs, choice of buff or green background, complete error protection, line counter, word counter, space left, current file name, default drive in effect, set line length on screen.

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— The RAINBOW, Jan. 1982

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material.

TW64's main menu has a new option, C (for characters/line), that allows the video display to duplicate the length of a printed line. Usually you compose text in the default 51-character mode for best readability, then reset the C parameter to the desired length of a printed line and switch to one of the high-density modes for final checking.

The manual advises choosing the mode greater than the desired printer line width. If you want to print 60-character lines, set C to 60 and select the 64-character mode with the command clear/;. Clear/@ brings up the 85-character mode and clear/zero gets you back to 51 characters.

Incidentally, if you change the C parameter in this way, you find your new value preserved when you call up the format menu. C is only accessible from format in earlier versions of Telewriter.

The relationship between the display mode, which defines the maximum possible length of a video line, and the C parameter, which sets the actual length, is a little hard to grasp at first. It is worth the effort to do so, however, because the ability to tinker with the display is the key to enjoying several of TW64's advanced features.

Page breaks, for instance, look unprofessional when they split the closing of a letter. It isn't attractive to have the first line of a paragraph at the bottom of a page, or the last line at the top of one. Full-featured word processors allow the user to examine the points at which pages of text end so you can take corrective action to avoid such embarrassments.

A new Vertical Tab command advances the cursor by exactly one page to give an on-screen indication of where the breaks appear in the printed material. Of course, you must first set up the format you use for printing so that the program can count margins, characters per line, and lines per page correctly. Use the format menu and choose the proper display mode.

Once you establish the format, you can examine page breaks by moving the cursor to the top of the text and hitting clear/V repeatedly. Each stopping point is the first line of a new page. If you don't like where it falls, you can fix it.

Corrections usually take the form of additional blank lines or an embedded new page command to force a new paragraph to begin at the top of the next

page. You can also rewrite some material when page breaks occur in the middle of paragraphs.

Once you make such a change, go back to the top of the text or to a previous page break to continue scanning. The very last examination should always begin at the top, because embedded changes in line width (^C commands) can temporarily fool the system.

In general, the page-finder routine takes proper account of such changes as they occur. However, confusion can result when you make page break corrections in the middle of a section that uses a temporarily altered line length.

Although this application is not stressed in the manual, the page finder is also useful for skipping rapidly up and back through large sections of text. It provides an alternative to scanning text one video screen at a time.

The page finder ignores embedded

"In general, the page-finder routine takes proper account of such changes as they occur."

command lines and nonprinting comments when counting the lines per page. You have to make an allowance for headers printed at the top of each page, though.

To get the line count right, the format menu's upper margin parameter U must be temporarily set to a fictitious value. The recipe is (True upper margin) + (Number of line feeds between header and text) + 1. Remember to reset U to its correct value before printing.

I slipped in something about nonprinting comments two paragraphs back. They are another new feature of TW64, and make use of a versatile new embedded command: ^T.

^T corrects one annoying deficiency of earlier Telewriters: the lack of user-definable tab stops. To set tabs in TW64, you use ^T followed by a series of two-digit numbers as the first line in a text file.

For example, the command line that sets up indentation for paragraphs and

the inside return address on my correspondence is:

^T 04 40 49

(Print lines begin at 00, so 04 refers to the fifth position.) The clear/enter combination serves as the tab key.

Incidentally, tabs are always referenced to the left margin of the text, not the edge of the paper. Your text stays in order if you change the margin later.

If ^T, followed by a space, appears anywhere other than the top of a text file, whatever follows on the same line is treated as a nonprinting comment. Thus you can put permanent page break markers in your text. Such comments are useful to remind yourself of the purpose of complicated sets of embedded commands—just as a Basic REM statement can jog your memory.

If ^T is followed by a bit of text without an intervening space, that text is printed but isn't subject to alignment (if it is less than half a line long). You can use this for the inside address of a letter, although I prefer to enclose the entire thing in a pair of ^; commands.

ASCII I/O

One important TW64 feature is the dramatically improved ASCII I/O capability. Telewriter normally writes tape or disk files in the binary format used by SAVEM and associated commands. However, it is often useful to create ASCII files; that's the format used by spelling checker programs, for one thing.

Cognitec included a conversion routine called CONVERT/XXX with earlier Telewriter disks, but it had some flaws. The worst was its inability to guide certain formatting commands through a complete binary-ASCII-binary conversion routine.

The TW64 disk now contains two copies of the normal binary I/O file names S/XXX and S/BIN, and S/ASC, which does the same job in ASCII. When you invoke the main menu's D command to call up the disk I/O menu, you normally get S/XXX.

To generate an ASCII file, you must return to Basic with the B command and enter RUN "S/ASC". The screen then displays another disk I/O menu, but with an "ASCII I/O" title.

Any text file generated before the switch is still in RAM. You can save it

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through this menu and manipulate it with other programs. You get an active video display during the save, by the way.

You can subsequently read the corrected files back through S/ASC and save them again in binary with S/XXX, if you like. That's the drill for using a spelling checker. Although it takes several minutes to write the ASCII file, the advantage of the new system is that all embedded commands are handled properly.

In a single-drive system, you must copy S/XXX and S/ASC onto each disk used for text files. If you have multiple drives, you need them only on the system disk in drive zero.

Should you know ahead of time that you'll be doing a lot of ASCII I/O, you can avoid much of the menu swapping. Make another work disk with S/ASC as the only I/O control file, and rename it S/XXX. Calling for disk I/O automatically sets you up for ASCII operation.

Cassette-based TW64 systems also support both output formats, although it requires a little more work. Appropriate I/O files are found on the flip side of the system tape.

Other Features

TW64 has several other features and some of them are interesting. I will not cover Cognitec's rather convoluted schedule of prices for upgrading from earlier versions of the program; contact them directly for that information.

Prior versions of the program required that you precede embedded command lines with a space to keep the alignment routine from blending them into one long line. This is no longer necessary; apparently the presence of the ^ control character in the first position of a line is enough.

Telewriter has always been able to send control codes to a printer through the embedded D command. For example, the line

```
^D2 31
```

defines a control character (2) that, when invoked, tells my LP VII to shift to double-width print. The invocation consists of typing clear/2, which inserts a reduced-size 2 that looks rather like an exponent, into the text.

TW64 has a new wrinkle: It is now possible to print some of these control codes. The definition command is ^DP,

followed by the appropriate numerical value. For example, the ASCII value for the up arrow is 94, so

```
^DP3 94
```

means that clear/3 embedded in text causes such an arrow to be printed: ^.

Wild card characters have been added to the global search/replace options. The ubiquitous ^ in any position of a search pattern causes that position to be treated as a wild card and ignored.

One handy example mentioned in the documentation is finding multi-word

*“As you can tell,
I think a great deal
of TW 64. It is now
my standard tool
for text processing
and that means something
like 10,000 words
per month of
final-draft material.”*

combinations that might be split by a carriage return in the final text. For instance, specify

```
abra^cadabra
```

as the search target results in a match even if “abra” came at the end of one line and “cadabra” at the beginning of the next.

TW64's format menu has been revised. In the old days, page numbers were always centered at the bottom of each sheet. A new option, W(HERE), allows the user to specify the numeral's position along a print line.

You calculate the position by adding the value of the left margin to the number of spaces by which the figure should be indented. Five spaces in from a ten-space margin means a W value of 15.

In fact, page numbers need not appear at the bottom at all. You can incorporate them in a header through the use of the backslash character, obtained by

hitting clear/.,. The backslash goes into the header definition line at the place where the number is to appear. You still have to specify the initial page number through the N parameter on the format menu.

Now you can print a header on the first page of a manuscript. Just follow the H in the definition line with a plus sign before specifying the number of blank lines between header and text.

Another new format parameter, O(NE PAGE), instructs the program to pause and await another print command after printing a single page. This is useful for correspondence on single sheets in a friction-feed printer. The default value is zero, change it to anything else less than 128 to get the pause.

Telewriter's ability to handle specific printers is expanded. The old E(PSON) parameter has been changed to something called EPS/OKI/LF, and now treats special line-feed/carriage return combinations. It can also specify whether or not the Grafrax option is present on an Epson MX-80.

Summing Up

As you can tell, I think a great deal of TW64. It is now my standard tool for text processing, and that means something like 10,000 words per month of final-draft material.

In terms of features, TW64 is beginning to approach even WordStar, the standard of comparison from CP/M systems. The comparison will be even more valid if Howard Cohen produces a mail-merge package. The possibility is mentioned in the TW64 manual, so this is more than speculation.

Of course, I still wish for a Move command that would automatically delete a chunk of material from its old location after a move. As things stand, TW64 users still have to do a block copy followed by a delete operation.

The ability to verify information written to disk without emptying RAM would be nice, too. Cassette Telewriter users have been able to do this all along. And how about printing headers and footers? Or different headers on alternate pages?

The fact that such questions are appropriate is a measure of TW64's maturity. It is worthy of consideration as a writing tool for major projects, perhaps even up to book length. That's a compliment to the program, and to the Col- or Computer itself. ■

REVIEW DIGEST

Pocket Magic, Bill R. Behrendt, Prentice-Hall Inc.; 96 pp., \$17.95 hardcover, \$9.95 softcover.

"Just as a dog is not meant for bipedal locomotion, the TRS-80 PC-1 is not designed for computer game playing. . . . Behrendt's games are certainly ingenious, and he is to be congratulated. But even his efforts cannot turn the PC-1 into a decent game-playing machine. For little more than the price of the PC-1, and certainly for the price of the PC-2, one can buy a computer that will allow the playing of far superior games." *Personal Computing*, April, p. 150.

Sands of Egypt, Tandy/Radio Shack, Fort Worth, TX 76102; Color Computer, \$29.95.

"Sands of Egypt is more than an adventure, it's an animated adventure. You tell the computer you want to go east and the scene on your screen shifts as you walk east. If you dig and find an object, you see the object. . . . Because of its excellent use of graphics animation, Sands of Egypt represents a new standard for adventure games." *The Color Computer Magazine*, April, p. 56.

The Genie in the Computer: Easy Basic Through Graphics (TRS-80 Edition), Rachel Kohl, Laura Karp, Ethan Singer, John Wiley & Sons Inc.; 169 pp., \$12.95, softcover.

"Learning to write Basic programs for the TRS-80 Model I and III doesn't have to be a long, laborious task. If you can put your intellectual ego aside for a few hours, turn on your machine, open *The Genie in the Computer*, and prepare to have some fun while learning the fundamentals of programming. Simple-minded language or not, this book will have you writing a program by the time you finish page two, which compensates for whatever flaws it may have." *Personal Computing*, April, p. 149.

Audio Spectrum Analyzer, Tandy/Radio Shack, Fort Worth, TX 76102; Color Computer, \$20.

"Every hi-fi buff is a fun lover at heart, and there is no denying that the Spectrum Analyzer is a lot of fun. In the kaleidoscope mode, it becomes a low-cost color organ with added capabilities such as freeze-frame. In the graph mode, the correspondence between music and display is absolutely mesmerizing. If you're the type of person who likes to watch the Mahler symphony, the Audio Spectrum Analyzer is well worth investigating." *Popular Computing*, April, p. 193.

The Professional Keyboard, Spectrum Projects, 93-15 86th Drive, Woodhaven, NY 11421; Color Computer, \$89.95.

"Once in place what we had, essentially, was a Model I keyboard in a Color Computer case. The fit was perfect. The touch was good and there were no real problems. . . . We have heard more complaints about the Color Computer's keyboard than anything else. For those of you who do not like it, the Professional Keyboard offers an excellent alternative that is well put together and works without any problem." *the Rainbow*, March, p. 20.

Preread, Prickly-Pear Software, 9822 E. Stella Road, Tucson, AZ 85701; Color Computer, \$24.95.

"If you have a young child you would like to see receive a head start in reading, Preread, by Prickly-Pear Software, is an excellent tool with which to begin. Three programs are contained within the Preread package. They can teach the young child from three years up important letter recognition. . . . My son, a kindergartner, thoroughly enjoyed all three programs. They keep the child's interest and are viewed as a game, not a test, although a percentage score is given at the end of each program." *the Rainbow*, March, p. 172.

TRS-80 Data Communications Systems—A Guide to the Operation of TRS-80 Microcomputers as Communication Devices, Frank J. Derfler, Jr., Prentice-Hall Inc.; 170 pp., \$12.95 softcover.

"Communications expert Frank Derfler characterizes our present age as 'the second great information explosion,' and compares it to the 'third wave' of the industrial revolution. Against this backdrop comes the easy availability of high-technology computer equipment, in sophisticated communication settings, and in kitchens and dens across the nation.

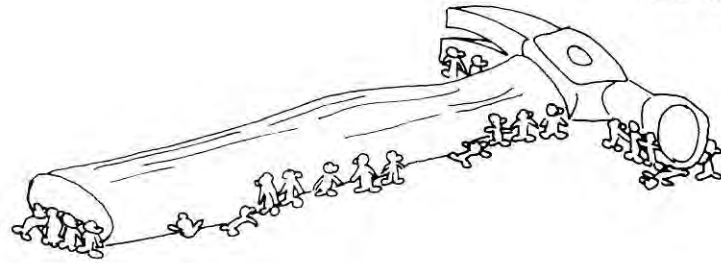
"The personal computerist first needs a friendly introduction and reference in data communications to guide him through the maze of new concepts and jargon. Derfler's book . . . provides a concise but thorough explanation of personal computers as communication devices. It concentrates on the hardware and software for TRS-80 microcomputers." *Softside*, March, p. 75.

Stinger, Eigen Systems, P.O. Box 1806, Austin, TX 78766; Color Computer, \$34.95 ROM Pak, \$24.95 cassette, \$29.95 disk.

"The objective of Stinger is to capture as many honey bees as possible. You have six bee catchers at your command. They attempt to capture honey bees by overtaking each one and landing on top of it. The honey bees are protected by stinger bees and the Queen bee, which emits killer bees if the stinger bees have trouble protecting the honey bees. When a stinger or killer bee catches one of your bee catchers, they kill it. The game is over when you lose all six bee catchers. . . . Stinger provides a high degree of excitement and a good test of your motor skills." *The Color Computer Magazine*, April, p. 62.

Drivers and DCBs

by Jerry Lindsly



Are you curious about machine-language programming? The ROM subroutines explained and demonstrated here will help you learn.

ROM subroutines make machine-language programming easier. Basic ROM, Disk Basic, DOS, and machine-language programs use driver routines to communicate with various input and

output devices. An I/O driver is used each time an I/O request is made. Standard drivers for keyboard, video, printer, and cassette devices are built into the ROM for Level II users, while disk users

find some of them located in RAM as well, along with disk I/O drivers.

Drivers are machine-language routines with the logic needed to input or output information to or from a specific hardware device in a system.

A driver can be located anywhere in memory. Therefore, if you plan on writing your own drivers or enhancing present ones, be certain that the RAM areas used by your routines don't conflict with RAM areas used by ROM, Disk Basic, or DOS.

Driver Utilization

For each device in the system, a device control block (DCB) is set up. The keyboard (*KI for keyboard input), video (*DO for display output), and printer (*PR for printer) DCBs are located at addresses 4015H-402CH (see Table 1). Each of these DCBs consists of: a 1-byte device type; a 2-byte driver address; 3 bytes that the driver uses to store data pertaining to that driver; and a 2-byte device ID (KI, DO, or PR in ASCII).

Device Type

The device type is used by a master I/O routine in ROM (at 3C2H) to determine whether the action requested is legal.

Here is a bit breakdown of the device type:

Address (HEX)	Comments
4015	Device type (01) Keyboard DCB
4016	LSB—Driver address (3E3H)
4017	MSB—Driver address
4018	Unused (0)
4019	Unused (0)
401A	Unused (0)
401B	"K"
401C	"I"
401D	Device type (07) Video DCB
401E	LSB—Driver address (458H)
401F	MSB—Driver address
4020	LSB—Cursor Position (3C00H)*
4021	MSB—Cursor Position *
4022	Cursor Character (0)*
4023	"D"
4024	"O"
4025	Device type (06) Printer DCB
4026	LSB—Driver address (58DH)
4027	MSB—Driver address
4028	Lines per page (67 or 43H)
4029	Line counter (0)*
402A	Unused (0)
402B	"P"
402C	"R"

Values in () are present on power-up (Level II).

Values with * change with output to device.

Table 1

The Key Box

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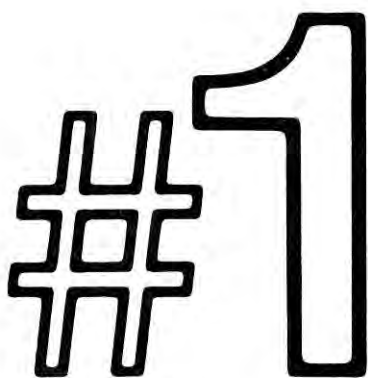
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MICROPROOF (EW's predecessor):

"There is simply **no finer program** available . . ." *Creative Computing*, March 1982

"This is a very useful product and should be obtained by anyone who uses a word processor." *80 Microcomputing*, August 1981

"The summary review of this program? **One word—Excellent.**" *Computronics*, September 1981

AND NOW ELECTRIC WEBSTER:

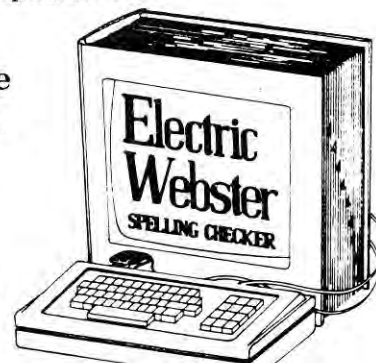
My spelling book is now gathering dust. Electric Webster not only checks spelling, displays words in context and corrects errors in the text, but it will also immediately take you to the right place in a 50,000 word dictionary so you can check the correct spelling for yourself." *Info World*, August 1982

"In my opinion, **the perfect combination** is Correcting Electric Webster with the hyphenation and grammar add-ons. To my surprise, it fills every reasonable expectation. It is fast, easy to use and accurate." *Desktop Computing*, December 1982

"Actually, Electric Webster is faster than its predecessor (Microproof). . . and spelling corrections are immediately verified against the dictionary before being accepted. . ." *Microcomputing*, September 1982

"Electric Webster is the **Cadillac of vocabulary programs**. . . If I could only have one, it would be Electric Webster." *80 Microcomputing*, September 1982

The Ultimate PROOFING SYSTEM



If bit 0 of the device is set, the device is used for input. If bit 1 is set, the device can be used for output. Bit 2 is unclear, possible uses could be: if set, to enable ability to output control byte to the driver or device or input status from them. The other bits are not used.

If you try an illegal function, ROM jumps to 4033H (Level II power-up), which usually consists of:

```
4033H LD A,0
4035H RET
```

The video is used as an input device. The device type is 07; bit 0 is set. To test this, try the following code:

```
LD DE,401DH ;Point DE to video DCB
CALL 13H ;Set input flag and jump to master I/O routine
```

The input byte will be in the A register and is the ASCII value of the character at the current cursor position on the video display.

Driver Address

The driver routine's address is stored in these 2 bytes in Z80 LSB/MSB

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format, with LSB followed by MSB. Turning on Level II puts the addresses of the standard drivers here.

Driver-used Bytes

While the keyboard driver at 3E3H uses none of these bytes, the video driver at 458H uses all three of these bytes as follows: 4020H and 4021H contain the address of the cursor position in screen memory (3C00H-3FFFH), and 4022H contains the cursor character (the character on the screen before the cursor (5FH) wrote over it). If 4022H equals zero, the cursor is not on.

The printer driver at 58DH uses two of these bytes as follows: 4028H contains the number of lines per page. 4029H contains the line number currently being printed.

*“A driver can
be located
anywhere in memory.”*

Using the Drivers

To use a driver, call the driver address. Since most drivers don't save registers you might be using, save them first. Be sure to tell the driver what type of action is required (input, output, or control).

There are ROM routines that make this easier. First, point DE to the DCB of the desired device and call one of the

Project 1—Flashing Cursor

Intercept the keyboard driver by putting the address of your own driver in the keyboard driver address

(4016H) in the *KI DCB (see Table 1). Whenever Basic, DOS, or any other program accesses the keyboard through 2BH, a jump is made to your driver. There you get the ad-

```
00100 ;*****
00110 ;** FLASH/ASM **
00120 ;** Flashing Cursor Program (A *KI DVR) **
00130 ;** Written by Jerry Lindsly **
00140 ;** 1175 Shuler Avenue **
00150 ;** Hamilton, Ohio 45011 **
00160 ;*****
00170 ;
00180 ;**** Define labels
00190 DELAY EQU 0060H ;ROM delay routine.
00200 KIDCB EQU 4015H ;Keyboard Device Control Block (*KI DCB).
00210 CURPOS EQU 4020H ;Cursor position.
00220 CURCHR EQU 4022H ;Cursor character.
00230 MAXMEM EQU 0FFFFH ;Highest RAM location in your machine.
00240 ;**** The following five lines if DOS:
00250 TOPMEM EQU 4049H ;Pointer to top of usable RAM (DOS).
00260 RETURN EQU 402DH ;Normal re-entry to DOS.
00270 ORG MAXMEM-62-6 ;Put in high RAM (MAXMEM
; minus length of program
; minus DOS work area).
00300 ;**** The following four lines if Level II Basic:
00310 ;TOPMEM EQU 40B1H ;Pointer to top of usable RAM (Basic).
00320 ;RETURN EQU 0072H ;Normal re-entry to Basic.
00330 ; ORG MAXMEM-62 ;Put in high RAM (MAXMEM
; minus length of program).
00350 ;**** Initialize
00360 START PUSH HL ;Save for return to DOS.
00370 LD HL,(KIDCB+1) ;Get old DVR's address.
00380 LD (KBSCAN+1),HL ;Save for patch back to old DVR.
00390 LD HL, BLINK ;Get new DVR's address
00400 LD (KIDCB+1),HL ;Save DVR address in *KI DCB.
00410 DEC HL ;Point to one less than DVR.
00420 LD (TOPMEM),HL ;Save in pointer to top of usable RAM.
00430 LD A,1CH ;Get "Home Cursor" ctrl code.
00440 CALL 33H ;Print it.
00450 LD A,1FH ;Get "Clear to End of Frame" ctrl code.
00460 CALL 33H ;Print it (clear screen).
00470 POP HL ;Restore.
00480 JP RETURN ;Re-entry to Basic or DOS.
00490 ;**** The driver
00500 BLINK LD A,(CURCHR) ;Get cursor character.
00510 OR A ;Test for zero.
00520 JR Z,KBSCAN ;Go if no cursor.
00530 LD HL,(CURPOS) ;Get cursor position.
00540 LD A,(IX+3) ;Get flag byte.
00550 XOR 1 ;Toggle flag and test.
00560 LD (IX+3),A ;Save new flag.
00570 LD (HL),8FH ;Display graphic block at cursor.
MORE
00580 JR Z,PAUSE ;If flag=0, skip next instruction.
00590 LD (HL),20H ;Display blank at cursor.
00600 PAUSE LD BC,180H ;Get delay count.
00610 CALL DELAY ;Delay 6 milliseconds (approx.).
00620 KBSCAN JP 0 ;Patch to old *KI DVR (get key & return).
00630 END START ;Auto-start (execution address).
```

Program Listing 1

following addresses:

● **13H-INPUT**—Saves BC RP to stack and loads B with 01. (01 is the flag that prepares the driver for input.) Remember: bit 0 is set. A jump is made to the master DCB routine (3C2H).

● **1BH-OUTPUT**—Saves BC RP to stack and loads B with 02 (02 is the flag that signals the driver for output; bit 1 is set). A jump is made to 3C2H.

● **23H-CONTROL**—Saves BC RP to stack and loads B with 04 (04 is the flag that outputs control or inputs status from the driver). Bit 2 is set and a jump is made to 3C2H.

All of these routines jump to the following one:

● **3C2H-Master DCB routine**—Registers are saved, and IX is pointed to the DCB. The C register is equal to output

byte, and device type is compared to the desired function (B register) for legality. If the function is illegal, a jump is made to 4033H. HL is pointed to the driver, and a call is made to the driver. Upon return from the driver, the register contents are restored and you are returned to the calling program.

The following routines point DE to the DCB and jump to the usual input (13H) or output (1BH) routine:

● **2BH-keyboard input**—DE is pointed to the *KI DCB and a jump is made to the input routine (13H).

● **33H-video output**—DE is pointed to *DO DCB and a jump is made to the output routine (1BH).

● **3BH-printer output**—DE is pointed to *PR DCB and a jump is made to the output routine (1BH).

Register Set-up to Call Routines

If you use an output driver to call these routines, place the byte to be output in the A register prior to calling 1BH, 33H, or 3BH. If you call 1BH, don't forget to place the address of the desired device's DCB in the DE RP; 33H and 3BH do this for you.

If an input driver is called, the A register contains the input byte after calling 13H or 2BH. If you call 13H, place the address of the desired device's DCB in the DE RP; 2BH does this for you.

If a control byte is to be output or a status byte is to be input from the driver, place the address of the desired device's DCB in the DE RP and the control byte in the A register prior to calling 23H. The status input byte is in the A register upon return.

dress of the cursor from the *DO DCB (see Table 1), and blink it off or

on. Then jump to the old keyboard driver, the address of which is stored

at 4016H prior to your putting the address of your driver there.

Program Listing 1 Line Functions

100-170	Program ID comments.	430-460	Clear screen.
180-340	Define labels and origin.	480	Return back to Basic or DOS.
190	Delay routine in ROM; load BC with delay count and CALL 60H (AF & BC are used and equal zero on return). The code at 60H looks like:	490-620	The actual flashing cursor driver.
	60H DEC BC ;Drop delay count.	500	Load A with the cursor character from the *DO DCB.
	61H LD A,B ;Get MSB.	510	Test it for zero. Zero means there is no cursor (instead of input, printing type action is being performed).
	62H OR C ;OR with LSB.	520	If no cursor, forget about making it flash and jump to the old *KI DVR.
	63H JR NZ,60H ;If both are not zero, do again.	530	Load HL with the address of the cursor from the *DO DCB.
	64H RET ;Return back.	540	On entry to a driver, IX points to the respective device's DCB; in this case, the *KI DCB. So load register A with flag byte stored at 4018H in the *KI DCB. Remember those three unused bytes? You're using one of them now as a flag byte.
230	Set MAXMEM equal to the highest RAM location in your machine:	550	Toggle flag. If A equaled zero, it now equals one, and vice versa. Z flag is set or reset depending on whether the result is zero or one, respectively.
	4K-4FFFH	560	Save the toggled flag back where you got it.
	16K-7FFFH	570	Store a graphics block at the cursor position (blink cursor on).
	32K-0BFFFH	580	If the flag equaled zero after you toggled it, skip the next instruction and leave the cursor on.
	48K-0FFFFH	590	Store a blank at the cursor position (blink cursor off).
240-290	DOS only lines.	600	Load BC with a 6-millisecond delay count.
250	This pointer protects your program from actions of DOS.	610	Delay. This slows down the blinking and provides some key debounce.
300-340	Level II Basic only lines.	620	Jump to the old *KI DVR. Get a key and return.
310	This pointer protects your program (like "MEMORY SIZE?" does) from the actions of Basic.	630	Auto-start. This is the execution address used by DOS to jump to the start of the program when it is loaded, and by Basic as the "/<ENTER>" address of the System command.
350-480	Initialize.		
360	Start of program. Save HL (used on return to DOS).		
370	Load HL with the address of the current *KI driver.		
380	Save the old *KI DVR's address at KBSCAN + 1 so the jump instruction at that location jumps to the old DVR to return a key to the calling program.		
390	Load HL with address of new *KI DVR.		
400	Store in the *KI DCB's DVR address.		
410	Point HL to one less than the driver and save in the pointer to top of usable RAM (protect program).		
420			

Register Set-up at Entrance to Drivers

Register A contains the function flag: 01 for input, 02 for output, or 04 for control status. Status flags are also set as follows: C flag is set for input, Z flag is set for output, and both reset for control/status.

B also contains the function flag, and C contains the byte to be output or the control byte. HL contains the address of the driver; this is useful for making your drivers relocatable. IX contains the address of the device's DCB and DE points to the DCB.

To return the input or status byte to the calling program, place it in the A register and return. ■

Jerry Lindsly can be reached at 1175 Shular Ave., Hamilton, OH 45011.

Project 2—PRINT/LPRINT Output Directing

If you put the address of the video driver into the *PR DCB driver address, all output that normally goes to the printer is directed to the video.

Program Listing 2 lets you direct the output from PRINT or LPRINT to the video, the printer, or both at the same time.

Since this program is executed from Basic, DOS users must use an origin that is easily remembered (such as 65432) so that you can load the program in. Go to Basic, and type "SYSTEM <ENTER>", "/65432<ENTER>". Level II users can simply execute as usual; load the program in with the System command and type "/<ENTER>".

Program Listing 2

```

00100 ;*****
00110 ;**          DIRECT/ASM          **
00120 ;**          Video/Printer Output Director    **
00130 ;**          Written by Jerry Lindsly         **
00140 ;**          1175 Shular Avenue              **
00150 ;**          Hamilton, Ohio 45011            **
00160 ;*****
00170 ;
00180 ;**** Define labels
00190 MAXMEM EQU 0FFFFH ;Highest RAM location in your machine.
00200 TOPMEM EQU 40B1H ;Pointer to top of usable RAM.
00210 BASIC EQU 0072H ;Re-entry to Basic.
00220 SNERR EQU 1997H ;Syntax error entry point.
00230 NAME EQU 418FH ;DOS reserved word vector.
00240 DODCB EQU 401DH ;Video DCB.
00250 PRDCB EQU 4025H ;Printer DCB.
00260 PRINT EQU 0B2H ;"PRINT" token.
00270 LPRINT EQU 0AFH ;"LPRINT" token.
00280 TO EQU 0BDH ;"TO" token.
00290 ;**** Initialize
00300 ORG MAXMEM-115 ;Originate in high RAM.
00310 START LD HL,(DODCB+1) ;Get video driver address.
00320 LD (DODVER+1),HL ;Save for later use.
00330 LD HL,(PRDCB+1) ;Get printer driver address.
00340 LD (PRDVR+1),HL ;Save.
00350 LD HL,DIRECT ;Point to output directing routine.
00360 LD (NAME),HL ;Save in NAME command vector.
00370 DEC HL ;Set "MEMORY SIZE?" to one
00380 LD (TOPMEM),HL ; less than directing routine.
00390 JP BASIC ;Jump to Basic "READY" condition.
00400 ;**** Directing routine.
00410 DIRECT CP PRINT ;Test for "PRINT" token.
00420 LD DE,DODCB+1 ;Point to *DO DCB DVR address.
00430 JR Z,DIR1 ;If "PRINT", skip over following code.
00440 CP LPRINT ;Test for "LPRINT" token.
00450 LD DE,PRDCB+1 ;Point DE to *PR DCB DVR address.
00460 JP NZ,SNERR ;If neither "PRINT" nor "LPRINT", syntax
error.
00470 DIR1 RST 16 ;Skip over "PRINT" or "LPRINT" token.
00480 RST 8 ;Syntax check, make sure
00490 DEFB TO ; "TO" token follows "PRINT" or
"LPRINT".
00500 CP 'V' ;Test for 'V'.
00510 LD BC,DODVR ;Point BC to video driver.
00520 JR Z,DIR2 ;If 'V', skip over following code.
00530 CP 'P' ;Test for 'P'.
00540 LD BC,PRDVR ;Point BC to printer driver.
00550 JR Z,DIR2 ;If 'P', skip over following code.
MORE
00560 CP 'B' ;Test for 'B'.
00570 LD BC,BOTH ;Point BC to DVR that outputs to both
video & printer.
00580 JP NZ,SNERR ;If neither 'V', 'P', nor 'B', syntax
error.
00590 DIR2 RST 16 ;Skip over 'V', 'P', or 'B'.
00600 EX DE,HL ;DE=Next Character Pointer, HL=DCB DVR
address.
00610 LD (HL),C ;Save LSB of selected driver address in
selected DCB.
00620 INC HL ;Bump to next address.
00630 LD (HL),B ;Save MSB.
00640 EX DE,HL ;HL=Next Character Pointer.
00650 RET ;Return to Basic.
00660 ;**** The drivers
00670 BOTH PUSH AF ;Save flags.
00680 CALL PRDVR ;Print character on printer.
00690 POP AF ;Restore flags.
00700 ;Display character on video.
00710 DODVR LD IX,DODCB ;Point IX to video DCB.
00720 DODVRL JP 0 ;Display character (patch to video DVR.).

```

Listing 2 continues

Program Listing 2 Line Functions

100-170	Program ID remarks.	230	NAME (418FH) is where control of the Basic interpreter is passed when the command "NAME" is encountered.
180-280	Define labels.	240	DODCB (401DH) is the address of the video device control block.
190	MAXMEM is used to tell the assembler where in memory to assemble the program. Set this equal to the highest free memory location in your machine: 4K—4FFFFH 16K—7FFFFH 32K—0BFFFFH 48K—0FFFFH	250	PRDCB (4025H) is the address of the printer DCB.
200	TOPMEM (40B1H) is where the pointer to the highest available RAM location is stored. Used to protect the program from Basic. This is equivalent to the answer to the "MEMORY SIZE?" question.	260	PRINT (0B2H) is the hex byte token where Basic stores the "PRINT" reserved word.
210	Basic (72H) is a re-entry point to Basic.	270	LPRINT (0AFH) is the token for the reserved word "LPRINT."
220	SNERR (1997H) is the entry point of the syntax error routine.	280	TO (0BDH) is the token for the reserved word "TO."
		290-390	Initialization.
		300	Originate machine code at MAXMEM minus 115 bytes.
		310	Execution starts here. Load HL with address of the video driver.

Table continues

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Continued

To use the program, execute the following statement from command mode or from a Basic program:

NAME src TO dest
src = PRINT or LPRINT
dest = V,P, or B (V = Video, P = Printer,
B = Both)

Example: NAME PRINT TO B
directs all output normally going to the video to both the video and printer.

If you would rather use a Basic program instead of an Assembly listing, see Program Listing 3. Before running the program, load in all other drivers that you'll need.

The program relocates the routines to just below wherever "MEMORY SIZE?" is set. "MEMORY SIZE?" is reset below these routines.

Note the thorough error-checking included in the program; not only does it tell you what kind of error (HEX Syntax or Checksum), it in-

Continues

Table continued			
320	Save, so you know where the video driver is.	570	Load BC with the address of the routine to direct output to both video and printer.
330	Load HL with address of the printer driver.	580	If character is not V, P, or B, syntax error.
340	Save this, too.	590	Increment HL over V, P, or B. At this point, DE points to the DCB driver address we want to change, video or printer. BC points to the address of the driver you want output to go to: video, printer, or both.
350	Load HL with address of your routine to change the drivers.	600	Point HL to the DCB driver address to change; DE contains the next character pointer to the Basic line.
360	Save in the "NAME" command vector, so that when the NAME command is used in Basic it jumps to your routine.	610	Save LSB of the address of selected driver in the LSB of the selected driver address.
370	Point HL to highest available RAM location to Basic.	620	Point HL to MSB of the driver address.
380	Save in the "MEMORY SIZE?" pointer so Basic doesn't overwrite your routine.	630	Save MSB.
390	Jump to Basic.	640	Restore next character pointer to HL (necessary to return to Basic properly).
400-650	Routine to interpret syntax and change the drivers as selected. Upon entry to the routine, HL points to the encoded Basic line after the occurrence of the NAME command. Register A contains the first character following the NAME token.	650	Return back to Basic (continue processing Basic line and program).
410	Test to see if the character is the "PRINT" token.	660-900	The drivers.
420	If it is, you want DE pointing to the video DCB driver address.	670-700	Driver to direct output to both printer and video.
430	If it is the "PRINT" token, skip the following processing.	670	Save flags so that they are the same for both drivers.
440	Test to see if the character is the "LPRINT" token.	680	Output character to printer.
450	If it is, you want DE pointing to the printer DCB driver address.	690	Restore flags.
460	If the character is neither "PRINT" nor "LPRINT", it must be a syntax error.	700	Since video driver immediately follows, there is no need to call it.
470	RST 16 is used to increment HL over the current character in the tokenized Basic program lines; skip over spaces, line feeds, etc., and retrieve the next character to the accumulator. The character is also tested for numeric. C is set if the character is in the range ASCII 0 (30H) to 9 (39H).	710-720	Video driver.
480	RST 18 makes a syntax check. If the next character (pointed to by HL) doesn't equal the byte following the RST 8 opcode, a jump is made to the syntax error routine (1997H). In this case, you want the next character to be the "TO" token.	710	Point IX to video DCB. At entrance to a driver, IX is assumed to point to the DCB of that device. If, however, output is directed from the *PR DCB to the video driver, IX points to the *PR DCB, not the *DO DCB, as it should. This code corrects that.
490	"TO" token used with RST 8 above.	720	Jump to the video driver. At initialization, the address of the actual *DO DVR was stored here at DODVR + 1.
500	Test for V.	730-900	Printer driver.
510	Load BC with the address of the video driver (stored earlier).	730	Save flags.
520	If V, skip over the following process so output goes to the video.	740-750	Transfer IX to HL.
530	Test for P.	760	Get LSB.
540	Load BC with the address of the printer driver.	770	Test to see if output came from *PR DCB (4025H); if so, IX points to it. Otherwise, IX points to *DO DCB (401DH).
550	If P, skip over the following process so output goes to the printer.	780	If output came from *PR DCB, skip the following filter code:
560	Test for B.	790-870	Filter code. Output coming from video DCB to the printer DVR may contain unneeded control codes. This code filters out all but carriage returns and line feeds.
		880	Restore flags.
		890	Point IX to printer DCB for same reasons IX is pointed to *DO DCB in line 710.
		900	Jump to the printer driver. At initialization, the address of the actual printer driver is stored here at PRDVR + 1.
		910	End of program; execution address.

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dicates in what data line the error occurred. This is accomplished by PEEKing a pointer in reserved RAM; this pointer is constantly updated by Basic and contains the line number of the last read data item. HEX Syntax error refers to an invalid hex character (those other than 0-9 or A-F). The last hex byte in each data line is the checksum for that line. If you get either error, compare the line to the listing.

Now you are familiar with DCBs and drivers. Experiment with what you have learned. Some information on using DOS-reserved words and syntax can also be picked up by studying Program Listing 2. ■

Listing 2 continued

```

00730 PRDVR  PUSH  AF          ;Save flags.
00740                PUSH  IX          ;IX points to DCB, so
00750                POP   HL          ; transfer IX to HL.
00760                LD    A,L         ;Get LSB.
00770                CP    25H         ;Test to see if output came from *PR DCB
(4025H).
00780                JR    Z,PR1       ;If it did, skip the following filter
code.
00790                LD    A,C         ;Get character to be printed.
00800                CP    20H         ;Test for control codes.
00810                JR    NC,PR1      ;If not a control code, go ahead and
print it.
00820                CP    0DH         ;Test for carriage return.
00830                JR    Z,PR1       ;If carriage return, go ahead and print
it.
00840                CP    0AH         ;Test for line feed.
00850                JR    Z,PR1       ;If linefeed, go ahead and print it.
00860                POP   AF          ;All other controls don't print;
00870                RET              ; just restore flags and return.
00880 PR1   POP   AF          ;Restore flags.
00890                LD    IX,PRDCB    ;Point to printer DCB.
00900 PRDVR1  JP    0             ;Print character & return (patch to
printer DVR.).
00910                END    START     ;Auto-start.

```

```

0 CLS: CLEAR200:DEFINTG
10 PRINT"*****"
20 PRINT"***          FLASH/BAS          ***"
30 PRINT"***          FLASHING CURSOR PROGRAM          ***"
40 PRINT"***          &          ***"
50 PRINT"***          DIRECT/BAS          ***"
60 PRINT"***          VIDEO/PRINTER OUTPUT DIRECTOR          ***"
70 PRINT"***          WRITTEN BY JERRY LINDSLY          ***"
80 PRINT"***          1175 SHULER AVENUE          ***"
90 PRINT"***          HAMILTON, OHIO 45011          ***"
100 PRINT"*****"
200 PRINT@847,"(F) LASH, (D) IRECT, OR (B) OTH":GOSUB205
202 PRINT@847,"( ) LASH, (.) IRECT, OR ( ) OTH":GOSUB205:GOTO200
205 FORN=1TO25:A$=INKEY$
210 IFA$="F"THENZ=1:L=47ELSEIFA$="D"THENZ=2:L=112ELSEIFA$="B"THENZ
=3:L=159ELSENEXT:RETURN
220 X=PEEK(16561)+256*PEEK(16562)-L
230 CLS:PRINT"START ADDRESS =":X:PRINT"END ADDRESS =":X+L-1:PRINT:
PRINT:GOSUB500
240 POKEL6411,G1:POKEL6412,G2:POKEL6419,Z:X=X-3:GOSUB500:POKEL6561
,G1:POKEL6562,G2
250 CLEAR200:DEFINTC-P:DEFSTRA,B,Z
260 X=PEEK(16411)+256*PEEK(16412):D=PEEK(16419):POKEL6411,75:POKEL
6412,73:POKEL6419,68
270 IFD AND 1 THENZ="FLASH" :GOSUB290
280 IFD AND 2 THENZ="DIRECT":GOSUB290
285 END
290 PRINT
300 READA:IFA<>ZTHEN300ELSE$X:PRINTZ;:Z1="END."+Z
310 READA:IFA=Z1THENS1=X:GOTO600ELSEQ=0
320 FORN=0TOINT(LEN(A)/3)-1:B=MID$(A,N*3+1,2):GOSUB400:GOSUB500
330 POKEG,H:Q=Q+H:X=X+1:PRINT".":NEXT
340 B=RIGHT$(A,2):GOSUB400:Q=Q-INT(Q/256)*256
350 IFH=QTHEN310ELSEPRINT:PRINT"CHECKSUM";:GOTO430
400 B1=LEFT$(B,1):GOSUB410:H=H1*16:B1=RIGHT$(B,1):GOSUB410:H=H+H1:
RETURN
410 H1=ASC(B1)-48:IFH1<-1THENIFH1<10THENRETURNELSEH1=H1-7:IFH1>9AN
DH1<16RETURN
420 PRINT:PRINT"HEX (";B;") SYNTAX";
430 PRINT" ERROR IN DATA LINE":PEEK(16602)+256*PEEK(16603):END
500 G=X+(X>32767)*65536:G2=X/256:G1=X-G2*256:RETURN
600 READM:IFM<>-1THENX=S+M:GOSUB500:GA=G:P=PEEK(G):X=X+1:GOSUB500:
GB=G:X=P+256*PEEK(G)+S:GOSUB500:POKEGA,G1:POKEGB,G2:GOTO600
610 X=S:GOSUB500:POKEL6782,195:POKEL6783,G1:POKEL6784,G2
620 NAME:PRINT:PRINTZ;" - ACTIVATED":X=S1:RETURN
1000 DATA "FLASH"
1010 DATA "E5 2A 16 40 22 2D 00 21 0F 00 22 16 40 E1 C9 3A 40"
1020 DATA "22 40 B7 28 17 2A 20 40 DD 7E 03 EE 01 DD 77 03 86"
1030 DATA "36 8F 28 02 36 20 01 80 01 CD 60 00 C3 00 00 B7"
1040 DATA "END.FLASH", 5, 8, -1
2000 DATA "DIRECT"
2010 DATA "E5 2A 1E 40 22 4E 00 2A 26 40 22 6E 00 21 15 00 33"
2020 DATA "22 8F 41 E1 C9 FE B2 11 1E 40 28 08 FE AF 11 26 CF"
2030 DATA "40 C2 97 19 D7 CF BD FE 56 01 49 00 28 0F FE 50 38"
2040 DATA "01 50 00 28 08 FE 42 01 44 00 C2 97 19 D7 EB 71 AB"
2050 DATA "23 70 EB C9 F5 CD 50 00 F1 DD 21 1D 40 C3 00 00 68"
2060 DATA "F5 DD E5 E1 7D FE 25 28 0F 79 FE 20 30 0A FE 0D 4B"
2070 DATA "28 06 FE 0A 28 02 F1 C9 F1 DD 21 25 40 C3 00 00 31"
2080 DATA "END.DIRECT", 5, 11, 14, 42, 49, 56, 70, -1

```

Program Listing 3

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The scenario is that you are the King of Jerusalem and have to rule your Kingdom from 1169 to 1177. Your ultimate aim is to prevent any incursions by the invading Saracens. You have a total of forty-eight fortresses, all interconnected by caravan routes. The program will pick these off one by one, unless you can defeat the Saracen army in the field, by gathering together an army for yourself from the various garrisons.

Each year consists of six (bi-monthly) moves. At the end of each year (at play rating 6), you will find a new Saracen army moves into the Kingdom from enemy territory. All Saracen armies that stay in the field for a year are reduced by desertions.

The program itself has an artificial intelligence, in as much as the Saracens attempt to seige and take castles and fortresses that they have not previously moved to. In this way a Saracen army that has been seiging for a few years may be reinforced by a new army, which may be sufficient troops to affect the taking of the fortress.

However, your troubles do not stop there! You have to provide food for garrisons and your assembling army. If you find a garrison is under seige, the only way to give them food is to send a caravan, which costs money!

The program is menu-orientated and a map is supplied for both the Northern area and the Southern. The graphics are good, and both Crusader lines and Saracen lines are also displayed, again with an appropriate map. The caravans, of course, are used to transport food from town to town and when this option in the menu is selected then the 5 available caravans are displayed on the screen. You then have four options, to attach or detach food or horses, and to raise or move caravans.

EMPEROR

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Occasionally a game comes along which is of such immensity that it is almost impossible to describe. Such a game is "Emperor". It is entirely a game of strategy, played on a graphic map of the Roman Empire as it was in the first four centuries A.D. The player takes the part of the Emperor and he must pit his wits and forces against invading barbarians, rebellious provincials and treacherous Roman Generals. Even the Plebs of Rome will have to be placated with bread and circuses if the Emperor is to keep his head and throne. If he can last out for the first eight years of the game, he is judged on the state of the Empire at the end of that time. There are three levels of play. Depending upon his choice, the Emperor has to guide the Empire through the first, third and fourth centuries. To win in the first century he must expand the Empire by two provinces, in the third he must maintain his Empire intact and in the fourth he must lose not more than two Provinces. For each Province the player is given three items of information, the number of loyal Legions, the number of revolting Legions and the number of Barbarian Invaders or Local Rebels. During play Legions must be raised, taxes inflicted and troops moved. The choice of Generals can be very critical—some are loyal and good fighters, some are neither. Battles must be fought and invasions repelled. All the while the citizens in Rome must be kept happy and —you must keep an eye on those Barbarians in Britannia!

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Apple Core Emulator

by Gary Grout

Now Model I and Model III users can have the best of both worlds. With this emulator, your TRS-80 writes and runs Apple II software.

The heart of the Apple II computer is the 6502 microprocessor. The Apple's popularity can be attributed to its simple program and interface requirements and is manifest by the wide variety of available software.

TRS-80 owners who want to access some of that software don't have to spend \$1,500 to buy an Apple. A less expensive solution is the Apple II emulator program provided here.

An emulator is a software program that mimics the way a particular piece of hardware (like a microprocessor) operates. It performs the same functions

and produces the same results as that hardware.

I call my 6502 emulator the Apple Core Emulator. Not only can it run Apple-compatible programs, it creates them as well. The emulator converts Assembly-language code for the TRS-80 Z80 microprocessor into 6502 machine code.

Since emulation is by nature slow, there are limitations to the emulator's processing speed. It takes several Z80 instructions to duplicate a single 6502 instruction, so it's doubtful that anyone would write a commercial machine-code program for the 6502 to run on a

Z80. But you can produce 6502 code with a TRS-80 that runs on a 6502 microprocessor.

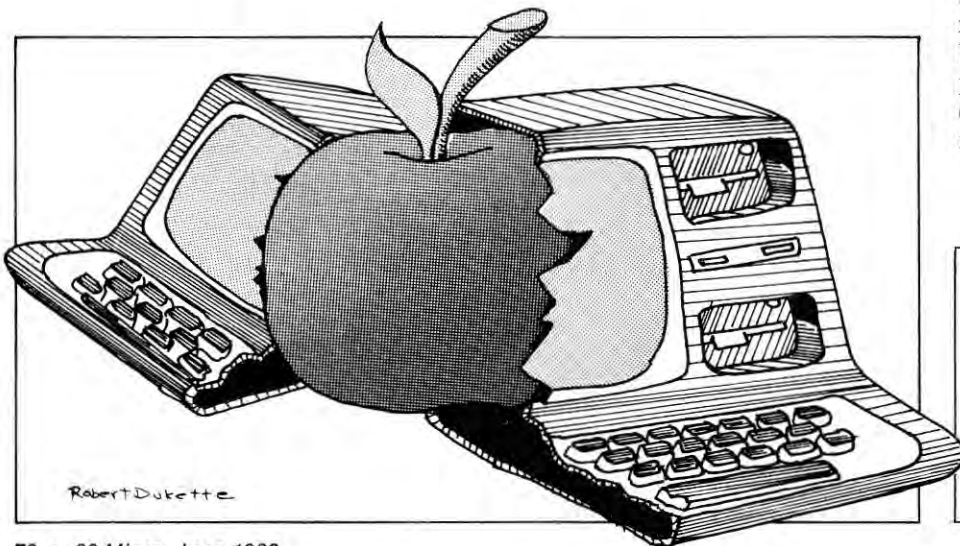
Going to the Code

The Apple Core Emulator interprets 6502 code one instruction at a time and substitutes Z80 routines for each.

The 6502 register structure and its addressing modes are quite different from those of the Z80. The Z80 has 14 registers, eight of which make up a rarely used alternate register set. The emulator uses this alternate register set to keep track of 6502 code.

The 6502 has only three 8-bit registers, a stack pointer, program counter, and flag register. The working registers are named A, X, and Y. The program counter is referred to as PC, the stack as S, and the flag register as P (for phlag).

Although the 6502 has fewer registers, it's more versatile. Microprocessors use addressing modes to access main memory or other registers. One difference between the 6502 and the Z80 is that the 6502 uses paging to address memory; it handles memory in 256-byte blocks called pages. The 6502 has a zero page, the first 256 bytes of memory, called frequently when using the different addressing modes.



The Key Box

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The 6502's nine different addressing modes let you manipulate data in many different ways. The nine modes are: immediate, absolute, direct, relative, indexed, pre-indexed, post-indexed, indirect, and implied.

Coming to Terms

Explaining the addressing modes is difficult. My analogy of a train delivering freight should help you understand each mode.

Consider the CPU as a train traveling down a track. The track represents a program with each railroad tie a byte. The program is a continuous track of memory from byte zero to FFFFH. The engine is a program counter. It travels down the line passing each instruction byte in a sequence determined by the track. The train cars are registers A, X, Y, and P. They are loaded and unloaded as they progress through the program.

Loading and unloading train cars is analogous to using the CPU addressing modes. The program instructions or opcodes (ties) encountered by the program counter (engine) one at a time determine what is loaded, how it is loaded, and which register (car) to load.

*“Consider the CPU
as a
train traveling
down a track.”*

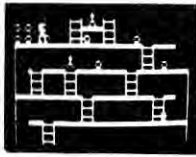
The following descriptions of the addressing modes provide a technical explanation, an example instruction, and an explanation using the train analogy.

In the implied mode, the opcode contains the names of the registers it will use. A mnemonic example is TXA. This instruction transfers the contents of the X register to the contents of the A register.

On the railroad, the program counter engine passes over the instruction on the track. TXA names the cars to load and unload; it tells the train to move the cargo from car X to car A.

Immediate addressing uses the next

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LIBERATOR by John Crane

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and rescue four lovely young girls from their monstrous capture. Ahh, but there's a catch! They've been captured by a 2000 pound, seven foot tall, mechanical robot gone mad. Sound easy? Just wait until you see the surprises we've got instore for you! 1982's most popular arcade game, Donkey Kong™, comes to life on your TRS-80 screen through the magic of John Cranes LIBERATOR! And if you thought Donkey Kong was fun, wait until you experience LIBERATOR's five seperate screens (more than the arcade version) each utilizing the best sound and graphics possible!

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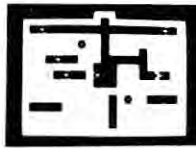
CLASH By Bill Dunlevy

Once again, one of the markets most creative programers, creator of Assault, Jovian, and the ever famous Cyborg, brings to the industry another smash hit! Yes, Bill Dunlevy has created CLASH, a fantastic new arcade simulation!

Mounted upon your great white winged stallion, prepare yourself for a clash within the arena. This day, you will be competeing against famous riders from all over the planet. As the tournament begins, their is a frenzy of flapping wings and bucking horses, but finally all riders are airborne and the contest has begun. With a firm grasp on the reins, maneuver your horse above the others and then descend upon them. You must dismount the other riders, before their skill prevails and they dismount you.

Be warned, CLASH is for those riders of skill and reactions! Even one second of carelessness can prove fatal. But for those who love a challenge and an adventure, CLASH, with its multi-levels of play, will definitely become a favorite! Model I/II

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DIG OUT by John Crane

Uh oh! The wackiest game to ever hit an arcade is now invading your computer! Dig Out, that crazy game of dirt and rock will turn your reactions inside out.

As the game begins, you'll find yourself amidst tons of rock and earth. You must dig your way through the surrounding tunnels and hunt down the deadly monsters. But watch out!!! As the hunter, you might just become the hunted. The monsters are strangely powerful, their touch can destroy and their eggs can obliterate. Besides all this, the underground is their natural habitat. With a mere thought, they can move through tons of rock and appear before you. So, you better be quick and your reactions better be good!!!

DIG-OUT is truly another COMPUTER SHACK classic. In each of its fifteen different levels, DIG-OUT combines the best sound, fantastic graphics, and above all, exciting action for a game that surpasses even the original. Model I/III

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ASSAULT by Dunlevy & Frayer

Strap yourself into the dimly lit ATV (All Terrain Transport), check the motor, the laser's, and visibility, Now prepare yourself for an underground trip that you won't soon forget . . . If you live! After weeks of exploring and mining, you've accumulated quite a tidy sum of gold. But just as you thought the adventure

to be over, you stumble upon a part of the mountain that is soon to become your battle ground, if not your grave. These wide open caverns are inhabited by strange creatures set upon stealing your gold and maybe even your life. You can battle them in your laser equipped ATV, but beware! Along the walls grow rather harmless looking mushrooms, that is until you've touched one. But all of this is childs play compared to battling NODRID, the emperor spider of this hellish place. His bloodthirsty fangs will make short work of any unwary adventurer, but you will not find him such an easy prey! Model I/III

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byte the program counter points to as data. For example, LDX 2 is an instruction that loads the X register with 2.

As the PC (program counter) engine passes over an immediate instruction, the engineer is informed that the next number he comes upon is something to be loaded onto or unloaded from the train. As the program counter travels over LDX of the example, it is told that the next number (2) should be picked up and placed in the X car.

Absolute addressing uses the next 2 bytes the program counter points to as an address for data in memory. STY \$FE00 is a store opcode that stores the Y register at location FE00H.

As the engine travels over an absolute instruction, the engineer is informed that the next two numbers on the track specify the station where cargo can be picked up or left. As the PC engine encounters the absolute STY instruction, it takes the next 2 bytes on the track (FE00H) as the name of the station where car Y is to be unloaded.

Direct addressing uses the byte encountered by the program counter as an address for a byte in the first page (256 bytes) of memory. This is referred to as zero page addressing; the data is a byte

in zero page. The STY 2 instruction stores the contents of the Y register in the zero page location 0002H.

As the train comes upon a direct instruction, the engineer learns that the next byte is the number of a warehouse at Central Station (page zero) where he is to transfer cargo. In this instance, the cargo is moved from car Y to warehouse 2 in Central Station.

“Indexed addressing uses a base address and adds the value in the X or Y register.”

Relative addressing uses the next byte ahead of the program counter as an offset added to the program counter, and makes the program branch to some other point of execution.

If the zero flag is set, BEQ 12, the

Branch Equal instruction, adds 12 to the data in the program counter. This instruction branches 128 bytes back or 127 bytes forward.

The instruction tells the engineer that a switch may have been thrown and that the distance to the new destination is the next number under the engine. The instruction, BEQ 12, says that if the flag car contains an equals sign, then it should take the next siding and rejoin the main line 12 bytes down the track.

Indexed addressing uses a base address and adds the value in the X or Y register to it.

The instruction LDA \$3C08,X adds the value in the X register to 3C08H and uses the result as the address of a data byte to be loaded into the A register.

When the train encounters an indexed instruction, the engineer is told the next station at which he is to stop. He is also informed that either the X or Y car has information as to which warehouse to use for transfer. With LDA \$3C08,X, the train stops at station 3C08H and adds the number in X to 3C08H. It then takes the resulting warehouse number, goes there, and then loads that cargo into car A.

Pre-indexed addressing adds the X

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register to the next byte in the program. The result is used to point to a 2-byte address in the zero page which then points somewhere else.

CMP (05,X) is the compare operation. It adds the value in X to 0005H, goes to that location in zero page, retrieves the address stored there, and uses it to fetch a data byte from memory to compare with register A.

At this point, the train analogy begins to read like a spy novel.

The engineer receives a message that the next byte the train passes over is the first half of a warehouse number at Central Station (zero page). The second half of the number is in the X car. The two numbers must be added together to get the complete warehouse number. In this warehouse is a note telling the real location of the cargo. In this example, the data in 0005H is added to the cargo number in the X car, resulting in a warehouse number. That warehouse is opened and the shipment address is found. The material at the shipping address is compared to the contents of car A.

Post-indexed addressing takes the next byte in the program as an address in zero page. It uses 2 bytes located there plus the contents of the Y register as a pointer to some other location in memory.

The STA (05),Y instruction adds Y to the 2-byte address in zero page locations 5 and 6. The result is used as the address for storing the data byte in A register.

The engineer receives the message that the next byte is a warehouse number in Central Station. A note in the warehouse holds an address that, when added to the number in the Y car, tells where the shipment is stored. In the example, warehouse 5 is opened and the number in car Y is added to the address. This gives the location of the warehouse in which to store the contents of car A.

The indirect mode uses the next 2 bytes of the program to point to some other locations. JMP (\$4035), the Jump instruction, takes an address from location 4035H and jumps to it.

The engineer receives word that the location of the next shipment is waiting at the next station, 4035H. There he gets a note specifying another location and proceeds there.

Instruction Sets on a Parallel Track

To compare the Z80 and 6502 instruction set, examine Fig. 1. Notice that, although the mnemonics are different, many of the 6502 instructions parallel the Z80 instruction set. All but three 6502 instructions have a corresponding Z80 instruction. The three

ADC	A+M+C-->A	ADD WITH CARRY
AND	A AND M-->A	LOGICAL AND
ASL	C<-7XXXXXX0	ARITHMETIC SHIFT LEFT
BCC	BRANCH C=0	BRANCH CARRY CLEAR
BCS	BRANCH C=1	BRANCH CARRY SET
BEQ	BRANCH Z=1	BRANCH EQUAL
BIT	A AND M	COMPARE BITS WITH MEMORY
BMI	BRANCH N=1	BRANCH MINUS
BNE	BRANCH Z=0	BRANCH NOT EQUAL
BPL	BRANCH N=0	BRANCH PLUS
BRK		BREAK
BVC	BRANCH V=0	BRANCH OVERFLOW CLEAR
BVS	BRANCH V=1	BRANCH OVERFLOW SET
CLC	0-->C	CLEAR CARRY
CLD	0-->D	CLEAR DECIMAL
CLI	0-->I	CLEAR INTERRUPT
CLV	0-->V	CLEAR OVERFLOW
CMP	A-M	COMPARE ACCUMULATOR
CPX	X-M	COMPARE X REGISTER
CPY	Y-M	COMPARE Y REGISTER
DEC	M-1-->M	DECREMENT
DEX	X-1-->X	DECREMENT X REGISTER
DEY	Y-1-->Y	DECREMENT Y REGISTER
EOR	A XOR M-->A	EXCLUSIVE OR
INC	M+1-->M	INCREMENT
INX	X+1-->X	INCREMENT X REGISTER
INY	Y+1-->Y	INCREMENT Y REGISTER
JMP	PC+M-->PC	JUMP
JSR	PC->S ADDR->PC	JUMP TO SUBROUTINE
LDA	M-->A	LOAD ACCUMULATOR
LDX	M-->X	LOAD X REGISTER
LDY	M-->Y	LOAD Y REGISTER
LSR	0->7XXXXXX0->C	LOGICAL SHIFT RIGHT
NOP		NO OPERATION
ORA	A OR M-->A	OR ACCUMULATOR
PHA	A-->S S=S-1	PUSH ACCUMULATOR
PHP	P-->S S=S-1	PUSH PROCESSOR FLAGS
PLA	S-->A S=S+1	PULL ACCUMULATOR
PLP	S-->P S=S+1	PULL PROCESSOR FLAGS
ROL	C<-7XXXXXX0<-C	ROTATE LEFT
ROR	C->7XXXXXX0->C	ROTATE RIGHT
RTI		RETURN FROM INTERRUPT
RTS	S->PC	RETURN FROM SUBROUTINE
SBC	A-M-C-->A	SUBTRACT WITH BORROW
SEC	1-->C	SET CARRY
SED	1-->D	SET DECIMAL
SEI	1-->I	SET INTERRUPT
STA	A-->M	STORE ACCUMULATOR
STX	X-->M	STORE X REGISTER
STY	Y-->M	STORE Y REGISTER
TAX	A-->X	TRANSFER ACCUMULATOR TO X REGISTER
TAY	A-->Y	TRANSFER ACCUMULATOR TO Y REGISTER
TSX	S-->X	TRANSFER STACK INTO X REGISTER
TXA	X-->A	TRANSFER X REGISTER TO ACCUMULATOR
TXS	X-->S	TRANSFER X REGISTER TO STACK
TYA	Y-->A	TRANSFER Y REGISTER TO ACCUMULATOR
	(M DENOTES MEMORY)	

Figure 1

6502		Z80
A	=	A'
P	=	F'
Y	=	B'
X	=	C'
PC	=	IX
S	=	HL'

Figure 2

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different instructions are Break, Return from Interrupt, and No Operation. The similarity in instruction sets is encouraging to the Z80 programmer learning about the 6502. The major task, however, is to gain an understanding of how the nine addressing modes come into play while using these instructions.

I said earlier that the emulator uses the Z80's alternate register set to simulate most of the working registers of the 6502.

In Fig. 2 the accumulator and flag register of the 6502 are emulated by the AF' (AF prime) Z80 registers. The 6502's Y and X registers use the Z80 B' and C', respectively. The Z80 HL' acts as the 6502 stack pointer, and the Z80 IX performs the duties of the program counter.

Any reference to zero page is automatically directed to that section of memory. The index register IY is also initialized to point to 6E00H and need not be altered by the operator.

Another difference between the 6502 and the Z80 is in the flag bit positioning. Viewed from Debug, the normal 6502 flag register would appear as:

	N	V	*	B	D	I	Z	C
	7	6	5	4	3	2	1	0 bit
N	Negative						1 = neg	
V	Overflow						1 = true	
*	Not used							
B	Break						break command	
D	Decimal Mode						1 = true	
I	Interrupt						1 = disable	
Z	Zero						1 = result zero	
C	Carry						1 = true	

The Z80 flags are:

	S	Z	*	H	*	V	N	C
	7	6	5	4	3	2	1	0 bit
S	Sign							
Z	Zero							
*	Not used							
H	Half carry							
V	Overflow							
N	Add/subtract							
C	Carry							

The emulator preserves the Z80 bit order to prevent errors in interpreting the flags. The decimal flag is not displayed although the decimal mode of the 6502 is simulated. Break and interrupt are not used since the emulator is only suited for applications where breaking and interrupting the program are not needed. Other differences, such as the clearing and setting of the carry

during addition and subtraction, are handled by the instruction subroutines.

The algorithm to perform 6502 code on the Z80 begins with an instruction to fetch the first 6502 operation code. This instruction is compared with a table for a match. This table holds all the addresses for the Z80 routines that simulate 6502 instructions. It consists of an instruction set opcode byte followed by the starting address of the routine to simulate the instruction.

When a 6502 instruction is matched to the Z80 routine, the program branches to that routine and the instruction is executed. The program then checks for single stepping or a break point. If these conditions don't exist, the second instruction is performed.

The subroutines that simulate the addressing modes of the 6502 are commonly used by all instructions. These addressing routines are found on lines 100-880 in the emulator. (See the Program Listing.) The subroutines that perform an instruction begin with line 880 and end with 7250.

The opcode labels are essentially the names of each instruction with a number before the last letter. An ADC instruction is labeled in the listing as AD1C. Labels that provide loops or location jump addresses are named some form of Go, Down, or Here, usually with a number.

The master routine that calls all other subroutines, searches tables, and checks for single stepping and break points falls on lines 10330-10720. From "Start," on line 10350, to "Loop," on line 10400, the HL register is saved, the next program instruction is fetched, and the address of the instruction table is loaded into HL.

The table search is performed from lines 10400-10500. From lines 10500-10570, the address of the subroutine that simulates the instruction is loaded into the 2 memory bytes behind the byte labeled "Inst." When Inst is read, the program counter calls the subroutine and then restores HL to check for single stepping. If no single stepping is required, IX is compared to HL for a break point and the program branches based on the result of that comparison.

Running Two at a Time

The Apple Core Emulator is run while in Debug. To begin the program, load the emulator with the DOS command Load and then enter Debug. Set the PC (program counter) register to the beginning of the emulating program (8000H). Load HL with a break-

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point address of the 6502 code or, if single stepping is desired, with 0000. Initialize the HL register to 6FFFH for the 6502 stack.

To run a 6502 program, load the starting address of the 6502 program into the IX register. To single step through the 6502 program execution, load HL with 0000 and press the C key twice for every instruction you wish to execute. To run the program in its entirety, load the address of the program's end into the HL register and type C. The emulator program returns when that address is reached.

Notes on Debug

The Debug utility that accompanies NEWDOS80 lets you clear the screen before you execute the machine code by pressing clear prior to typing the G command. TRSDOS Debug for the Model I does not support that feature, but it can be simulated by inserting the following line into the Assembly listing. The line should be numbered 10325 and labeled Begin.

```
CD C9 01 10325 BEGIN CALL 01C9H
;CLEARS SCREEN
```

Delete the Begin label from line 10330. Then press C three times to execute a single 6502 instruction. When single-stepping, press the C key once to clear the screen, once to execute the code, and once to return to the beginning of the emulator.

In the Model I Debug, you can alter Debug while it is in memory; Model III users can't. Because of this, you can rename the alternate registers to match

```

                                100
E000 A9 41 110                .OR    $E000
E002 A0 00 120                LDA    #$41    ;HEX A
E004 99 00 3C 130            LOOP   LDY    #$0
E007 C8 140                    STA    $3C00,Y
E009 F0 03 150                INY
E00A 4C 04 E0 160            BEQ    DONE
E00D 00 170                    JP     LOOP
                                180            .BYTE  $00
                                .END
```

Figure 3

```

                                100
E000 A0 00 110                BEGIN  LDY    0
E002 AD 01 38 110            LDA    ROW1
E005 20 3B E0 120            JSR   TEST
E008 A0 08 130                LDY    8
E00A AD 02 38 140            LDA    ROW2
E00D 20 3B E0 140            JSR   TEST
E010 A0 10 150                LDY    16
E012 AD 04 38 160            LDA    ROW3
E015 20 3B E0 170            JSR   TEST
E018 A0 18 180                LDY    24
E01A AD 08 38 190            LDA    ROW4
E01D 20 3B E0 200            JSR   TEST
E020 A0 20 210                LDY    32
E022 AD 10 38 220            LDA    ROW5
E025 20 3B E0 230            JSR   TEST
E028 A0 28 240                LDY    40
E02A AD 20 38 250            LDA    ROW6
E02D 20 3B E0 260            JSR   TEST
E030 A0 30 270                LDY    48
E032 AD 40 38 280            LDA    ROW7
E035 20 3B E0 290            JSR   TEST
E038 4C 00 E0 300            JMP    BEGIN
E03B D0 01 310                TEST   BNE    DISP
E03D 60 320                    RTS
E03E 18 330                    DISP  CLC
E03F A2 00 340                LDY    0
E041 6A 350                    DISPL ROR
E042 E8 360                    INX
E043 90 FC 370                BCC   DISPL
```

Figure 4 continues

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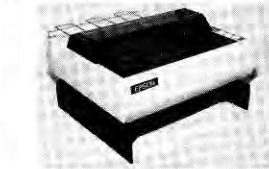
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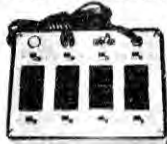

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 E056 B9 60 E0 490
 E059 A4 02 500
 E05B 99 00 3C 510
 E05E E6 02 520
 E060 60 530
 E061 40 540
 E062 41 550
 E063 42 560
 E064 43 570
 E065 44 580
 E066 45 590
 E067 46 600
 E068 47 610
 E069 48 620
 E06A 49 630
 E06B 4A 640
 E06C 4B 650
 E06E 4C 660
 E06F 4D 670
 E070 4E 680
 E071 4F 690
 E072 50 700
 E073 51 710
 E074 52 720
 E075 53 730
 E076 54 740
 E077 55 750
 E078 56 760
 E079 57 770
 E07A 58 780
 E07B 59 790
 E07C 5A 800
 E07D 00 00 00 810
 E080 00 00 820
 E082 30 830
 E083 31 840
 E084 32 850
 E085 33 860
 E086 34 870
 E087 35 880
 E088 36 890
 E089 37 900
 E08A 38 910
 E08B 39 920
 E08C 3A 930
 E08D 3B 940
 E08E 2C 950
 E08F 2D 960
 E090 2E 970
 E091 2F 980
 E092 0D 990
 E093 00 1000
 E094 00 1010
 E095 5B 1020
 E096 5C 1030
 E097 5D 1040
 E098 5E 1050
 E099 20 1060
 E09A 21 1070
 E09B 22 1080
 E09C 23 1090

CLC
 TYA
 STX PTR3
 ADC PTR3
 BCC DISPl
 CLC
 TYA
 STX PTR3
 ADC PTR3
 TAY
 LDA SHIFT
 BEQ DOWN
 CLC
 TYA
 ADC 23
 TAY
 DOWN LDA LETTER-I, Y
 LDY PRT1
 STA SCREEN, Y
 INC PTR1
 RTS
 LETTER .BYT ' @ABCDEFGG '

.BYT ' HIJKLMNO '

.BYT ' PQRSTUUVW '

.BYT ' XYZ '

.BYT \$00,00,00,00,00

.BYT ' 01234567 '

.BYT ' 89:;,-./ '

.BYT \$0D,\$00,\$00

.BYT \$5B,\$5C,\$5D,\$5E,\$20

.BYT ' !"#%&' '

Figure 4 continues



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6502 notation. Memory from 4F61H-4F70H holds the names of the registers displayed by Debug. Modify those bytes to display the 6502 register names. (Caution: you must then refer to those registers using the 6502 names, not the alternate register-set names.)

If you rename BC' as YX', you must type RYX',xxxxh(enter) to change the contents of YX'.

Debugging

Experiment with the two sample programs in Figs. 3 and 4. The first program fills the screen with 250 A's. It's a good program to use while assembling and debugging the Apple Core Emulator. The second program is a keyboard scan that displays a character on the screen when a key is pressed. Assem-

“The emulator’s goal is to acquaint you with the operation of the 6502.”

bling these 6502 programs enables you to get to know 6502 opcode.

When you debug the emulator, single-step one instruction in all of its addressing modes. If the addressing modes are working correctly, it is easier to pinpoint the subroutines that are assembled with errors.

Run the sample programs by entering the hex code into memory. You will immediately realize one drawback of an emulator: Because it interprets 6502 code, its execution is slow, just as Basic is slow when compared to an Assembly-language program.

However, the emulator’s goal is to acquaint you with the operation of the 6502, not to simulate real-time arcade games. If you have software to convert to the 6502, the emulator gives you a head start on the task.

The 6502, together with a variety of support integrated circuits, simplified microcomputer construction. Today you can find 6502 microprocessors used in many popular computers. So if you're looking to expand your understanding of today's microcomputers, a few hours emulating the 6502 will be time well spent. ■

Gary Grout can be reached at 26324 Edgewater Blvd. NW, Poulsbo, WA 98370.

Figure 4 continued

```

E09D 24          1100
E09E 25          1110
E09F 26          1120
E0A0 27          1130
E0A1 28          1140      .BYT      '( ) *+<=>?'
E0A2 29          1150
E0A3 2A          1160
E0A4 2B          1170
E0A5 3C          1180
E0A6 3D          1190
E0A7 3E          1200
E0A8 3F          1210
                1220      SCREEN      .EQ      $3C00
                1230      PTR3        .EQ      $03
                1240      PTR1        .EQ      $01
                1250      ROW1       .EQ      $3801
                1260      ROW2       .EQ      $3802
                1270      ROW3       .EQ      $3804
                1280      ROW4       .EQ      $3808
                1290      ROW5       .EQ      $3810
                1300      ROW6       .EQ      $3820
                1310      ROW7       .EQ      $3840
                1320      SHIFT      .EQ      $3880
                1330      .END

```

Program Listing

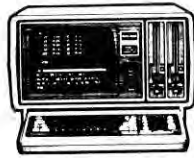
```

00100  ORG      7000H
00110  IM      LD      A,(IX)      ; IMMEDIATE MODE ROUTINE
00120  INC     IX
00130  RET
00140  ABS     LD      L,(IX)      ; ABSOLUTE MODE ROUTINE
00150  INC     IX
00160  LD      H,(IX)
00170  INC     IX
00180  RET
00190  ZPAGE   LD      C,(IX)      ; ZERO PAGE MODE ROUTINE
00200  INC     IX
00210  LD      IY,ZEROP
00220  LD      B,0
00230  ADD     IY,BC
00240  PUSH   IY
00250  POP    HL
00260  RET
00270  HERE   LD      IY,ZEROP
00280  LD      B,0
00290  ADD     IY,BC
00300  LD      L,(IY)
00310  INC     IY
00320  LD      H,(IY)
00330  RET
00340  INDX   LD      A,(IX)      ; INDEX INDIRECT X MODE
00350  INC     IX
00360  CALL  ADX
00370  LD      C,A
00380  JP     HERE
00390  INDY   LD      A,(IX)      ; INDEX INDIRECT Y MODE
00400  INC     IX
00410  LD      C,A
00420  CALL  HERE
00430  LD      A,0
00440  CALL  ADY
00450  LD      C,A
00460  LD      B,0
00470  ADD     HL,BC
00480  RET
00490  ADX    EXX              ; ADD X REG TO A ROUTINE
00500  PUSH  BC
00510  EXX
00520  POP   BC
00530  ADD  A,C
00540  RET
00550  ADY    EXX              ; ADD Y REG. TO A ROUTINE
00560  PUSH  BC
00570  EXX
00580  POP   BC
00590  ADD  A,B
00600  RET
00610  ZPAGEX LD      A,(IX)      ; ZERO PAGE INDEXED X MODE
00620  INC     IX
00630  CALL  ADX

```

Listing continues

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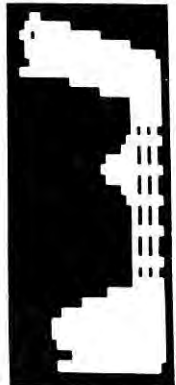
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Listing continued

```

00640 LD      H,06EH
00650 LD      L,A
00660 RET
00670 ZPAGEY LD      A,(IX)      ;ZERO PAGE INDEXED Y MODE
00680 INC      IX
00690 CALL    ADY
00700 LD      H,06EH
00710 LD      L,A
00720 RET
00730 ABSX   CALL    ABS      ;ABSOLUTE INDEXED X MODE
00740 LD      A,0
00750 CALL    ADX
00760 LD      C,A
00770 LD      B,0
00780 ADD     HL,BC
00790 RET
00800 ABSY   CALL    ABS      ;ABSOLUTE INDEXED Y MODE
00810 LD      A,0
00820 CALL    ADY
00830 LD      C,A
00840 LD      B,0
00850 ADD     HL,BC
00860 RET
00870 ZEROP EQU     06E00H      ;ZERO PAGE ASSIGNED 6E00H
00880 ADIC   CALL    IM      ;ADC ADD CARRY IMMEDIATE
00890 LD      B,A
00900 HERE2 LD      HL,DECI    ;CHECK FOR DECIMAL MODE
00910 LD      A,(HL)
00920 OR      A
00930 JP      Z,GO
00940 EX      AF,AF'
00950 ADC     A,B
00960 DAA
00970 EX      AF,AF'
00980 RET
00990 GO     EX      AF,AF'
01000 ADC     A,B
01010 EX      AF,AF'
01020 RET
01030 AD2C   CALL    ABS      ;ADC ADD CARRY
01040 GO1    LD      B,(HL)
01050 JP      HERE2
01060 AD3C   CALL    ZPAGE
01070 JP      GO1
01080 AD4C   CALL    INDX
01090 JP      GO1
01100 AD5C   CALL    INDY
01110 JP      GO1
01120 AD6C   CALL    ZPAGEX
01130 JP      GO1
01140 AD7C   CALL    ABSX
01150 JP      GO1
01160 AD8C   CALL    ABSY
01170 JP      GO1
01180 AN1D   CALL    IM      ;AND COMMAND
01190 GO2    LD      B,A
01200 EX      AF,AF'
01210 AND     B
01220 EX      AF,AF'
01230 RET
01240 AN2D   CALL    ABS
01250 HERE3  LD      A,(HL)
01260 JP      GO2

```

```

01270 AN3D   CALL    ZPAGE
01280 JP      HERE3
01290 AN4D   CALL    INDX
01300 JP      HERE3
01310 AN5D   CALL    INDY
01320 JP      HERE3
01330 AN6D   CALL    ZPAGEX
01340 JP      HERE3
01350 AN7D   CALL    ABSX
01360 JP      HERE3
01370 AN8D   CALL    ABSY
01380 JP      HERE3
01390 AS1L   CALL    ABS      ;ASL ARITH SHIFT LEFT
01400 EX      AF,AF'
01410 GO4    SLA     (HL)
01420 EX      AF,AF'
01430 RET
01440 AS2L   CALL    ZPAGE
01450 JP      GO4
01460 AS3L   EX      AF,AF'
01470 SLA     A
01480 EX      AF,AF'
01490 RET
01500 AS4L   CALL    ZPAGEX
01510 JP      GO4
01520 AS5L   CALL    ABSX
01530 JP      GO4
01540 BC1C   EX      AF,AF'      ;BCC BRANCH CARRY CLEAR
01550 JP      C,DN3
01560 LD      C,(IX)
01570 INC     IX
01580 CALL    ADRNEW
01590 RET
01600 ADRNEW EX      AF,AF'
01610 PUSH    IX
01620 POP     DE
01630 LD      A,E
01640 ADD     A,C
01650 LD      E,A
01660 PUSH    DE
01670 POP     IX
01680 RET
01690 BC1S   EX      AF,AF'      ;BCS BRANCH CARRY SET
01700 JP      NC,DN3
01710 LD      C,(IX)
01720 INC     IX
01730 CALL    ADRNEW
01740 RET
01750 BEQ     EX      AF,AF'      ;BEQ BRANCH EQUAL
01760 JP      NZ,DN3
01770 LD      C,(IX)
01780 INC     IX
01790 CALL    ADRNEW
01800 RET
01810 BITT   CALL    ABS      ;BIT BIT TEST
01820 HERES  EX      AF,AF'
01830 AND     (HL)
01840 EX      AF,AF'
01850 RET
01860 BI2T   CALL    ZPAGE
01870 JP      HERES
01880 BMI    EX      AF,AF'      ;BMI BRANCH MINUS
01890 JP      P,DN3
01900 GO5    LD      C,(IX)

```

Listing continues

Listing continued.

```

01910 INC IX
01920 CALL ADDRNEW
01930 RET
01940 BNE EX AF,AF' ;BNE BRANCH NOT EQUAL
01950 JP Z, DN3
01960 JP GO5
01970 DN3 EX AF,AF'
01980 INC IX
01990 RET
02000 BPL EX AF,AF' ;BPL BRANCH PLUS
02010 JP M, DN3
02020 JP GO5
02030 BRK NOP ;BREAK NOT IMPLEMENTED
02040 RET
02050 BVC EX AF,AF' ;BVC BRANCH OVERFLOW CLEAR
02060 JP PO, DN3
02070 JP GO5
02080 BVS EX AF,AF' ;BVS BRANCH OVERFLOW SET
02090 JP PE, DN3
02100 JP GO5
02110 CLC EX AF,AF' ;CLC CLEAR CARRY
02120 SCF
02130 CCF
02140 EX AF,AF'
02150 RET
02160 CLD EX AF,AF' ;CLD CLEAR DECIMAL FLAG
02170 PUSH AF
02180 POP BC
02190 RES 3, C
02200 PUSH BC
02210 POP AF
02220 EX AF,AF'
02230 RET
02240 CLI EX AF,AF' ;CLI CLEAR INTERRUPT FLAG
02250 PUSH AF
02260 POP BC
02270 RES 2, C
02280 PUSH BC
02290 POP AF
02300 EX AF,AF'
02310 RET
02320 CLV EX AF,AF' ;CLV CLEAR OVERFLOW FLAG
02330 PUSH AF
02340 POP BC
02350 RES 6, C
02360 PUSH BC
02370 POP AF
02380 EX AF,AF'
02390 RET
02400 CMLP CALL IM ;CMP COMPARE A REG
02410 HERE6 LD B,A
02420 EX AF,AF'
02430 CP B
02440 CCF
02450 EX AF,AF'
02460 RET
02470 CM2P CALL ABS
02480 LD A, (HL)
02490 JP HERE6
02500 CM3P CALL ZPAGE
02510 LD A, (HL)
02520 JP HERE6
02530 CM4P CALL INDX

```

```

02540 LD A, (HL)
02550 JP HERE6
02560 CM5P CALL INDY
02570 LD A, (HL)
02580 JP HERE6
02590 CM6P CALL ZPAGE
02600 LD A, (HL)
02610 JP HERE6
02620 CM7P CALL ABSX
02630 LD A, (HL)
02640 JP HERE6
02650 CM8P CALL ABSY
02660 LD A, (HL)
02670 JP HERE6
02680 CPX CALL IM ;CPX COMPARE X REG
02690 LD C,A
02700 HERE7 EX AF,AF'
02710 LD B,A
02720 EXX
02730 PUSH BC
02740 EXX
02750 POP DE
02760 LD A,E
02770 CP C
02780 CCF
02790 LD A,B
02800 EX AF,AF'
02810 RET
02820 CPLX CALL ABS
02830 LD C, (HL)
02840 JP HERE7
02850 CP2X CALL ZPAGE
02860 LD C, (HL)
02870 JP HERE7
02880 CPLY CALL IM ;CPY COMPARE Y REG
02890 LD C,A
02900 HERE7A EX AF,AF'
02910 LD B,A
02920 EXX
02930 PUSH BC
02940 EXX
02950 POP DE
02960 LD A,D
02970 CP C
02980 CCF
02990 LD A,B
03000 EX AF,AF'
03010 RET
03020 CP2Y CALL ABS
03030 LD C, (HL)
03040 JP HERE7A
03050 CP3Y CALL ZPAGE
03060 LD C, (HL)
03070 JP HERE7A
03080 DE1C CALL ABS ;DEC DECREMENT
03090 EX AF,AF'
03100 (HL)
03110 EX AF,AF'
03120 RET
03130 DE2C CALL ZPAGE
03140 HERE8 EX AF,AF'
03150 (HL)
03160 EX AF,AF'

```

Listing continues on p. 94

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printers without any hardware additions or modifica-
tions to your TRS-80. You can draw directly on your
screen which is a "picture window" of a much larger
drawing area and move the window to other areas of
the drawing. Your only limitations are imagination
and disk space. The completed drawing is dumped to
the above printers by reducing and transforming the
complete graphic pixels to single hi-res dots. Use the
same disk for booting on MOD I or MOD III. Desig-
ners, architects, engineers and artists will love this
unique drawing program.

MOD I or MOD III

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DOSPLUS II outperforms the O.E.M.
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operating system that far exceeds
manufacturer's specifications with
more potential and capacity to handle
any business needs.

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MOD I
MOD I DD
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SEE SNAPP-WARE AD IN
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DETAILS.

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By Micro Systems Software

Manufacturer's Suggested List 199.95
DiskCount Data Special 149.95

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SAVINGS**

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A point of sale
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register and
accounts receivable interactive
system with invoicing. Prints sales
summaries by code and sales person.
Daily, weekly and monthly. Requires
2 Drive MOD III minimum with 3 Drive
optimum. Small businesses will adore
this outstanding program.

POWERMAIL

By Powersoft

Manufacturer's Suggested List 99.95
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Powermail is a highly sophisticated mass mailing system designed to run under all of the popular DOS's currently available for the Mod I or Mod III. The program is written entirely in machine language for maximum operation speed, and occupies only 4K of the available RAM in your computer. There are no slow periods when Powermail is running. New features have been added to the program that others have always lacked. You now have the ability to keep track of mailings using the 24 'flags' that are incorporated into the Powermail program. The Powermail system will handle a file up to 8 megabytes, or 65535 names, whichever is smaller. The program will also sort the entire maximum file size and open up to 168 files simultaneously during the process. Author Kim Watt.

MOD I or MOD III

THE TOOLBOX for LDOS

by Powersoft

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PFIIX/CMD PCLEAR/CMD
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PVU/CMD PMAP/CMD
PERASE/CMD PMX/FLT MX80
PMOVE/CMD PHELP/CMD
PDIRT/CMD PBOOT/CMD
PASSGO/CMD PFILT/FLT
PUN/CMD DVORAK/FLT
PEX/CMD DVORAK/JCL
PMD/CMD CODE/JCL
PFIND/CMD DECODE/JCL

MOD I or MOD III

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by Micro Systems Software

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by United Software

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This communications package is one of the most versatile available. It includes a full featured intelligent terminal program, host program, direct file transfer function, and hex conversion utilities for bulletin board downloading plus: • Support for virtually all manual and auto dial modems • Exclusive Ultra Term direct disk file transfer function allows full control from the transmitting computer, and unattended operation at the receiving computer. • Split screen feature lets you type outgoing messages on the bottom half of the screen while incoming messages are displayed on the top of the screen. • Full Line printer support. • Universal ASCII format file transmission and reception with memory input/output buffer supports delays between characters, delays between lines, and prompt controlled transmission for compatibility with virtually all systems. A counter continuously displays the amount of free memory remaining whenever the buffer is in use. • Full featured host program that supports PRINT and PRINT graphics from basic, and automatically relocates and protects itself in the top of memory is included. • Auto Dial phone numbers stored in program with single Key Auto Dial.

MOD I or MOD III

POWERDRAW

BY Powersoft

Retail Price 39.95
Special Sale 34.95

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A full screen graphics editor PowerDRAW is 100% assembly language. You can create screens of graphics, save to disk, merge them, run in sequence like a movie, merge text with graphics, and write your own game or business application screen! PowerDRAW saves graphics to disk or tape, so that they can be recalled at a later time in the following formats:
0) CONDENSED TOKENS
1) EDAS Source file format
2) EDI/TASM Source file format
3) BASIC data statements
4) BASIC strings
5) BASIC arrays (New in version 1.3h)
6) Load File Format
Many more features! Completely cursor controlled. PowerDRAW comes complete with PDRAW/CMD as well as three other utilities written by Kim for extending the use of PowerDraw. Also has 3 printer drivers including one that is specifically written for the Epson printer, with or without Graft! That means all the graphics you design may be printed out PERFECTLY on your printer! Works with joystick also.

MICRO-80

by Micro Systems Software

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The Newest Bulletin Board Communications Network

Your computer becomes a mini-communications network. MICRO80 allows a person to exchange messages or information via the telephone. Access can be completely public, private to authorized users or limited to certain individuals. MICRO 80 can leave messages on another terminal acting as a rapid electronic mailman. MICRO 80 provides some of the most advanced and most convenient features ever incorporated in a microcomputer bulletin board system including:
Message reformatting to screen width
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MICRO 80 "remembers" each regular user and stores terminal information security access levels, last message retrieved during last call etc.
Individual user passwords.
Users may "upload" or transmit data and programs files to MICRO-80. These programs may then be "downloaded" to other MICRO-80 users.
MICRO-80 is self maintaining. Message space is automatically reclaimed when messages are deleted.

MOD I or III

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Listing continued from p. 91

```

03170 RET
03180 DE3C CALL ZPAGEX
03190 JP HERE8
03200 DE4C CALL ABSX
03210 JP HERE8
03220 DEX EX AF,AF' ;DEX DECREMENT X
03230 EXX
03240 DEC C
03250 EX AF,AF'
03260 EXX
03270 RET
03280 DEY EX AF,AF' ;DEY DECREMENT Y
03290 EXX
03300 DEC B
03310 EX AF,AF'
03320 EXX
03330 RET
03340 EOR1 CALL IM ;EOR EXCLUSIVE OR
03350 HERE9 LD B,A
03360 EX AF,AF'
03370 XOR B
03380 EX AF,AF'
03390 RET
03400 EOR2 CALL ABS
03410 LD A,(HL)
03420 JP HERE9
03430 EOR3 CALL ZPAGE
03440 LD A,(HL)
03450 JP HERE9
03460 EOR4 CALL INDX
03470 LD A,(HL)
03480 EOR5 CALL INDY
03490 LD A,(HL)
03500 JP HERE9
03510 EOR6 CALL ZPAGEX
03520 LD A,(HL)
03530 JP HERE9
03540 EOR7 CALL ABSX
03550 LD A,(HL)
03560 JP HERE9
03570 EOR8 CALL ABSY
03580 LD A,(HL)
03590 JP HERE9
03600 IN1C CALL ABS ;INC INCREMENT
03610 EX AF,AF'
03620 INC (HL)
03630 EX AF,AF'
03640 RET
03650 IN2C CALL ZPAGE
03660 HERE10 EX AF,AF'
03670 INC (HL)
03680 EX AF,AF'
03690 RET
03700 IN3C CALL ZPAGEX
03710 JP HERE10
03720 IN4C CALL ABSX
03730 JP HERE10
03740 INCX EX AF,AF' ;INX INCREMENT X
03750 EXX
03760 INC C
03770 EX AF,AF'
03780 EXX
03790 RET

```

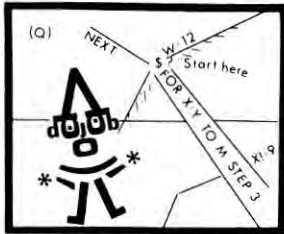
```

03800 INCY EX AF,AF' ;INX INCREMENT Y
03810 EXX
03820 INC B
03830 EX AF,AF'
03840 EXX
03850 RET
03860 JM1P CALL ABS ;JMP JUMP
03870 PUSH HL
03880 POP IX
03890 RET
03900 JM2P LD L,(IX)
03910 INC IX
03920 LD H,(IX)
03930 INC IX
03940 LD C,(HL)
03950 INC HL
03960 LD B,(HL)
03970 PUSH BC
03980 POP IX
03990 RET
04000 JSR CALL ABS ;JSR JUMP SUBROUTINE
04010 EXX
04020 PUSH IX
04030 POP DE
04040 LD (HL),D
04050 DEC HL
04060 LD (HL),E
04070 DEC HL
04080 EXX
04090 PUSH HL
04100 POP IX
04110 RET
04120 LD1A CALL IM ;LDA LOAD A REG
04130 HERE11 LD B,A
04140 EX AF,AF'
04150 LD A,B
04160 INC A
04170 DEC A
04180 EX AF,AF'
04190 RET
04200 LD2A CALL ABS
04210 HERE12 LD A,(HL)
04220 JP HERE11
04230 LD3A CALL ZPAGE
04240 JP HERE12
04250 LD4A CALL INDX
04260 JP HERE12
04270 LD5A CALL INDY
04280 JP HERE12
04290 LD6A CALL ZPAGEX
04300 JP HERE12
04310 LD7A CALL ABSX
04320 JP HERE12
04330 LD8A CALL ABSY
04340 JP HERE12
04350 LD1X CALL IM ;LDX LOAD X REG
04360 HERE13 EXX
04370 LD C,A
04380 EX AF,AF'
04390 INC C
04400 DEC C
04410 EXX
04420 EX AF,AF'

```

Listing continues

Lost in the Line Edit Jungle?



 Do you get frustrated
 trying to cage the line
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* Disk versions also available on tape.

** FREE compass with every Editor ordered for those who need extra guidance.

des SOFTWARE

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 Tel. 201 398-8281



✓517

ACCEL 3/4

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Affects Sound.

ACCEL3/4 will compile OUT statements, turning simple clicks into... hilarious sound effects!

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 - 4-LOSING FANFARE
 - 5-RASPBERRY
 - 6-WHITE NOISE
 - 7-CREAKING DOOR
 - 8-TRIMFONE
 - 9-TV TENNIS
 - 10-SFORZANDO
 - 11-GUNFIRE
 - 12-FREQUENCY SELECTION
 - 13-QWERTYUI PIANO KEYBOARD
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- Find and/or Replace occurrences of strings.
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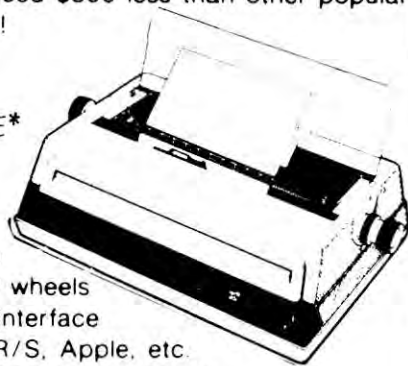
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Listing continued

04430	RET		
04440	LD2X	CALL	ABS
04450	LD	A, (HL)	
04460	JP	HERE13	
04470	LD3X	CALL	ZPAGE
04480	LD	A, (HL)	
04490	JP	HERE13	
04500	LD4X	CALL	ABSX
04510	LD	A, (HL)	
04520	JP	HERE13	
04530	LD5X	CALL	ZPAGEY
04540	LD	A, (HL)	
04550	JP	HERE13	
04560	LD1Y	CALL	IM
04570	HERE14	EXX	;LDY LOAD Y REG
04580	LD	B, A	
04590	EX	AF, AF'	
04600	INC	B	
04610	DEC	B	
04620	EXX		
04630	EX	AF, AF'	
04640	RET		
04650	LD2Y	CALL	ABS
04660	LD	A, (HL)	
04670	JP	HERE14	
04680	LD3Y	CALL	ZPAGE
04690	LD	A, (HL)	
04700	JP	HERE14	
04710	LD4Y	CALL	ZPAGEX
04720	LD	A, (HL)	
04730	JP	HERE14	
04740	LD5Y	CALL	ABSX
04750	LD	A, (HL)	
04760	JP	HERE14	
04770	LS1R	CALL	ABS
04780	HERE15	EX	;LSR LOGICAL SHIFT RIGHT
04790	SRL	(HL)	
04800	EX	AF, AF'	
04810	RET		
04820	LS2R	CALL	ZPAGE
04830	JP	HERE15	
04840	LS3R	EX	AF, AF'
04850	SRL	A	
04860	EX	AF, AF'	
04870	RET		
04880	LS4R	CALL	ZPAGEX
04890	JP	HERE15	
04900	LS5R	CALL	ABSX
04910	JP	HERE15	
04920	NO1P	RET	;NOP NO OPERATION
04930	OR1A	CALL	IM
04940	HERE16	LD	B, A
04950	EX	AF, AF'	
04960	OR	B	
04970	EX	AF, AF'	
04980	RET		
04990	OR2A	CALL	ABS
05000	LD	A, (HL)	
05010	JP	HERE16	
05020	OR3A	CALL	ZPAGE
05030	LD	A, (HL)	
05040	JP	HERE16	
05050	OR4A	CALL	INDX

05060	LD	A, (HL)	
05070	JP	HERE16	
05080	OR5A	CALL	INDY
05090	LD	A, (HL)	
05100	JP	HERE16	
05110	OR6A	CALL	ZPAGEX
05120	LD	A, (HL)	
05130	JP	HERE16	
05140	OR7A	CALL	ABSX
05150	LD	A, (HL)	
05160	JP	HERE16	
05170	OR8A	CALL	ABSX
05180	LD	A, (HL)	
05190	JP	HERE16	
05200	PHA	EX	AF, AF'
05210	EXX		;PHA PUSH A REG
05220	LD	(HL), A	
05230	DEC	HL	
05240	EXX		
05250	EX	AF, AF'	
05260	RET		
05270	PHP	EX	AF, AF'
05280	EXX		;PHP PUSH FLAG REG
05290	PUSH	AF	
05300	POP	DE	
05310	LD	(HL), E	
05320	DEC	HL	
05330	EXX		
05340	EX	AF, AF'	
05350	RET		
05360	PLA	EX	AF, AF'
05370	EXX		;PLA PULL A REG
05380	INC	HL	
05390	LD	A, (HL)	
05400	EX	AF, AF'	
05410	EXX		
05420	RET		
05430	PLP	EX	AF, AF'
05440	EXX		;PLP PULL FLAG REG
05450	INC	HL	
05460	LD	E, (HL)	
05470	LD	D, A	
05480	PUSH	DE	
05490	POP	AF	
05500	EXX		
05510	EX	AF, AF'	
05520	RET		
05530	ROL	CALL	ABS
05540	HERE17	EX	AF, AF'
05550	RL	(HL)	
05560	EX	AF, AF'	
05570	RET		
05580	RO2L	CALL	ZPAGE
05590	JP	HERE17	
05600	RO3L	EX	AF, AF'
05610	RL	A	
05620	EX	AF, AF'	
05630	RET		
05640	RO4L	CALL	ZPAGEX
05650	JP	HERE17	
05660	RO5L	CALL	ABSX
05670	JP	HERE17	
05680	RO1R	CALL	ABS
			;ROR ROTATE RIGHT

Listing continues

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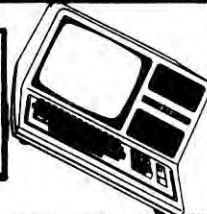
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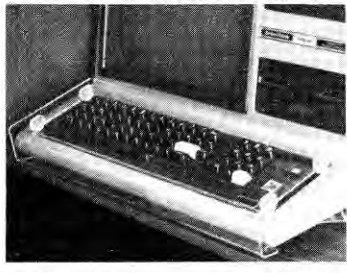
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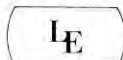
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```

05690 HERE18 EX AF,AF'
05700 RR (HL)
05710 EX AF,AF'
05720 RET
05730 RO2R CALL ZPAGE
05740 JP HERE18
05750 RO3R EX AF,AF'
05760 RR A
05770 EX AF,AF'
05780 RET
05790 RO4R CALL ZPAGEX
05800 JP HERE18
05810 RO5R CALL ABSX
05820 JP HERE18
05830 RTI NOP ;RTI RETRN FROM INTERRUPT
05840 RET
05850 RTS EXX ;RTS RETURN FROM SUBRTN
05860 EX AF,AF'
05870 INC HL
05880 LD E,(HL)
05890 INC HL
05900 LD D,(HL)
05910 PUSH DE
05920 POP IX
05930 EX AF,AF'
05940 EXX
05950 RET
05960 SB1C CALL IM ;SBC SUBTRACT WITH CARRY
05970 LD B,A
05980 HERE19 LD HL,DECI
05990 LD A,(HL)
06000 OR A
06010 JP Z,G01A
06020 EX AF,AF'
06030 CCF
06040 SBC A,B
06050 DAA
06060 CCF
06070 EX AF,AF'
06080 RET
06090 G01A EX AF,AF'
06100 CCF
06110 SBC A,B
06120 CCF
06130 EX AF,AF'
06140 RET
06150 SB2C CALL ABS
06160 HERE20 LD B,(HL)
06170 JP HERE19
06180 SB3C CALL ZPAGE
06190 JP HERE20
06200 SB4C CALL INDX
06210 JP HERE20
06220 SB5C CALL INDY
06230 JP HERE20
06240 SB6C CALL ZPAGEX
06250 JP HERE20
06260 SB7C CALL ABSX
06270 JP HERE20
06280 SB8C CALL ABSY
06290 JP HERE20
06300 SEC EX AF,AF' ;SEC SET CARRY FLAG
06310 SCF

```

```

06320 EX AF,AF'
06330 RET
06340 SED LD HL,DECI ;SED SET DECIMAL FLAG
06350 LD (HL),1
06360 RET
06370 SEI EX AF,AF' ;SEI SET INTERRUPT FLAG
06380 NOP
06390 NOP
06400 NOP
06410 EX AF,AF'
06420 RET
06430 ST1A CALL ABS ;STA STORE A REG
06440 HERE22 EX AF,AF'
06450 LD (HL),A
06460 EX AF,AF'
06470 RET
06480 ST2A CALL ZPAGE
06490 JP HERE22
06500 ST3A CALL INDX
06510 JP HERE22
06520 ST4A CALL INDY
06530 JP HERE22
06540 ST5A CALL ZPAGEX
06550 JP HERE22
06560 ST6A CALL ABSX
06570 JP HERE22
06580 ST7A CALL ABSY
06590 JP HERE22
06600 ST1X CALL ABS ;STX STORE X REG
06610 HERE23 EXX
06620 PUSH BC
06630 EXX
06640 POP BC
06650 LD (HL),C
06660 RET
06670 ST2X CALL ZPAGE
06680 JP HERE23
06690 ST3X CALL ZPAGEY
06700 JP HERE23
06710 ST1Y CALL ABS ;STY STORE Y REG
06720 HERE24 EXX
06730 PUSH BC
06740 EXX
06750 POP BC
06760 LD (HL),B
06770 RET
06780 ST2Y CALL ZPAGE
06790 JP HERE23
06800 ST3Y CALL ZPAGEX
06810 JP HERE23
06820 TAX EX AF,AF' ;TAX TRANSFER A TO X REG
06830 EXX
06840 LD C,A
06850 INC C
06860 DEC C
06870 EXX
06880 EX AF,AF'
06890 RET
06900 TAY EX AF,AF' ;TAY TRANSFER A TO Y REG
06910 EXX
06920 LD B,A
06930 INC B

```

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06940	DEC	B		
06950	EXX			
06960	EX	AF,AF'		
06970	RET			
06980	TSX	EX	AF,AF'	;TSX TRANSFER STACK TO X
06990	EXX			
07000	LD	C, (HL)		
07010	EX	AF,AF'		
07020	EXX			
07030	RET			
07040	TXA	EX	AF,AF'	;TXA TRANSFER X TO A REG
07050	EXX			
07060	LD	A,C		
07070	INC	A		
07080	DEC	A		
07090	EXX			
07100	EX	AF,AF'		
07110	RET			
07120	TXS	EX	AF,AF'	;TXS TRANSFER X TO STACK
07130	EXX			
07140	LD	(HL),C		
07150	EX	AF,AF'		
07160	EXX			
07170	RET			
07180	TYA	EX	AF,AF'	;TYA TRANSFER Y TO A REG
07190	EXX			
07200	LD	A,B		
07210	INC	A		
07220	DEC	A		
07230	EXX			
07240	EX	AF,AF'		
07250	RET			
07260	ORG	7500H		;LOOK UP TABLE
07270	DEFB	69H		
07280	DEFW	AD1C		
07290	DEFB	6DH		
07300	DEFW	AD2C		
07310	DEFB	65H		
07320	DEFW	AD3C		
07330	DEFB	61H		
07340	DEFW	AD4C		
07350	DEFB	71H		
07360	DEFW	AD5C		
07370	DEFB	75H		
07380	DEFW	AD6C		
07390	DEFB	7DH		
07400	DEFW	AD7C		
07410	DEFB	79H		
07420	DEFW	AD8C		
07430	DEFB	29H		
07440	DEFW	AN1D		
07450	DEFB	2DH		
07460	DEFW	AN2D		
07470	DEFB	25H		
07480	DEFW	AN3D		
07490	DEFB	21H		
07500	DEFW	AN4D		
07510	DEFB	31H		
07520	DEFW	AN5D		
07530	DEFB	35H		
07540	DEFW	AN6D		
07550	DEFB	3DH		
07560	DEFW	AN7D		

07570	DEFB	39H		
07580	DEFW	AN8D		
07590	DEFB	0EH		
07600	DEFW	AS1L		
07610	DEFB	06H		
07620	DEFW	AS2L		
07630	DEFB	0AH		
07640	DEFW	AS3L		
07650	DEFB	16H		
07660	DEFW	AS4L		
07670	DEFB	1EH		
07680	DEFW	AS5L		
07690	DEFB	90H		
07700	DEFW	BC1C		
07710	DEFB	0B0H		
07720	DEFW	BC1S		
07730	DEFB	0F0H		
07740	DEFW	BEQ		
07750	DEFB	2CH		
07760	DEFW	BIT		
07770	DEFB	24H		
07780	DEFW	BI2T		
07790	DEFB	30H		
07800	DEFW	BMI		
07810	DEFB	0D0H		
07820	DEFW	BNE		
07830	DEFB	10H		
07840	DEFW	BPL		
07850	DEFB	00		
07860	DEFW	BRK		
07870	DEFB	50H		
07880	DEFW	BVC		
07890	DEFB	70H		
07900	DEFW	BVS		
07910	DEFB	18H		
07920	DEFW	CLC		
07930	DEFB	0D8H		
07940	DEFW	CLD		
07950	DEFB	58H		
07960	DEFW	CLI		
07970	DEFB	0B8H		
07980	DEFW	CLV		
07990	DEFB	0C9H		
08000	DEFW	CM1P		
08010	DEFB	0CDH		
08020	DEFW	CM2P		
08030	DEFB	0C5H		
08040	DEFW	CM3P		
08050	DEFB	0C1H		
08060	DEFW	CM4P		
08070	DEFB	0D1H		
08080	DEFW	CM5P		
08090	DEFB	0D5H		
08100	DEFW	CM6P		
08110	DEFB	0DDH		
08120	DEFW	CM7P		
08130	DEFB	0D9H		
08140	DEFW	CM8P		
08150	DEFB	0E0H		
08160	DEFW	CPX		
08170	DEFB	0ECH		
08180	DEFW	CP1X		
08190	DEFB	0E4H		
08200	DEFW	CP2X		
08210	DEFB	0C0H		
08220	DEFW	CP1Y		
08230	DEFB	0CCH		
08240	DEFW	CP2Y		
08250	DEFB	0C4H		
08260	DEFW	CP3Y		
08270	DEFB	0CEH		
08280	DEFW	DE1C		
08290	DEFB	0C6H		
08300	DEFW	DE2C		
08310	DEFB	0D6H		
08320	DEFW	DE3C		
08330	DEFB	0DEH		
08340	DEFW	DE4C		
08350	DEFB	0CAH		
08360	DEFW	DEX		
08370	DEFB	88H		
08380	DEFW	DEY		
08390	DEFB	49H		
08400	DEFW	EOR1		
08410	DEFB	4DH		
08420	DEFW	EOR2		
08430	DEFB	45H		
08440	DEFW	EOR3		
08450	DEFB	41H		
08460	DEFW	EOR4		
08470	DEFB	51H		
08480	DEFW	EOR5		
08490	DEFB	55H		
08500	DEFW	EOR6		
08510	DEFB	5DH		
08520	DEFW	EOR7		
08530	DEFB	59H		
08540	DEFW	EOR8		
08550	DEFB	0EEH		
08560	DEFW	IN1C		
08570	DEFB	0E6H		
08580	DEFW	IN2C		
08590	DEFB	0F6H		
08600	DEFW	IN3C		
08610	DEFB	0FEH		
08620	DEFW	IN4C		
08630	DEFB	0E8H		
08640	DEFW	INCX		
08650	DEFB	0C8H		
08660	DEFW	INCY		
08670	DEFB	4CH		
08680	DEFW	JM1P		
08690	DEFB	6CH		
08700	DEFW	JM2P		
08710	DEFB	20H		
08720	DEFW	JSR		
08730	DEFB	0A9H		
08740	DEFW	LD1A		
08750	DEFB	0ADH		
08760	DEFW	LD2A		
08770	DEFB	0A5H		
08780	DEFW	LD3A		
08790	DEFB	0A1H		
08800	DEFW	LD4A		
08810	DEFB	0B1H		
08820	DEFW	LD5A		
08830	DEFB	0B5H		

Listing continues

```

08840  DEFW  LD6A
08850  DEFB  0BDH
08860  DEFW  LD7A
08870  DEFB  0B9H
08880  DEFW  LD8A
08890  DEFB  0A2H
08900  DEFW  LD1X
08910  DEFB  0AEH
08920  DEFW  LD2X
08930  DEFB  0A6H
08940  DEFW  LD3X
08950  DEFB  0BEH
08960  DEFW  LD4X
08970  DEFB  0B6H
08980  DEFW  LD5X
08990  DEFB  0A0H
09000  DEFW  LD1Y
09010  DEFB  0ACH
09020  DEFW  LD2Y
09030  DEFB  0A4H
09040  DEFW  LD3Y
09050  DEFB  0B4H
09060  DEFW  LD4Y
09070  DEFB  0BCH
09080  DEFW  LD5Y
09090  DEFB  4EH
09100  DEFW  LS1R
09110  DEFB  46H
09120  DEFW  LS2R
09130  DEFB  4AH
09140  DEFW  LS3R
09150  DEFB  56H
09160  DEFW  LS4R
09170  DEFB  5EH
09180  DEFW  LS5R
09190  DEFB  0EAH
09200  DEFW  NOLP
09210  DEFB  09H
09220  DEFW  OR1A
09230  DEFB  0DH
09240  DEFW  OR2A
09250  DEFB  05H
09260  DEFW  OR3A
09270  DEFB  01
09280  DEFW  OR4A
09290  DEFB  11H
09300  DEFW  OR5A
09310  DEFB  15H
09320  DEFW  OR6A
09330  DEFB  1DH
09340  DEFW  OR7A
09350  DEFB  19H
09360  DEFW  OR8A
09370  DEFB  48H
09380  DEFW  PHA
09390  DEFB  08H
09400  DEFW  PHP
09410  DEFB  68H
09420  DEFW  PLA
09430  DEFB  28H
09440  DEFW  PLP
09450  DEFB  2EH
09460  DEFW  ROLL
    
```

```

09470  DEFB  26H
09480  DEFW  RO2L
09490  DEFB  2AH
09500  DEFW  RO3L
09510  DEFB  36H
09520  DEFW  RO4L
09530  DEFB  3EH
09540  DEFW  RO5L
09550  DEFB  6EH
09560  DEFW  RO1R
09570  DEFB  66H
09580  DEFW  RO2R
09590  DEFB  6AH
09600  DEFW  RO3R
09610  DEFB  76H
09620  DEFW  RO4R
09630  DEFB  7EH
09640  DEFW  RO5R
09650  DEFB  40H
09660  DEFW  RTI
09670  DEFB  60H
09680  DEFW  RTS
09690  DEFB  0E9H
09700  DEFW  SB1C
09710  DEFB  0EDH
09720  DEFW  SB2C
09730  DEFB  0E5H
09740  DEFW  SB3C
09750  DEFB  0E1H
09760  DEFW  SB4C
09770  DEFB  0F1H
09780  DEFW  SB5C
09790  DEFB  0F5H
09800  DEFW  SB6C
09810  DEFB  0FDH
09820  DEFW  SB7C
09830  DEFB  0F9H
09840  DEFW  SB8C
09850  DEFB  38H
09860  DEFW  SEC
09870  DEFB  0F8H
09880  DEFW  SED
09890  DEFB  78H
09900  DEFW  SEI
09910  DEFB  8DH
09920  DEFW  ST1A
09930  DEFB  85H
09940  DEFW  ST2A
09950  DEFB  81H
09960  DEFW  ST3A
09970  DEFB  91H
09980  DEFW  ST4A
09990  DEFB  95H
10000  DEFW  ST5A
10010  DEFB  9DH
10020  DEFW  ST6A
10030  DEFB  99H
10040  DEFW  ST7A
10050  DEFB  8EH
10060  DEFW  ST1X
10070  DEFB  86H
10080  DEFW  ST2X
10090  DEFB  96H
10100  DEFW  ST3X
10110  DEFB  8CH
    
```

```

10120  DEFW  ST1Y
10130  DEFB  84H
10140  DEFW  ST2Y
10150  DEFB  94H
10160  DEFW  ST3Y
10170  DEFB  0AAH
10180  DEFW  TAX
10190  DEFB  0A8H
10200  DEFW  TAY
10210  DEFB  0BAH
10220  DEFW  TSX
10230  DEFB  8AH
10240  DEFW  TXA
10250  DEFB  9AH
10260  DEFW  TXS
10270  DEFB  98H
10280  DEFW  TYA
10290  TOP      DEFW  0000      ;END OF TABLE
10300  DECI     DEFB  00      ;SUBSTITUE DECIMAL FLAG
10310  DEFB    00
10320  ORG     8000H
10330  BEGIN   CALL    START      ;START OF EMULATOR SUB.
10340  JP      BEGIN
10350  START   PUSH   HL          ;SAVE BREAK PT.
10360  LD      A,(IX)           ;GET NEXT INSTR.
10370  INC     IX
10380  LD      HL,7500H        ;LOAD HL WITH TABLE ADDR
10390  LD      DE,TOP
10400  LOOP    CP      (HL)      ;SEARCH TABLE
10410  JP      Z,FOUND
10420  INC     HL
10430  INC     HL
10440  INC     HL
10450  PUSH   AF
10460  RST    18H
10470  JP      Z,ERROR
10480  POP    AF
10490  JP      LOOP,
10500  FOUND   INC     HL        ;COMMAND FOUND
10510  LD      DE,INST+1
10520  LD      A,(HL)
10530  LD      (DE),A
10540  INC     HL
10550  INC     DE
10560  LD      A,(HL)
10570  LD      (DE),A
10580  INST    DEFB    0CDH      ;SUBRTN ADDR LOADED HERE
10590  DEFB    0              ;AND THEN CALLED
10600  DEFB    0
10610  POP    HL              ;GET BREAK PT ADDR
10620  LD      A,H            ;CHECK FOR 0
10630  OR     L
10640  JP      Z,STOP
10650  PUSH   IX              ;REACHED BREAK PT. ?
10660  POP    DE
10670  RST    18H
10680  JP      Z,STOP
10690  JP      START
10700  STOP   RET
10710  ERROR  JP      ERROR
10720  END
    
```

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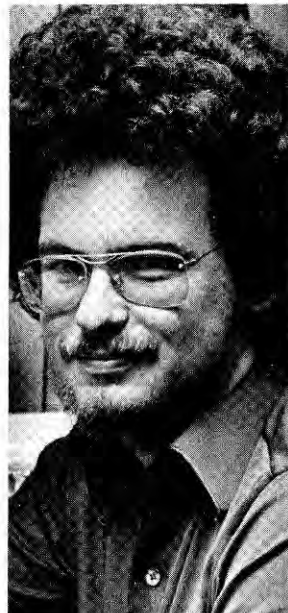
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The Snappware College Educated Garbage Collector (SNAPP-VI) is an intelligent processing function which greatly improves performance of typical BASIC applications. And here's why.

Microsoft uses a 'variable length string' in the BASIC interpreter. Each time the string is assigned a new value, it is relocated in a string pool. Periodically the string pool must be reorganized and condensed into a single contiguous area. Performing this string space reclamation is time consuming and inefficient because this approach evaluates and collects each string individually. The time required is roughly proportional to the square of the number of active strings in the resident program. During reclamation the system seems to 'lock-up' and does not respond to the operator until the process is completed.

This time consuming approach requires a better solution. Snappware has developed a solution which takes advantage of the auxiliary memory available. SNAPP-VI requires only four bytes per active string as a work area. When free storage space is available, our system temporarily borrows, uses and returns the space to the free storage pool when completed. If storage is not available, our system will temporarily transfer out to disk enough of the BASIC program to make room for our work area and return the 'paged out' information to its correct location when completed.

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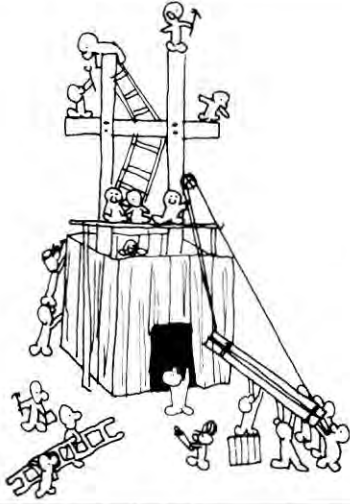
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Basic, Faster and Readable—Part I

by John Corbani

If you remember some of the rules you learned about grammar so long ago, then you should be able to use Basic effectively and efficiently.

The microcomputer industry was built on Microsoft Basic, and with good reason: Basic gets you from here to there in a reasonable amount of time using rules known by anyone who made it through elementary school. All you need is a reasonable understanding of English grammar.

But Microsoft Basic has a tremendous number of unwritten rules that either get you into or out of trouble. This series of articles will help you use those rules, along with the generally accepted rules of grammar, to write programs that run well, are understandable, and are maintainable.

The Rules

Format and punctuate Basic statements using the same rules used in an English sentence, paragraph, or sequence of phrases. Think of a numbered Basic statement as a sentence. Organize statements into groups and put common groups in their own numbered statement as you would put sentences into a paragraph.

Format the text into columns if reasonable. Basic allows 255 characters per

numbered statement. Use as many characters per statement and as many physical lines as make sense. Use LF and spaces as required for exact format. Use spaces and punctuation only when required for readability and where speed constraints make it plausible. See Program Listings 1a and 1b.

Listing 1a is a statement combination that might normally run once when initializing a program. There are no particular constraints on timing, so open things up and give yourself a chance to breathe, as in 1b.

Punctuation is used at the end of statements and lines, as in English. Data is formatted into easily readable rows and columns.

Secondary lines are indented to the same starting position as the text of the first line. The read loop is a complete thought and has its own line. Spaces are used only where readability is improved; note "A=1." No improvement in readability is obtained by typing "A = 1."

NEXT does not require an argument. Don't use one unless there is a possibility of confusion. LET is an anachronism; there is no good reason for its use.

REM statements in programs can either be useful or they can slow things down. It makes sense to identify all major blocks or subroutines. If you put a REM statement immediately in front of a called line number, there will be no speed overhead. Remarks after a GOTO or a RETURN incur no loss of speed overhead and can be used freely. All other situations are suspect.

If you are almost out of memory or character space, remember that REM is saved as one character even though it prints as three. A single quote (') used in place of REM requires 2 bytes of storage even though it prints as one character.

Blank lines in a listing can do wonders to ease readability. If you want a mostly blank line somewhere, type a single quote, a line feed, three or four spaces and a second single quote. The spaces are required only for Centronics printers that overshoot after returning from printing a short line. The trailing single quote gives a smart printer something to do after a series of unprintable characters. A REM statement that incorporates leading and trailing blank lines really gets your attention.

Print is, by far, the fastest and one of the most commonly used Basic operations. There are many ways to perform most print functions and they each have their place. A good starting point for looking at the possibilities is to first position the cursor for printing.

The TRS-80 Model I and III screens

The Key Box

**Model I, III
Basic**

```
40 REM TEST
50 DATA84,72,73,83,32,73,83,32,65,32,84,69,83,84,32,76,73,78,69,46,13
60 FORA=1TO21:READX(A):NEXTA:LETA=2
```

Program Listing 1a

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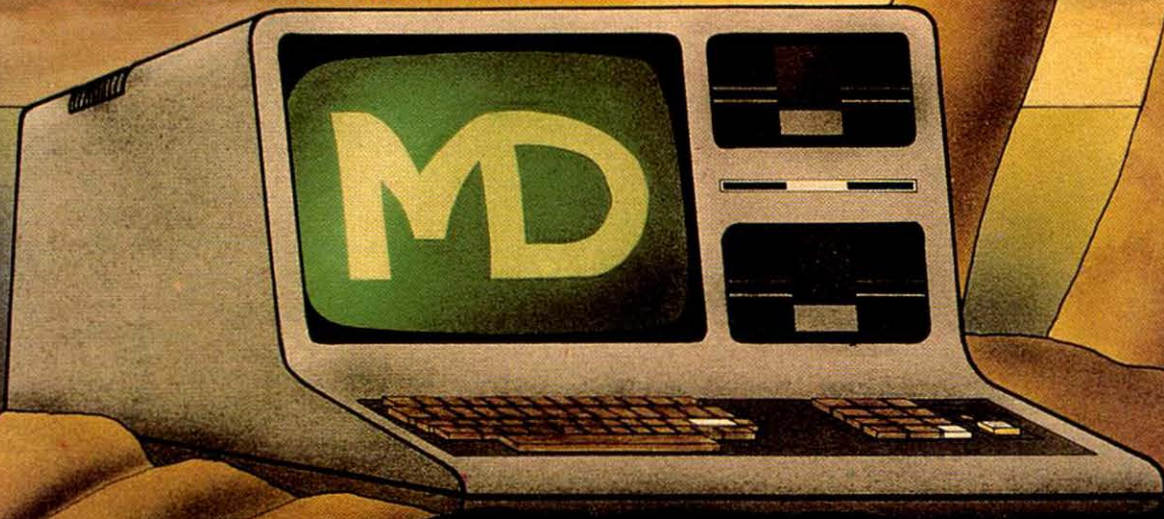
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start at memory address 15360 and go for 1,024 bytes, 64 bytes per line, 16 lines per screen. POKE 15360,95 puts a cursor (underline) in the upper left corner of the screen. POKE 15360,32 (space) erases it. While this combination puts what looks like a cursor anywhere on the screen, print statements start wherever they left off after the last print command.

```

40      TEST
      .
50 DATA
      84,72,73,83,32,73,83,32,65,32,
      84,69,83,84,32,76,73,78,69,46,
      13
60 FOR A=1 TO 21: READ X(A): NEXT:
      A=2

```

Program Listing 1b

A device control block (DCB) positions the cursor for print commands. The DCB is set by either print or POKE commands. If you POKE the right number in this 2-byte block, you move the print position wherever you want it. The high byte address is at 16417 and should hold the integer result of dividing the desired screen address by 256. The low byte (16416) holds the remainder after the division. There are times when doing two POKES is easier or faster than printing. Integer variables for both data and addresses can make things go even faster. Try:

POKE 16417, 60: POKE 16416, 0:

The next character printed appears in the upper left corner of the screen. Try again:

POKE 16417, 60: POKE 16416, 130:

The next character printed appears as the third character of the third line.

There are other ways to get from here to there:

PRINT @ 130,,: or
PRINT CHR\$(28) CHR\$(2,26) CHR\$(2,25),:

The first line is straightforward. Print position zero is the upper left corner of the screen. The second statement puts the cursor at the upper left corner of the screen, moves it down two lines and over two spaces. Characters 24 (left), 25 (right), 26 (down), and 27 (up) move the cursor to the next print position without affecting text already on the screen.

Watch out for TAB(n). It is not the same as PRINT STRING\$(n,25). The tab function prints spaces from where you are to column (n) and erases anything it crosses (not good for moving a cursor from the front to the middle of a full line when you want to keep the old text). Character numbers from 192-255 are space strings ranging in length from one character (192) to 64 characters (255). These work just like STRING\$(n,32) where n ranges from one to 64.

```

570 PRINT@130,A$NTAB(10)M;A"DAY$"
580 PRINT @ 130, A$;N;TAB(10) M;A;"DAY$"
590 PRINT @ 130, A$ N TAB(10) M; A "DAY$"

```

Program Listing 2

PRINT CHR\$(201),: or
PRINT STRING\$(10,32),:

Both statements give you 10 spaces in a row. Anything in the way is cleared out.

Back to positioning for a print command. Try keeping a variable for the X and the Y axes of the screen when you must print in random positions.

560 X=2: Y=128
570 PRINT @ X+Y,;

Lines 560 and 570 cause subsequent printing to start at the third character position of the third line. The addition overhead is not too bad.

Once you've established the print position, use the Basic punctuation that will print what you want using the fewest readable source code characters possible. A space is as good a character delimiter as the textbook semicolon in most cases and it's easier to read.

Program Listing 2 shows three lines that print the same message at the same place on the screen. 570 is a mess to read, but it runs. 580 is what you might do if you read more into the Radio Shack instructions than is really there. 590 is more readable and only one byte longer. The semicolon after the M separates the two numeric variables. With-

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out the semicolon, Basic prints the value of M A, a three-character variable with only the first two characters being significant. Remember, all Basic key words are delimiters.

Formatting strings to be printed is much slower than the printing itself. If much formatting is involved, the famed garbage collection monster slows you down for minutes at a time. LEFT\$, MID\$, RIGHT\$, concatenation (A\$=A\$+IN\$), redefining a string (A\$=B\$), and using USING burn up a new chunk of memory every time they are called. When memory is all used up, Basic goes back through string memory and sorts leftover fragments from good data. It takes forever to throw out the junk, compress the good data and get back to work.

Format the screen and position the cursor using PRINT @ and POKE whenever practical. It can be faster than PRINT STRING\$(n,n) or TAB(n).

INPUT n\$ is always a dangerous command. In addition to exercising string-handling routines, unexpected input can bomb the program.

INKEY\$ or PEEK work better when you do as little string manipulation as possible. Is any key pressed? Try I=PEEK(15359). If I>0 then a key is

down. If you have to use INKEY\$ and have to test for a lot of control characters, try something like Program Listing 3. The code tests to see whether the return, left-arrow, right-arrow, and space keys have been pressed.

Testing a single character numeric variable against a *small* constant is faster than testing against a numeric variable in most cases, and as fast as comparing a string with a string. If you are sure a string manipulation is necessary, then go ahead. Once you are committed to playing with a string,

finish it up and save it the way it will be printed later. Writing B\$=A\$+IN\$ sets you up to print B\$ in half the time it takes to print A\$+IN\$. Of course, you must have a reason to print or otherwise manipulate the combination more than once before you make the effort. ■

John Corbani's hobbies include programming, radio-controlled model aircraft, sailboats and railroading, skiing, and windsurfing.

```

390 '
      '
      '          SCAN KEYBOARD
      '
400 I$=INKEY$: IF I$="" THEN 400 ELSE I=ASC(I$)
410 IF I=13 THEN xxx ELSE
      IF I=8 THEN yyy ELSE
      IF I=9 THEN zzz ELSE
      IF I>31 THEN 440
420 GOTO 400
430 '
      '          ADD IS TO INS
      '
440 INS=IN$+I$
450 GOTO 400

```

Program Listing 3

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Restrict field Length automatically	YES	YES	YES	NO
Unlimited Restriction choice for each field	YES	YES	NO	NO
User defined Custom Prompts for each Field	YES	YES	NO	NO
Full Speed Typing in ALL Fields	YES	YES	NO	YES
Immediate Exit from Any Field to Menu	YES	YES	NO	YES
Enter Fields from last Record automatically	YES	YES	NO	NO
Fast BTREE File Structure (No Sort Needed)	YES	YES	NO	NO
Find Record with Part of a Key	YES	YES	NO	NO
Hi-Speed Global Search for ANY Field in a Record	YES	YES	NO	NO
Duplicate Keys and Multiple Keys Supported	YES	YES	limited	NO
Global Field Replacement Function	YES	YES	NO	NO
Run Predefined Reports from Finished Program	YES	YES	NO	NO
Select Reports from Menu in Finished Program	YES	NO	NO	NO
Sort (machine language) ANY Field-Free	YES	NO	NO	NO
Custom Mailing Labels Option (any Size)	YES	NO	NO	NO
Do Calculations on fields in Program	YES	YES	YES	NO
Sell Finished Program with No Royalty	YES	YES	NO	NO
PRODUCER CAPABILITIES & FEATURES				
Toll Free Question Line	YES	YES	NO	NO
Create PROFESSIONAL Finished Program	YES	YES	NO	NO
Modify Program without Starting Over	YES	YES	NO	NO
Ease of Use, including Complete TUTORIAL	YES	NO	NO	NO
Number of Calculations allowed per field	8	8	1	0
Use Field Names for Calculations	YES	NO	NO	NO
Use ALL Math Functions in Calculations	YES	NO	NO	NO
Generates a BASIC Program	YES	YES	YES	YES
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For an independent product review of the PRODUCER see page 62 of March issue of 80 Micro.

Color Sketchpad

by Larry Colle

Creating graphics on your Color Computer is tedious when you have to program the necessary commands. You can avoid this ennui with Draw, a CoCo program that lets you design graphics using your keyboard.

Draw runs on a 16K Color Computer. It includes three Extended Basic functions (Line, Circle, and Paint) and provides four colors. You can create many types of graphics, including pictures and gameboards.

How to Use Draw

When you run Draw, a pixel-sized dot (the cursor) appears in the center of the screen. Move the cursor one space at a time with one of the four arrow keys. Move it continuously by pressing shift and an arrow key simultaneously; the cursor moves until you press another key or until it encounters the edge of the graphics screen.

Change the cursor's color by pressing 1, 2, 3, or 4. These numbers correspond to the colors in the color graphics modes. Pressing 1 makes the cursor disappear, because 1 is the background color. To change from one color set to the other, press R.

To set a pixel's color, move the cur-

By using your keyboard to draw, you can avoid the drudgery of designing graphics.

sor to the pixel, select a color, and press S. Then, every pixel that the cursor passes over adopts this color. Change color by pressing a number key.

Draw horizontal and vertical lines by pressing shift and an arrow key. With some colors, the horizontal and vertical lines are different shades because of the built-in video display generator's border function. To leave the set mode, press S.

Drawing diagonal lines is easy with the line function. Position the cursor

where you want the line to begin and press L. Then place the cursor where you want the line to end and again press L. The line appears between these points. This function's shortcoming is that it uses Extended Basic's Line function and draws only in the foreground color. But using this function is much easier than drawing a line one point at a time.

To draw a circle, position the cursor on the pixel desired for the circle's center, and press C. Then, move the cursor to a pixel on the circumference of the circle and press C again. A circle the color of the cursor appears.

With the Paint function, you can color large areas. Change the cursor to the preferred color and draw a border around the area. Position the cursor inside the area and press P; the area fills with the selected color. You can also paint circles with this method.

A Few Tips

To erase, move the cursor to the appropriate pixels. Change the cursor to the background color, 1. Then, using the set option, erase the pixels by replacing them with the background color.

When the cursor passes through an

The Key Box

Color Computer
16K RAM
Extended Color Basic

Line Modification

20	Change	PMODE3, 1	to	PMODE4, 1
50	Change	F=1	to	F=2
400	Change	Both (X+2)s	to	X+1
400	Change	253	to	254
415	Change	X+2	to	X+1
420	Change	Both (X-2)s	to	X-1
420	Change	2	to	1
435	Change	X-2	to	X-1

Table 1. To use PMODE4, make these modifications.

Variable Function

X	Horizontal coordinate
Y	Vertical coordinate
C	Color control
L	Line mode flag
CI	Circle mode flag
S	Set mode flag
P	Color of pixel before cursor is moved to pixel
SC	Variable for color set selection
F	Color to set pixel after cursor moves if not in 'set' mode

Table 2. Variables

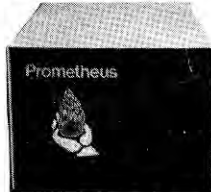
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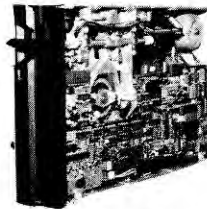
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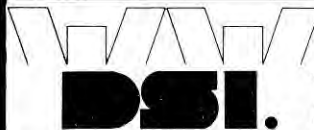
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Line	Function
5-60	Initialization
70-170	Keyboard scan routine
80	Set mode routine
85	Line mode routine
90	Circle mode routine
95	Paint mode routine
100	Color set change routine
180-190	Color set change routine
300-360	Repeat (rapid motion) cursor subroutines
400-475	Cursor single move and pixel set subroutines
500-530	Circle radius subroutines

Table 3. Line Functions

Program Listing

```

5  ****DRAW***LARRY COLLE**JAN82*
10 POKE65495,1
20 PMODE3,1
30 PCLS
40 SCREEN1,0
50 X=128:Y=96:C=3:L=1:CI=1:S=1:F=1:R=1
60 PSET(X,Y,C)
70 A$=INKEY$
80 IFA$="S"THENL=L*-1:IFL=-1THENL=X:A2=Y ELSEA3=X:A4=Y:LINE(A1,
A2)-(A3,A4),PSET:F=4
90 IFA$="C"THENCI=CI*-1:IFCI=-1THENL=X:A2=Y ELSEGOSUB500:CIRCLE
(A1,A2),A7,C:F=C
100 IFA$="R"THENGOTO180

```

Listing continues

```

5  ***DISPLAY**
10 PMODE3,1
20 SCREEN1,0
30 GOTO30
40 GOTONEW

```

Program Listing 2

area of the same color, change the cursor's color.

If the Paint function doesn't work, move the cursor up or down slightly to another location inside the border, and press P again.

Sometimes the program isn't in the keyboard scan routine. If the keyboard doesn't respond to a command, reenter the command.

If your circles aren't round, add a ratio factor to the circle statement in line 90. This factor changes the circle's height-to-width ratio. (I use .88 for my 19-inch Sony.) Consult your manual if you aren't familiar with this syntax.

Should the program not run on your computer, eliminate line 10. Line 10 puts the computer in the faster dual-speed mode of operation. If you use the dual-speed mode, remember to either reset your computer or POKE 65494,1 before doing any cassette tape operations.

Saving a Display

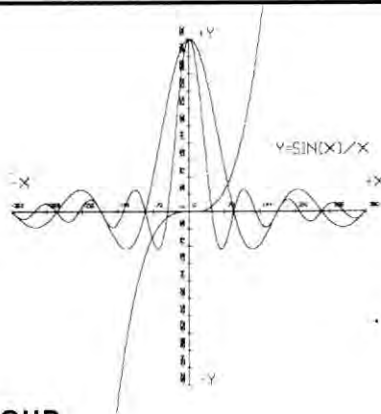
Use the CSAVEM statement to save a display on cassette tape. The syntax is CSAVEM"NAME", X,Y,Z. NAME is the name you give your display and it must be eight or fewer characters long. X is the starting memory address of the block of machine language or data you want to save. With PMODE3, 1 and with PMODE4, 1, X is 1536. Y is the end address of the block; in this case, it's 7679. Z stands for transfer, which is used by the EXEC command but isn't used here. I use a 1.

To retrieve graphics from tape, use a CLOADM statement with the drawing's name. This loads the file back into the same memory block from which it was saved. Program Listing 2 lets you display the graphics. Use the same PMODE and start page you used when creating the design. You can also load a program into the computer to use or modify the drawing. Just don't use a PCLS statement as this clears graphics memory.

PMODE4

PMODE4 creates some interesting results. With SCREEN1,0, the cursor changes between red and green as it moves horizontally. Vertical lines ap-

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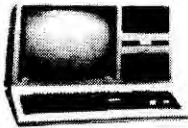
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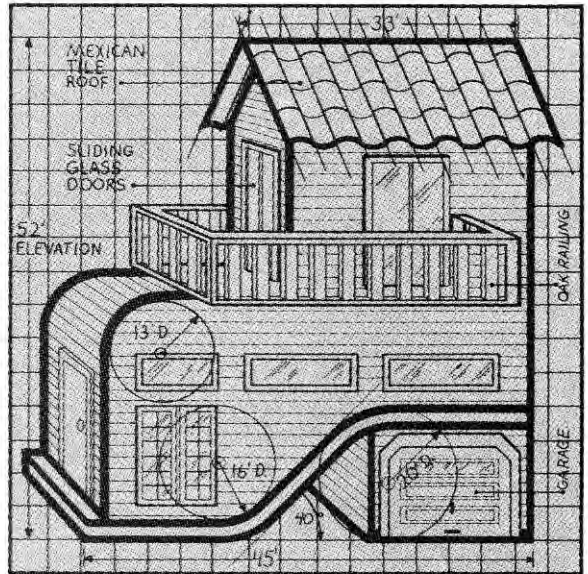
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pear as the color of the cursor, either bright red or green.

When you draw a series of vertical lines and move the cursor two spaces horizontally between each line, a solid block of either red or green appears. But, moving the cursor one space horizontally between each line creates a block of the normal foreground color. In effect, by manipulating the space between the vertical lines, you can create four colors in PMODE4. The Paint function only paints in the foreground color as it fills all the vertical lines with color. To use PMODE4, alter the program as indicated in Table 1.

Conclusion

You can master this program in a few minutes, and you should find it useful. I use a modified version with a stock market price program; I draw trend lines, channels, envelopes, and projected moving averages over a computer-generated stock chart. Another application might be drawing electronic circuit diagrams and saving completed circuits on tape. ■

Larry W. Colle (12101 N.W. Porter, Parkville, MO 64152) works for KCMO-TV. His hobbies include electronics and playing the guitar.

Listing continued

```

105 IFA$="1"THENC=1
110 IFA$="2"THENC=2
115 IFA$="3"THENC=3
120 IFA$="4"THENC=4
125 IFA$="P"THENPAINT(X-2,Y),C,C:F=C
130 IFA$=CHR$(9) THENGOSUB400
135 IFA$=CHR$(93) THENGOSUB300
140 IFA$=CHR$(8) THENGOSUB420
145 IFA$=CHR$(21) THENGOSUB320
150 IFA$=CHR$(10) THENGOSUB440
155 IFA$=CHR$(91) THENGOSUB340
160 IFA$=CHR$(94) THENGOSUB460
165 IFA$=CHR$(95) THENGOSUB360
170 GOTO70
180 IFSC=1THENS=0ELSESC=1
190 SCREEN1,SC:GOTO70
300 GOSUB400
310 A$=INKEY$: IFA$="" THENGOTO300ELSERETURN
320 GOSUB420
330 A$=INKEY$: IFA$="" THENGOTO320ELSERETURN
340 GOSUB440
350 A$=INKEY$: IFA$="" THENGOTO340ELSERETURN
360 GOSUB460
370 A$=INKEY$: IFA$="" THENGOTO360ELSERETURN
400 IFX>253THENRETURNELSEP=PPOINT(X+2,Y):PSET(X+2,Y,C)
410 IFS=-1THENPSET(X,Y,C) ELSEPSET(X,Y,F)
415 X=X+2:F=P:RETURN
420 IFX<2THENRETURNELSEP=PPOINT(X-2,Y):PSET(X-2,Y,C)
430 IFS=-1THENPSET(X,Y,C) ELSEPSET(X,Y,F)
435 X=X-2:F=P:RETURN
440 IFY>190THENRETURNELSEP=PPOINT(X,Y+1):PSET(X,Y+1,C)
450 IFS=-1THENPSET(X,Y,C) ELSEPSET(X,Y,F)
455 Y=Y+1:F=P:RETURN
460 IFY<1THENRETURNELSEP=PPOINT(X,Y-1):PSET(X,Y-1,C)
470 IFS=-1THENPSET(X,Y,C) ELSEPSET(X,Y,F)
475 Y=Y-1:F=P:RETURN
500 A3=X:A4=Y
510 A5=A3-A1:A6=A4-A2
520 A5=ABS(A5):A6=ABS(A6)
530 A7=SQR((A5*A5)+(A6*A6)):A7=INT(A7):RETURN

```

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As featured in Ciarcia's Circuit Cellar
Byte Magazine, March 1981

Reviewed in March '82 "80 Microcomputing"

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"Reviewing Disk-80 is almost incongruous, because any comments can be summarized with the sentence, 'It works.'" Dennis Bathory Kitsz, 80 Microcomputing, March 1982.

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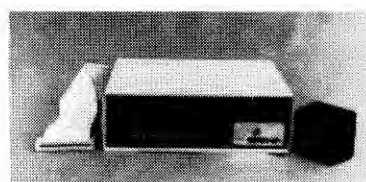
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The 80 Goes Color—Part II

by James W. Cole

Now that you've modified your TRS-80 so it's capable of color graphics, you need this set of USR routines to enhance your programming.

Last month I described the hardware required to add high-resolution color graphics to the TRS-80 Models I/III. I added an interface circuit between the TRS-80 and the TMS 9918A Video Display Processor (VDP) from Texas Instruments.

The hardware works great, but the four Basic routines I used to control the MikroKolor are crude and slow, and they require a lot of programming.

This month I'll correct these shortcomings with a set of USR routines, ten machine-language routines that you can call from Basic. Or, if you prefer, include this set as part of your Assembly-language routines.

These USR routines provide a fast, easy interface between the programmer and the TMS 9918A VDP. Before I discuss the detailed control of the VDP, I'll review the relationship between binary and hexadecimal numbers.

duce the patterns for color graphics.

A one-to-one relationship exists between four-digit binary numbers and one-digit hexadecimal (base 16) numbers (see Table 1). It's much easier to deal with a single digit than with four 1's and zeros. The letters A-F represent values greater than nine.

Two of these nibbles (4 bits) together form an 8-bit pattern equivalent to a

Binary	Hex
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

Table 1. Binary/Hex Relationships

Bits to Bytes

In your work with computers, you will eventually need the binary, or base two, number system that uses only two digits, zero and 1. Binary numbers pro-

Binary	Hex
11111111	FF
10000001	81
10000001	81
10000001	81
10000001	81
10000001	81
10000001	81
11111111	FF

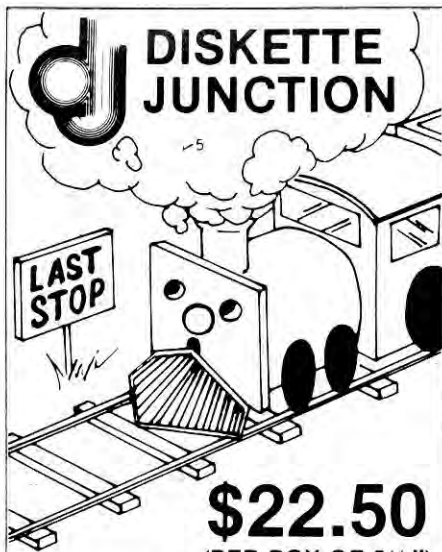
Table 2

Binary	Hex
00111000	38
01010100	54
10010010	92
11101110	EE
10010010	92
01010100	54
00111000	38
00000000	00

Table 3

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Listing 1 continued

```

710 REM NOW FOR THE SLOPES
720 FOR N = 0 TO 31 : READ P,P1 : U = FN PC(P,P1) : NEXT N
730 U = FN DP(AS(0),512) : U = FN CG("3737373737373737",512) : R
EM SET PATTERN AND COLOR FOR LOWER 1/3 OF SCREEN
740 U = FN DP(AS(0),257) - FN CG("E3E3E3E3E3E3E3E3",257) + FN CG
("E3E3E3E3E3E3E3E3",256) : REM DEFINE PATTERN AND COLOR OF GRAP
HICS BLOCK FOR ROAD
750 FOR N = 384 TO 511 : U = FN PC(N,257) : NEXT : REM PRINT GRA
PHICS CHARACTERS FOR ROAD
760 REM MOVE THE SPACE SHIP AT KEYBOARD COMMAND
770 CL = 48
780 AS = INKEY$: IF AS = "" THEN 780
790 IF AS = CHR$(8) THEN X = X - 1 : GOTO 840
800 IF AS = CHR$(9) THEN X = X + 1 : GOTO 840
810 IF AS = CHR$(10) THEN Y = Y + 1 : GOTO 840
820 IF AS = CHR$(91) THEN Y = Y - 1 : GOTO 840
830 IF AS <> " " THEN 780 ELSE CL = CL + 1 : IF CL = 71 THEN CL
= 48 ELSE U = FN SC(CHR$(CL),5) - FN SC(CHR$(CL),6) : REM CHANG
E COLOR OF SPACE SHIP
840 U = FN SL(X,Y,5) + FN SL(X+16,Y,6)
850 GOTO 780
860 DATA 160,192,193,224,225,226,168,199,200,201,111,142,143,144
,147,148,152,153 : REM INDIVIDUAL SOLID BLOCKS THAT ARE SET
870 DATA 173,188,204,221,230,254 : REM END POINTS FOR ROWS OF SO
LID GRAPHIC CHARACTERS
880 DATA 128,2,161,7,194,7,227,9,228,3,229,4,198,5,167,6,136,3,1
69,8,202,9,203,6,172,4,141,5,110,6,79,2,112,7,145,7,146,5,115,4,
116,8,149,9,150,2,151,4,120,5,121,8,154,7,155,6,156,8,189,7,222,
8,255,9
890 REM SCREEN LOCATIONS FOLLOWED BY THE PATTERN THAT IS TO BE P
RINTED IN THAT LOCATION, THESE PAIRS ARE READ BY STATEMENT 720

```

byte. A byte is stored in one address of the Z80 microprocessor in your TRS-80 memory or the TMS 9918A VRAM.

By using two hexadecimal digits to represent a pattern of eight binary digits, you reduce the work of entering values by 75 percent. The chance to make mistakes is reduced as well; 110110011

looks just like 110011011, but D3 and CB, their hex equivalents, are easy to distinguish.

Pattern Strings

The TMS 9918A provides a 256-by-192-pixel display of 49,152 dots that you must set or reset with the VDP.

Two of the tables in the TMS 9918A use patterns of 64 pixels. The pattern table and the sprite pattern table use a set of 8 bytes to form a single 8-by-8 pixel pattern. You can think of a pixel as a binary digit; it has only two possible states, on or off. A 1 represents the on state and a zero represents the off state.

The best way to understand how to convert a pixel pattern to hex digits is with an example. Table 2 shows how to form a square, and hex values for the user routine inputs. The first row has all 1's in it, the next six rows have a 1 in the first and last columns, and the last row has all 1's. You can represent this pattern with 16 hex digits (FF8181818181FF) instead of 64 bits (1111111110000011 00000011000000110000001100000011 000000111111111).

Since USR routines require patterns defined as hex values, you need to understand this process to define your own patterns. One more example is your favorite laser cannon sight. The laser sight is defined by the string 385492EE92543800. When this string passes to the USR routines, it loads the pixel pattern shown in Table 3.

Graph paper helps you design patterns. Take a piece of graph paper, mark off an 8-by-8-character area and color in the 1's and zeros until you find a pleasing combination. Graph paper is

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SCRINPUT

(outline #1 in a series)

SCRINPUT, (SCREen INPUT), is a fully relocatable 908 byte machine language routine that replaces the BASIC INPUT statement. Instead of entering data one item at a time, SCRINPUT allows you to create a video form on the screen of your disk based Radio Shack TRS-80 Model 1 or 3. Data entry is then a simple matter of filling in the blanks. Up to 80 "data fields" can be created on one video screen. Each field is assigned a length, screen position and one or more data types: Upper case alpha, lower case alpha, numeric or punctuation. Only characters matching type specifications can be placed in the field.

After defining data fields and specifying screen information, (Caps lock, Case reversal, cursor symbol and initial cursor location are among the features that can be activated), SCRINPUT is called via the BASIC USR function.

A flashing cursor symbol indicates where keyboard entered data will appear. As each character is entered, the cursor moves right one position. At the end of a data field, SCRINPUT repositions the cursor to the start of the next field. Keystrokes of invalid type are ignored.

Arrow keys can be used to move the cursor from one data field to another. Error correction is a simple matter of overtyping the bad characters with new data. The whole process is very similar to traditional screen oriented word processors.

SCRINPUT assigns all data fields to standard BASIC variables. These can be handled by your BASIC program in the same manner as information gathered by INPUT. You can even include error checking to insure that information is within reasonable bounds.

Be warned! SCRINPUT is only a utility and is designed for use within BASIC programs. If you cannot program, you can't use SCRINPUT. SCRINPUT works with any Disk Operating System (DOS) and comes with a 65 page manual containing sample programs, instructions and suggestions. Flow charts and source code are also included.

SCRINPUT has a 15 day money back guarantee: If you are not satisfied for ANY reason, return the package in good condition for a full refund. This is an enhanced version of the original SCRINPUT reviewed in the 4/82 issue of 80 Micro. Features added since that review include character insert and delete, user defined cursor character, a completely revised manual and alterations to allow easy use of SCRINPUT in the editing of existing data files.

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TMS 9918 User Routines

SN = Sprite Number SP = Sprite Position
SL = Screen Location PN = Pattern Number

To set mode

Text A = USR0 (0)
Multicolor A = USR0 (1)
Graphics I A = USR0 (2)
Graphics II A = USR0 (3)

To set sprite size

8x8 MAG 1 A = USR1 (0)
16x16 MAG 1 A = USR1 (1)
8x8 MAG 2 A = USR1 (2)
16x16 MAG 2 A = USR1 (3)

Define sprite pattern

A\$ = "FFFFFFFFFFFFFF"
A = USR3 (VARPTR (A\$))
A = USR5 (SN)

Set sprite color

A\$ = "F"
A = USR3 (VARPTR (A\$))
A = USR7 (SN)

Set sprite name (Pattern #)

A = USR3 (PN)
A = USR7 (-SN)

Sprite position

Vertical
A = USR3 (SP)
A = USR2 (SN)

Horizontal
A = USR3 (SP)
A = USR2 (-SN)

Clear sprites

A = USR8 (-1)

Clear pattern plane

A = USR8 (1)

Define pattern/character

A\$ = "FFFFFFFFFFFFFF"
A = USR3 (VARPTR (A\$))
A = USR4 (PN)

Define colors for patterns/text

Text
A\$ = "FF"
A = USR6 (VARPTR (A\$))

Multicolor
A\$ = "FFFF"
A = USR3 (VARPTR (A\$))
A = USR6 (PN)

Graphics I

A\$ = "FF"
A = USR3 (VARPTR (A\$))
A = USR6 (PN)

Graphics II

A\$ = "FFFFFFFFFFFFFF"
A = USR3 (VARPTR (A\$))
A = USR6 (PN)

Print char/pattern at location

A = USR3 (SL)
A = USR9 (PN)

Note: If locations are sequential, it is not necessary to load the screen location every time. The program will automatically increment the location.

especially helpful in visualizing sprites, text characters, and graphics.

USR Routines

The set of 10 USR routines I have defined provides control over most of the functions of the TMS 9918A. Table 4 shows the calling sequence for each operation you might want to perform. All hex string values are filled with F's; you will replace these values with your own strings.

The VARPTR function passes strings to the USR routines. More information on this function is in your Basic manual. Now take a closer look at each of these USR routines.

USR0 selects the mode of operation for the TMS 9918A, clears the pattern plane, clears all sprites, and sets default colors for the background and pattern planes.

USR1 selects pattern size of sprites (8-by-8-character or 16-by-16-character), and selects the magnification factor of sprites *1 or *2.

USR2 updates sprite location on the screen. If you call USR2 with a positive sprite number, update the vertical coordinate. If you call it with a negative sprite number, update the horizontal coordinate. You must load the value of the coordinate into a temporary location by calling USR3.

USR3 temporarily stores values to be used by another routine. These values can be a pattern number, a pointer to a string, or even a two-character string itself.

USR4 loads a pattern into the pattern table. The pattern number is passed in the USR4 call. A pointer to the string of 16 hex digits that is to be loaded into the pattern table is in the temporary value of USR3.

USR5 loads a pattern into the sprite pattern table. This routine performs the same function for sprites as USR4 does for the pattern plane, except that the sprites can be either 16 hex digits or 64 hex digits depending on the sprite size selected in USR2.

USR6 sets the colors for the various modes. For text, the color string for the background and character color are passed directly in the USR6 call. For multicolor, the color string is passed through USR3, and the pattern number is passed in the USR6 call. Graphics I and graphics II are identical to multicolor except for the length of the string.

USR7 serves two purposes. If you call it with a positive sprite number, it sets the color of the sprite to the value pointed to by the USR3 temporary variable. If you call USR7 with a negative

sprite number, it sets the name of the sprite to the value in the USR3 temporary variable.

USR8 also serves two purposes. If you call it with a positive value, it sets the entire pattern plane to pattern zero. This clears the screen if pattern zero is defined as all zeros or all 1's. If you call USR8 with a negative value, it turns off all sprite processing (clearing all sprites).

USR9 prints a pattern at a particular location on the screen that is passed in USR3 and is automatically incremented for sequential operation. The pattern number is passed in the USR9 call.

Basic Functions

One of the easiest ways to call these USR routines is by defining a set of functions at the beginning of a Basic program.

Functions allow you to call a set of USR routines in a sequence with only one statement. These functions should be defined near the beginning of your program, just after you define the USR-routine starting locations. You should order your program as follows:

- Variable declarations, including type definitions and array declarations
- USR routine addresses defined
- Functions defined
- Basic program logic
- End of program

Program Listing 1 shows the use of Basic functions.

Options

This program runs on a machine with

48K of memory. With minor changes, it runs on a 32K or 16K machine. You need to change the origin statement to a lower address and the USR routine addresses to the new memory locations. Answer the memory-size question for a 48K machine with 61440.

You can also use these programs in your own routines to control the TMS 9918A. I have included a few elementary functions that let you read/write the VRAM of the TMS 9918A, write to the control register, and read the status register.

These are the same four Basic operations shown last month but they are now in Assembly language. The rest of the program uses these routines to perform the operations requested by the USR routine.

Finished?

The hardware and software are both complete, and your TRS-80 can draw high-resolution color graphics. However, you still have games and 3D graphics packages to write. You could use the 16K of VRAM as a printer buffer with the right software to drive it. You don't even have a character set defined for the text mode yet.

This project has just begun. Look for more programs for the Mikrokolor interface in the future, some from me and possibly some from other users who have new applications. ■

James Cole can be reached at 515 Aspen St., Vandenberg, CA 93437.

Program Listing 2

```

00100 ;*****
00110 ;***
00120 ;***          9918A USER ROUTINES
00130 ;***          JIM COLE
00140 ;***          12 AUG 1982
00150 ;***
00160 ;*****
00170 ; JUMP TABLE TO ALL 10 USR ROUTINES TO BE CALLED
FROM BASIC
F000 00180      ORG      0F000H ; START OF USR PROGRAMS
F000 C31EF0    00190 USR0   JP      USER0
F003 C364F1    00200 USR1   JP      USER1
F006 C3A0F1    00210 USR2   JP      USER2
F009 C3D7F1    00220 USR3   JP      USER3
F00C C3E0F1    00230 USR4   JP      USER4
F00F C357F2    00240 USR5   JP      USER5
F012 C38BF2    00250 USR6   JP      USER6
F015 C3E3F2    00260 USR7   JP      USER7
F018 C336F3    00270 USR8   JP      USER8
F01B C36DF3    00280 USR9   JP      USER9
00290 ;
00300 ;
00310 ; USR0  DEFINE MODE OF OPERATION AND CLEAR SCREEN
00320 ;
00330 ;      0= TEXT , 1 = MULTICOLOR , 2 = GRAPHICS I
00340 ;      3 = GRAPHICS II
00350 ;      CLEAR SCREEN AND ALL SPRITES
00360 ;
F01E CD7F0A    00370 USER0  CALL   0A7FH ;LOAD VALUE INTO HL
F021 3E10      00380      LD     A,16 ;ENABLE I/O BUS FOR MODEL III
F023 D3EC      00390      OUT   (236),A

```

Listing 2 continues

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Listing 2 continued

```

F025 AF 00400 XOR A ;CLEAR A REGISTER
F026 B5 00410 OR L ;LOAD A REG WITH VALUE
F027 32PDF0 00420 LD (MODE),A
F02A 280C 00430 JR Z,TEXT
F02C 3D 00440 DEC A
F02D 2820 00450 JR Z,MULTI
F02F 3D 00460 DEC A
F030 2837 00470 JR Z,GRP1
F032 3D 00480 DEC A
F033 284E 00490 JR Z,GRP2
F035 C3CAF0 00500 JP ERROR
00510 ;SET UP TEXT MODE REGISTERS
00520 ;CLEAR THE SCREEN
00530 ;
F038 21FEF0 00540 TEXT LD HL,REGTBL ;SET POINTER TO REGISTER TAB
LE
F03B 3E00 00550 LD A,0 ;REGISTER VALUE OF ZERO
F03D 77 00560 LD (HL),A ;LOAD INTO REGISTER TABLE
F03E 23 00570 INC HL ;NEXT REGISTER
F03F 3ED2 00580 LD A,0D2H ;REGISTER 1 VALUE
F041 77 00590 LD (HL),A ;LOAD INTO REGISTER TABLE
F042 CDA0F0 00600 CALL RGSET1 ;SET REMAINING REGISTERS
F045 CDEEF0 00610 CALL REGLD ;LOAD REGISTERS INTO VDP
F048 CD06F1 00620 CALL TCLR ;CLEAR SCREEN
F04B CD4CF3 00630 CALL CLS ;CLEAR SCREEN
F04E C9 00640 RET
00650 ;SET UP REGISTERS FOR MULTICOLOR MODE
00660 ;AND CLEAR THE SCREEN
00670 ;
F04F 21FEF0 00680 MULTI LD HL,REGTBL ;SET POINTER TO REGISTER TAB
LE
F052 3E00 00690 LD A,0 ;REGISTER ZERO VALUE
F054 77 00700 LD (HL),A ;LOAD INTO REGISTER TABLE
F055 23 00710 INC HL ;NEXT REGISTER
F056 3ECA 00720 LD A,0CAH ;REGISTER 1 VALUE
F058 77 00730 LD (HL),A ;STORE REGISTER 1 VALUE
F059 CDA0F0 00740 CALL RGSET1 ;SET REMAINING REGISTERS
F05C CDEEF0 00750 CALL REGLD ;LOAD REGISTERS
F05F CD06F1 00760 CALL MCMCLR ;DEFINE CLS CHAR
F062 CD4CF3 00770 CALL CLS ;CLEAR SCREEN
F065 CD3DF3 00780 CALL CLRSPR ;CLEAR ALL SPRITES
F068 C9 00790 RET
00800 ;
00810 ;DEFINE REGISTER VALUES FOR GRAPHICS 1 MODE
00820 ;AND CLEAR THE SCREEN
00830 ;
F069 21FEF0 00840 GRP1 LD HL,REGTBL ;SET POINTER TO REGISTER TAB
LE
F06C 3E00 00850 LD A,0 ;REGISTER ZERO VALUE
F06E 77 00860 LD (HL),A ;STORE REGISTER 0
F06F 23 00870 INC HL ;NEXT REGISTER
F070 3EC2 00880 LD A,0C2H ;REGISTER 1 VALUE
F072 77 00890 LD (HL),A ;STORE REG 1
F073 CDA0F0 00900 CALL RGSET1 ;LOAD REGISTER INTO VDP
F076 CDEEF0 00910 CALL REGLD ;DEFINE 0 CHAR
F079 CD14F1 00920 CALL G1CLR ;CLEAR SCREEN
F07C CD4CF3 00930 CALL CLS ;CLEAR SCREEN
F07F CD3DF3 00940 CALL CLRSPR ;CLEAR ALL SPRITES
F082 C9 00950 RET
00960 ;
00970 ;GRAPHICS 2 MODE REGISTERS DEFINED
00980 ;AND SCREEN CLEARED
00990 ;
F083 21FEF0 01000 GRP2 LD HL,REGTBL ;POINTER TO REGISTER TABLE
F086 3E02 01010 LD A,2 ;REG 0 VALUE
F088 77 01020 LD (HL),A ;STORE INTO REG TABLE
F089 23 01030 INC HL ;NEXT REGISTER
F08A 3EC2 01040 LD A,0C2H ;REG 1 VALUE
F08C 77 01050 LD (HL),A ;STORE REG 1 VALUE
F08D CDA0F0 01060 CALL RGSET1 ;SET REMAINING REGISTERS
F090 CDB9F0 01070 CALL RGSET2 ;SET MSB OF REGISTERS
F093 CDEEF0 01080 CALL REGLD ;LOAD VDP REGISTERS
F096 CD27F1 01090 CALL G2CLR
F099 CD4CF3 01100 CALL CLS ;CLEAR SCREEN
F09C CD3DF3 01110 CALL CLRSPR ;CLEAR SPRITES
F09F C9 01120 RET
01130 ;
01140 ;
01150 ;
01160 ;
01170 ;
01180 ;SET UP REGISTER TABLE REG 2-7 FOR TEXT,MULTI & GRP1
01190 ;
F0A0 23 01200 RGSET1 INC HL ;NEXT REGISTER
F0A1 3E0F 01210 LD A,NTBA ;LOAD NAME TABLE BASE ADDR
F0A3 77 01220 LD (HL),A ;LOAD INTO REGISTER TABLE
F0A4 23 01230 INC HL ;NEXT REGISTER
F0A5 3E0F 01240 LD A,CTBA ;LOAD COLOR TABLE BASE ADDR
F0A7 77 01250 LD (HL),A ;LOAD INTO REGISTER TABLE
F0A8 23 01260 INC HL ;NEXT REGISTER
F0A9 3E00 01270 LD A,PGBA ;LOAD PATTERN GENERATOR BASE
ADDR
F0AB 77 01280 LD (HL),A ;LOAD INTO REGISTER TABLE
F0AC 23 01290 INC HL ;NEXT REGISTER
F0AD 3E70 01300 LD A,SATBA ;LOAD SPRITE ATTRITIBUE TABL
E BASE ADDR
F0AF 77 01310 LD (HL),A ;LOAD INTO REGISTER TABLE
F0B0 23 01320 INC HL ;NEXT REGISTER
F0B1 3E03 01330 LD A,SGBA ;LOAD SPRITE GENERATOR BASE
ADDR
F0B3 77 01340 LD (HL),A ;STORE IN REGISTER TABLE
F0B4 23 01350 INC HL ;NEXT REGISTER
F0B5 3E03 01360 LD A,COLOR0 ;LOAD DEFAULT COLORS
F0B7 77 01370 LD (HL),A ;LOAD INTO REGISTER TABLE
F0B8 C9 01380 RET
01390 ;
01400 ;SET LSB'S FOR GRAPHICS 2 MODE
01410 ;
F0B9 3A01F1 01420 RGSET2 LD A,(REG3)
F0BC F67F 01430 OR 7FH
F0BE 3201F1 01440 LD (REG3),A
F0C1 3A02F1 01450 LD A,(REG4)
F0C4 F603 01460 OR 3H
F0C6 3202F1 01470 LD (REG4),A
F0C9 C9 01480 RET
01490 ;
01500 ;GENERAL ERROR ROUTINE
01510 ;
F0CA 21DBF0 01520 ERROR LD HL,ERMSG
F0CD 0613 01530 LD B,ERMSG
F0CF 7E 01540 LOOP2 LD A,(HL)
F0D0 23 01550 INC HL
F0D1 E5 01560 PUSH HL
F0D2 C5 01570 PUSH BC
F0D3 CD3300 01580 CALL 33H
F0D6 C1 01590 POP BC
F0D7 E1 01600 POP HL
F0D8 10F5 01610 DJNZ LOOP2
F0DA C9 01620 RET
F0DB 43 01630 ERMSG DEFM 'COLOR ROUTINE ERROR'
4F 4C 4F 52 20 52 4F 55
54 49 4E 45 20 45 52 52
4F 52
0013 01640 ERMSG EQU $-ERMSG
01650 ;
01660 ;LOAD VDP REGISTER FROM REGISTER TABLE
01670 ;
F0EE 2105F1 01680 REGLD LD HL,REGTBL+7 ;SET POINTER
F0F1 0E07 01690 LD C,7 ;SET REGISTER COUNTER
F0F3 7E 01700 LOOP1 LD A,(HL) ;GET VALUE FROM TABLE

```

Listing 2 continues

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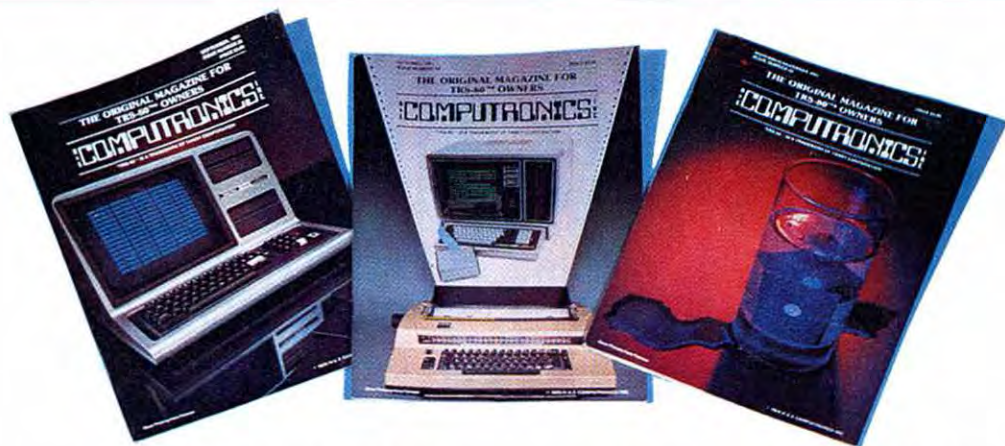
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Listing 2 continued

```

F0F4 CDA6F3 01710 CALL WRTREG ;SEND TO VDP REGISTER
F0F7 2B 01720 DEC HL ;NEXT REGISTER
F0F8 0D 01730 DEC C ;NEXT REGISTER
F0F9 F2F3F0 01740 JP P,LOOP1 ;LAST REG?
F0FC C9 01750 RET
01760 ;
01770 ;STORAGE LOCATIONS
01780 ;
F0FD 00 01790 MODE DEFB 0 ;MODE FLAG
F0FE 00 01800 REGTBL DEFB 0 ;REG 0
F0FF 00 01810 REG1 DEFB 0 ;REG 1
F100 00 01820 REG2 DEFB 0 ;REG2
F101 00 01830 REG3 DEFB 0
F102 00 01840 REG4 DEFB 0
F103 00 01850 REG5 DEFB 0
F104 00 01860 REG6 DEFB 0
F105 00 01870 REG7 DEFB 0
01880 ;
01890 ;VALUES USED IN THESE ROUTINES
01900 ;
000F 01910 NTBA EQU 15D ;NAME TABLE BASE ADDRESS
00FF 01920 CTBA EQU 255D ;COLOR TABLE BASE ADDRESS
0000 01930 PGBA EQU 0 ;PATTERN GENERATOR BASE ADDRESS
0070 01940 SATBA EQU 112D ;SPRITE ATTRITIBUE TABLE BASE ADDR
0003 01950 SGBA EQU 3D ;SPRITE GENERATOR BASE ADDRESS
0083 01960 COLOR0 EQU 83H ;BLACK ON MED GREEN
01970 ;
01980 ;CLEAR CHARACTER PATTERN AND COLOR 0
01990 ;
F106 2600 02000 TCLR LD H,PGBA ;LOAD PATTERN GENERATOR BASE
ADDR
F108 CB24 02010 SLA H
F10A CB24 02020 SLA H
F10C CB24 02030 SLA H
F10E 2E00 02040 LD L,0 ;FORM ADDR OF PATTERN 0
F110 CD58F1 02050 CALL MODEX ;LOAD PATTERN OF 0'S
F113 C9 02060 RET
F106 02070 MCMCLR DEFL TCLR
F114 CD06F1 02080 G1CLR CALL TCLR
F117 26FF 02090 LD H,CTBA ;ZERO OUT COLOR TABLE
F119 2E00 02100 LD L,0
F11B CB3C 02110 SRL H
F11D CB1D 02120 RR L
F11F CB3C 02130 SRL H
F121 CB1D 02140 RR L
F123 CD58F1 02150 CALL MODEX ;LOAD ZEROS INTO TABLE
F126 C9 02160 RET
F127 CD14F1 02170 G2CLR CALL G1CLR
F12A 3E00 02180 LD A,PGBA
F12C CD38F1 02190 CALL ZEROY ;ZERO PATTERN IN SECOND TWO
BLOCKS
F12F 3EFF 02200 LD A,CTBA ;LOAD COLOR TABLE BASE ADDR
F131 07 02210 RLCA
F132 07 02220 RLCA
F133 07 02230 RLCA
F134 CD38F1 02240 CALL ZEROY
F137 C9 02250 RET
F138 E604 02260 ZEROY AND 4D
F13A CB27 02270 SLA A
F13C CB27 02280 SLA A
F13E CB27 02290 SLA A
F140 67 02300 LD H,A
F141 2E00 02310 LD L,0
F143 E5 02320 PUSH HL ;DO FIRST BLOCK OF GRAPHICS
F144 CD58F1 02330 CALL MODEX
F147 E1 02340 POP HL
F148 110008 02350 LD DE,2048D ;CONSTANT BETWEEN SCREEN BLO
CKS
F14B 19 02360 ADD HL,DE ;FORM ADDR FOR SECOND BLOCK
F14C E5 02370 PUSH HL

```

```

F14D D5 02380 PUSH DE ;SAVE FOR NEXT BLOCK
F14E CD58F1 02390 CALL MODEX ;ZERO CHARACTER
F151 D1 02400 POP DE
F152 E1 02410 POP HL
F153 19 02420 ADD HL,DE ;FORM ADDR FOR THIRD BLOCK
F154 CD58F1 02430 CALL MODEX ;ZERO CHARACTER
F157 C9 02440 RET
F158 1E00 02450 MODEX LD E,0
F15A 0607 02460 LD B,7
F15C CDAEF3 02470 CALL WRTRAM
F15F D301 02480 CZERO OUT (1),A
F161 10FC 02490 DJNZ CZERO
F163 C9 02500 RET
02510 ;
02520 ;*****
02530 ;
02540 ;USR1 SET SPRITE SIZE
02550 ;0 = (8X8)*1
02560 ;1 = (16X16)*1
02570 ;2 = (8X8)*2
02580 ;3 = (16X16)*2
02590 ;
F164 CD7F0A 02600 USER1 CALL 0A7FH ;LOAD VALUE INTO HL
F167 AF 02610 XOR A ;CLEAR A REG
F168 B5 02620 OR L ;LOAD A REG WITH VALUE
F169 32FF1 02630 LD (SPRTSZ),A ;SAVE SPRITE SIZE
F16C 280C 02640 JR Z,SMALL1 ; (8X8)*1
F16E 3D 02650 DEC A
F16F 2810 02660 JR Z,BIG1 ; (16X16)*1
F171 3D 02670 DEC A
F172 2814 02680 JR Z,SMALL2 ; (8X8)*2
F174 3D 02690 DEC A
F175 281A 02700 JR Z,BIG2 ; (16X16)*2
F177 C3CAF0 02710 JP ERROR
F17A 3AFF0 02720 SMALL1 LD A,(REG1) ;GET REGISTER THAT CONTROLS
SPRITE SIZE
F17D E6FC 02730 AND 0FCH ;MASK OFF SIZE BITS
F17F 1815 02740 JR SIZELD ;LOAD REGISTER
F181 3AFF0 02750 BIG1 LD A,(REG1)
F184 E6FE 02760 AND 0FEH ;MASK OFF MAGNIFICATION BIT
F186 180E 02770 JR SIZELD ;LOAD REGISTER
F188 3AFF0 02780 SMALL2 LD A,(REG1)
F18B E6FD 02790 AND 0FDH ;MASK OFF BIG BIT
F18D F601 02800 OR 1 ;SET MAGNIFICATION BIT
F18F 1805 02810 JR SIZELD ;LOAD REGISTER
F191 3AFF0 02820 BIG2 LD A,(REG1) ;GET REGISTER
F194 F603 02830 OR 3H ;SET BIG AND MAG BITS
F196 32FF0 02840 SIZELD LD (REG1),A ;SAVE REGISTER LOAD
F199 0E01 02850 LD C,1 ;SET REGISTER NUMBER
F19B CDA6F3 02860 CALL WRTREG ;LOAD VDP REGISTER
F19E C9 02870 RET
F19F 00 02880 SPRTSZ DEFB 0 ;SPRITE SIZE INDICATOR
02890 ;
02900 ;*****
02910 ;
02920 ;USR2 UPDATE SPRITE LOCATION
02930 ;SPRITE NUMBER IS PASSED IN USR2 CALL
02940 ;+ IS VERTICAL
02950 ;- IS HORIZONTAL POSITION UPDATE
02960 ;THE COORDINATE HAS BEEN LOADED INTO TEMP BY USR3 CALL
02970 ; SPRITES ARE NUMBERED 1-32 TO PREVENT AN -0 PROBLEM
02980 ;
F1A0 CD7F0A 02990 USER2 CALL 0A7FH ;LOAD HL WITH CALL VALUE
F1A3 7C 03000 LD A,H ;TEST FOR ZERO SPRITE NUMBER
F1A4 B5 03010 OR L
F1A5 CACAF0 03020 JP Z,ERROR
F1A8 CB7C 03030 BIT 7,H ;NEGATIVE?
F1AA 200D 03040 JR NZ,HORZ ;IS IT A VERTICAL OR HORZ
F1AC 7D 03050 LD A,L ;GET LSB

```

Listing 2 continues

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System Diagnostic

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- Line Printer: Character test
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- RS-232-C Interface: Read sense switches (Model I), connector fault, data transmission, framing, data loop, baud rate generator
- Disk Drives: Disk controller, drive select and restore, track seek and verify read, read/write/verify all tracks and sectors, formatting, disk drive timer, disk head cleaner
- Model I: single or double density, 35, 40 or 80 track drives
- Model 3: single or double density, 35, 40 or 80 track drives
- single or double sided drives

- One program adapts to any system configuration and hardware.
- Individual tests of each device with operator monitoring and intervention.
- Continuous system tests run continually for hours, with diagnostic reports optionally written on line printer.
- Complete instructions and documentation.

SPECIFY TRS-80™ MODEL I OR MODEL III

SMART TERMINAL

Enables your TRS-80 to be used as a data communications terminal to a time-sharing system, computer bulletin board, or another computer, via the RS-232-C interface.

- MEMORY BUFFER holds data for transmission or data received from other computer.
 - CASSETTE or DISK may be used to load or save data from memory.
 - AUTOMATIC TRANSMISSION of data from memory.
 - AUTOMATIC STORAGE of incoming data at user's option.
 - TRANSMIT or RECEIVE WITH VERIFICATION options included for communication between two TRS-80s using Smart Terminal.
 - Full CONTROL KEYS, including control key mapping into any ASCII character. True BREAK key. Lower case supported on Model I.
 - Buffered LINE PRINTER ECHO for incoming data.
 - Disk and cassette files fully compatible with ELECTRIC PENCIL™ and SCRIPSIT™ programs.
 - BAUD RATE and RS-232-C CHARACTERISTICS can be reset from within the program.
 - SAVE PROGRAM option creates "personalized" back-up copy of program with all options set as specified by user.
 - ONE PROGRAM supports both cassette and disk systems. Program is compatible with PMC-80 and other TRS-80 "work alike" computers.
- Model I or III Version supplied on cassette \$69.95**
Model II (CP/M) Version supplied on diskette \$74.95
Model I or III Version supplied on diskette \$79.95

MON-3 and MON-5

Monitor Programs #3 and #5 are powerful utility programs which enable you to interact directly with the TRS-80 in machine language. They are useful both for beginners and for advanced programmers.

- BEGINNERS can learn to use machine language.
 - COMPLETE instruction manual.
 - SIMPLE commands, easy to use.
- Both MON-3 and MON-5 contain the following features:
- DISPLAY memory in ASCII and hexadecimal form.
 - DISASSEMBLE memory to see machine language commands.
 - MOVE and COMPARE blocks.
 - SEARCH through memory to find specific values.
 - MODIFY memory in different ways.
 - RELOCATE object programs.
 - READ and WRITE object tapes in SYSTEM format.
 - UNLOAD programs in low RAM on disk.
 - CREATE SYMBOLIC CASSETTES of disassembled output for use as input to EDTASM program (MON-3 only).
 - PRINT output optionally on video display or line printer.
- Monitor #5 adds the following features:
- SAVE and LOAD disk files.
 - INPUT and OUTPUT of disk sectors, bypassing disk operating system.
 - RS-232-C COMMANDS for terminal mode, send and receive data.
 - COMPLETE DEBUGGING PACKAGE including setting and displaying registers, single stepping, setting breakpoints and executing machine instructions.

Available for Model I and III Level II computers (16K, 32K and 48K).

Specify TRS-80™ Model I or III

MON-3 (for cassette systems) \$39.95
MON-5 (for disk systems) \$59.95

MAILING LIST

Maintains mailing lists of up to 1326 names (48K version). Add, change, delete, or find names. Machine language sort according to information in ANY field (first or last name, address, city, state, zip code). Three or four line labels printed in 1, 2, 3, or 4 columns, in master list, or on video display.

TRS-80 Model 1/3 Disk Version \$69.95
IBM PC Disk Version \$79.95

HOME BUDGET

Keeps track of your monthly and year-to-date income and expenses. Income and expenses classified by code numbers for identification of categories. Data includes date, code number, amounts and check number (optional). Computes monthly and year-to-date summaries showing income tax deductions. All output printed on video display or line printer at user's option. Complete instructions for customizing to suit your own budget.

TRS-80 Model 1/3 Cassette Version \$29.95
TRS-80 Model 1/3 Disk Version \$49.95
IBM PC Disk Version \$59.95

SMALL BUSINESS ACCOUNTING

Based on Dome Bookkeeping Record #612, this program keeps track of income, expenditures, and payroll for a small business. Receipts and expenditures can be entered on a daily, weekly, or monthly basis. Program computes monthly, through last month, and year to date summaries. Payroll section (included in disk version only) keeps record of employees and paychecks with up to six categories of payroll deductions. Computes employee payroll records and year-to-date payroll totals. Complete instructions for customizing to suit your own business.

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Listing 2 continued

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FLAD 3D      03060      DEC      A          ;CORRECT OFF BY ONE FOR -0 P
ROB
F1AE CDC9F1  03070      CALL     SPRLOC     ;GET SPRITE VRAM ADDRESS
F1B1 ED5BDEF1 03080      LD       DE,(TEMP)  ;GET VERT POSITION
F1B5 CDAEF3  03090      CALL     WRTRAM     ;WRITE TO VRAM
F1B8 C9      03100      RET
F1B9 7D      03110      LD       A,L        ;GET LSB
F1BA ED44    03120      NEG      ;CONVERT NEG TO POS VALUE
F1BC 3D      03130      DEC      A          ;CORRECT OFF BY ONE FOR -0 P
ROB
F1BD CDC9F1  03140      CALL     SPRLOC     ;GET SPRITE LOCATION
F1C0 23      03150      INC     HL          ;SET POINTER TO HORZ BYTE
F1C1 ED5BDEF1 03160      LD       DE,(TEMP)  ;GET HORZ POSITION
F1C5 CDAEF3  03170      CALL     WRTRAM
F1C8 C9      03180      RET
F1C9 6F      03190      SPRLOC  LD       L,A    ;LOAD SPRITE #
F1CA 2670    03200      LD       H,SATBA   ;ATTRIBUTE TABLE
F1CC CB25    03210      SLA     L
F1CE CB25    03220      SLA     L
F1D0 CB25    03230      SLA     L
F1D2 CB0C    03240      RRC     H
F1D4 CB1D    03250      RR      L
F1D6 C9      03260      RET
03270 ;
03280 ;*****
03290 ;
03300 ;USR3 LOAD VALUE TO BE USED LATER
03310 ;
F1D7 CD7F0A  03320      USER3  CALL     0A7FH    ;LOAD HL VALUE
F1DA 22DEF1  03330      LD       (TEMP),HL ;SAVE FOR LATER USE
F1DD C9      03340      RET
F1DE 0000    03350      TEMP   DEFW     0
03360 ;
03370 ;*****
03380 ;
03390 ;USR4 SET PATTERN
03400 ;PATTERN # IS PASSED IN USR4
03410 ;PATTERN # = (0-767) G2 : (0-255) ALL OTHER MODES
03420 ;USR3 TEMP IS THE VARPTR TO A STRING THAT DEFINES THE PATER
N
03430 ;
F1E0 CD7F0A  03440      USER4  CALL     0A7FH    ;LOAD PATTERN #
F1E3 3AFDF0  03450      LD       A,(MODE)  ;GET MODE
F1E6 B7      03460      OR      A          ;TEST FOR 0
F1E7 280C    03470      JR      Z,PTEXT    ;TEXT PATTERN
F1E9 3D      03480      DEC     A
F1EA 2809    03490      JR      Z,PTEXT    ;MULTICOLOR PATTERN IS THE S
AME
F1EC 3D      03500      DEC     A
F1ED 2806    03510      JR      Z,PTEXT    ;GRP1 PATTERN IS THE SAME AL
SO
F1EF 3D      03520      DEC     A
F1F0 2812    03530      JR      Z,PGRP2
F1F2 C3CAF0  03540      JP      ERROR
F1F5 3E00    03550      PTEXT  LD       A,PGBA   ;SET UP VRAM ADDRESS
F1F7 CB27    03560      SLA     A
F1F9 CB27    03570      SLA     A
F1FB CB27    03580      SLA     A
F1FD 29      03590      ADD     HL,HL
F1FE 29      03600      ADD     HL,HL
F1FF 29      03610      ADD     HL,HL
F200 B4      03620      OR      H
F201 67      03630      LD       H,A
F202 180F    03640      JR      PATOUT
F204 3E00    03650      PGRP2  LD       A,PGBA   ;SET UP VRAM ADDRESS
F206 CB27    03660      SLA     A
F208 CB27    03670      SLA     A
F20A E620    03680      AND     20H
F20C 29      03690      ADD     HL,HL
F20D 29      03700      ADD     HL,HL

F20E 29      03710      ADD     HL,HL
F20F B4      03720      OR      H
F210 67      03730      LD       H,A
F211 1800    03740      JR      PATOUT
F213 E5      03750      PATOUT PUSH     HL          ;SAVE ADDR ON STACK
F214 2ADEF1  03760      LD       HL,(TEMP) ;GET STRING POINTER
F217 46      03770      LD       B,(HL)    ;STRING LENGTH
F218 23      03780      INC     HL          ;NEXT WORD IS POINTER TO STR
ING
F219 5E      03790      LD       E,(HL)    ;LOAD STRING POINTER
F21A 23      03800      INC     HL
F21B 56      03810      LD       D,(HL)
F21C E1      03820      POP     HL          ;GET VRAM ADDRESS
F21D CBF4    03830      SET     6,H        ;PREPARE TO WRITE TO VRAM
F21F CD9FF3  03840      CALL     OUTADR    ;SEND ADDRESS TO VRAM
F222 EB      03850      EX      DE,HL      ;HL POINTS TO STRING
F223 58      03860      LD       E,B        ;LOOP COUNTER
F224 CB3B    03870      SRL     E          ;DIVIDE BY 2
F226 CD2FF2  03880      LOOP3  CALL     CVERT ;CONVERT ASCII TO HEX
F229 D301    03890      OUT     (1),A      ;LOAD TABLE
F22B 1D      03900      DEC     E
F22C 20F8    03910      JR      NZ,LOOP3   ;FINISHED?
F22E C9      03920      RET
03930 ;CONVERT 2 BYTE ASCII TO 1 BYTE HEX
F22F 0E00    03940      CVERT  LD       C,0      ;CLEAR RESULT
F231 7E      03950      LD       A,(HL)    ;GET FIRST CHAR
F232 FE60    03960      CP      60H        ;CHECK FOR LOWER CASE
F234 FA39F2  03970      JP      M,UPCASE   ;GO IF UPPER CASE
F237 D620    03980      SUB     20H        ;CONVERT TO UPPER CASE
F239 CD4CF2  03990      UPCASE  CALL     CONV     ;CONVERT CHAR TO HEX
F23C 4F      04000      LD       C,A        ;SAVE FIRST NIBBLE
F23D CB21    04010      SLA     C          ;ALIGN THE TWO NIBBLES
F23F CB21    04020      SLA     C
F241 CB21    04030      SLA     C
F243 CB21    04040      SLA     C
F245 23      04050      INC     HL          ;NEXT CHAR
F246 7E      04060      LD       A,(HL)    ;GET SECOND CHAR
F247 CD4CF2  04070      CALL     CONV     ;CONVERT CHAR TO HEX
F24A 23      04080      INC     HL          ;INCREMENT CHAR
F24B C9      04090      RET
F24C D630    04100      CONV     SUB     30H      ;CONVERT 0-15
F24E FE0A    04110      CP      10D        ;CHECK FOR A-F
F250 FA55F2  04120      JP      M,JUMPI    ;GO IF 0-9
F253 D607    04130      SUB     7          ;CONVERT A-F TO 10-15
F255 81      04140      JUMPI  ADD     A,C   ;MERGE RESULT
F256 C9      04150      RET
04160 ;
04170 ;*****
04180 ;
04190 ;USR5 DEFINE SPRITE PATTERN SMALL 1-256 LARGE 1-64
04200 ;PATTERN # PASSED IN USR5
04210 ;POINTER TO STRING PASSED IN USR3 TEMP
04220 ;
F257 CD7F0A  04230      USER5  CALL     0A7FH    ;LOAD SPRITE NUMBER
F25A 7C      04240      LD       A,H        ;TEST FOR ZERO SPRITE NUMBER

F25B B5      04250      OR      L
F25C CACAF0  04260      JP      Z,ERROR
F25F 2B      04270      DEC     HL          ;CORRECT OFF BY 1 SPRITE NUM
BER ERROR
F260 3A9FF1  04280      LD       A,(SPRTSZ) ;LOAD SPRITE SIZE
F263 B7      04290      OR      A
F264 280C    04300      JR      Z,SPRT8
F266 3D      04310      DEC     A
F267 2819    04320      JR      Z,SPRT16
F269 3D      04330      DEC     A
F26A 2806    04340      JR      Z,SPRT8
F26C 3D      04350      DEC     A
F26D 2813    04360      JR      Z,SPRT16
F26F C3CAF0  04370      JP      ERROR

```

Listing 2 continues

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NAME

DESCRIPTION

1	RULE78	Interest Apportionment by Rule of the 78's
2	ANNUI	Annuity computation program
3	DATE	Time between dates
4	DAYYEAR	Day of year a particular date falls on
5	LEASEINT	Interest rate on lease
6	BREAKEVN	Breakeven analysis
7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDDB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QJUEJ1	Single server queuing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQJQJQ	Fixed quantity economic order quantity model
53	FQEOJSH	As above but with shortages permitted
54	FQEQJQB	As above but with quantity price breaks
55	QJUEJCB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAP1	Cap. Asset Pr. Model analysis of project

59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
68	TIMETR	Time series analysis linear trend
69	TIMEMOV	Time series analysis moving average trend
70	FUPRINF	Future price estimation with inflation
71	MAILPAC	Mailing list system
72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUD	HOME business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
88	ARBCOMP	Arbitrage computations
89	DEPRSF	Sinking fund depreciation
90	UPSZONE	Finds UPS zones from zip code
91	ENVELOPE	Types envelope including return address
92	AUTOEXP	Automobile expense analysis
93	INSFILE	Insurance policy file
94	PAYROLL2	In memory payroll system
95	DILANAL	Dilution analysis
96	LOANAFFD	Loan amount a borrower can afford
97	RENTPRCH	Purchase price for rental property
98	SALELEAS	Sale-leaseback analysis
99	RCONVBD	Investor's rate of return on convertible bond
100	PORTVAL9	Stock market portfolio storage-valuation program

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Listing 2 continued

```

04380 ;FIND ADDRESS OF 8X8 SPRITE IN TABLE
F272 3E03 04390 SPRT8 LD A,SGBA ;LOAD SPRITE PATTERN GEN BAS
E ADDR
F274 CB27 04400 SLA A
F276 CB27 04410 SLA A
F278 CB27 04420 SLA A
F27A 29 04430 ADD HL,HL
F27B 29 04440 ADD HL,HL
F27C 29 04450 ADD HL,HL
F27D B4 04460 OR H
F27E 67 04470 LD H,A
F27F C313F2 04480 JP PATOUT
04490 ;CONVERT AND LOAD PATTERN
;FIND ADDRESS OF 16X16 SPRITE IN TABLE
F282 7D 04500 SPRT16 LD A,L ;LOAD SPRITE NUMBER
F283 E63F 04510 AND 3FH ;LIMIT TO 63
F285 6F 04520 LD L,A ;SAVE SPRITE NUMBER
F286 29 04530 ADD HL,HL ;SHIFT OVER
F287 29 04540 ADD HL,HL ;SHIFT OVER ONCE MORE
F288 C372F2 04550 JP SPRT8 ;FINISH UP IS THE SAME
04560
04570 ;
04580 ;*****
04590 ;
04600 ;USR6 SET COLORS FOR VARIOUS MODES
04610 ;PASS PATTERN # IN USR6 CALL
04620 ;PASS VARPTR TO STRING IN USR3 CALL TEMP
04630 ;
F28B CD7F0A 04640 USER6 CALL 0A7FH ;LOAD HL REGISTER
F28E 3AFDF0 04650 LD A,(MODE) ;GET MODE VALUE
F291 B7 04660 OR A
F292 280C 04670 JR Z,CTEXT ;SET TEXT COLORS
F294 3D 04680 DEC A
F295 2818 04690 JR Z,CMULTI ;SET MULTI COLORS
F297 3D 04700 DEC A
F298 2824 04710 JR Z,CGRP1 ;SET GRP1 COLORS
F29A 3D 04720 DEC A
F29B 2836 04730 JR Z,CGRP2 ;SET GRP2 COLORS
F29D C3CAF0 04740 JP ERROR
04750 ;SET TEXT COLORS
F2A0 23 04760 CTEXT INC HL
F2A1 5E 04770 LD E,(HL) ;LOAD POINTER TO STRING
F2A2 23 04780 INC HL
F2A3 56 04790 LD D,(HL)
F2A4 EB 04800 EX DE,HL
F2A5 CD2FF2 04810 CALL CVERT ;CONVERT ASCII TO HEX
F2A8 3205F1 04820 LD (REG7),A
F2AB CDEEF0 04830 CALL REGLD
F2AE C9 04840 RET
04850 ;SET MULTICOLOR MODE PATTERN COLORS
F2AF 7D 04860 CMULTI LD A,L ;SAVE NAME
F2B0 2600 04870 LD H,PGBA ;LOAD PATTERN GEN BASE ADDR
F2B2 CB3C 04880 SRL H
F2B4 CB1D 04890 RR L
F2B6 B5 04900 OR L
F2B7 6F 04910 LD L,A
F2B8 29 04920 ADD HL,HL
F2B9 29 04930 ADD HL,HL
F2BA 29 04940 ADD HL,HL
F2BB C313F2 04950 JP PATOUT
04960 ;SET COLOR PATTERN FOR GRAPHICS 1 MODE
F2BE 7D 04970 CGRP1 LD A,L
F2BF CB3F 04980 SRL A
F2C1 CB3F 04990 SRL A
F2C3 CB3F 05000 SRL A
F2C5 21FF00 05010 LD HL,CTBA ;LOAD COLOR TABLE BASE ADDR
F2C8 29 05020 ADD HL,HL
F2C9 29 05030 ADD HL,HL
F2CA 29 05040 ADD HL,HL
F2CB 29 05050 ADD HL,HL

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F2CC 29 05060 ADD HL,HL
F2CD 29 05070 ADD HL,HL
F2CE B5 05080 OR L
F2CF 6F 05090 LD L,A
F2D0 C313F2 05100 JP PATOUT
05110 ;SET COLOR PATTERN FOR GRAPHICS 2 MODE
F2D3 3EFF 05120 CGRP2 LD A,CTBA ;LOAD COLOR TABLE BASE ADDR
F2D5 CB3F 05130 SRL A
F2D7 CB3F 05140 SRL A
F2D9 E620 05150 AND 20H
F2DB 29 05160 ADD HL,HL
F2DC 29 05170 ADD HL,HL
F2DD 29 05180 ADD HL,HL
F2DE B4 05190 OR H
F2DF 67 05200 LD H,A
F2E0 C313F2 05210 JP PATOUT
05220 ;
05230 ;*****
05240 ;
05250 ;USR7 SET SPRITE COLOR / NAME
05260 ;PASS SPRITE NUMBER IN USR7 + = COLOR - = NAME
05270 ;PASS VARPTR IN TEMP POINTING TO STRING DEFINING COLOR
05280 ;PASS VARPTR IN TEMP OF SPRITE NAME (PATTERN #)
05290 ;
F2E3 CD7F0A 05300 USER7 CALL 0A7FH ;LOAD VALUE INTO HL
F2E6 7C 05310 LD A,H ;TEST FOR ZERO SPRITE NUMBER
05320 ;
F2E7 B5 05320 OR L
F2E8 CACAF0 05330 JP Z,ERROR
F2EB 7D 05340 LD A,L
F2EC CB74 05350 BIT 6,H ;NEGATIVE?
F2EE 2022 05360 JR NZ,SPRNAM ;JUMP IF NEGATIVE
F2F0 3D 05370 DEC A ;CORRECT OFF BY 1 ERROR IN S
PRITE #
F2F1 CDC9F1 05380 CALL SPRLOC ;FIND LOCATION OF SPRITE ATT
RIBUTE
F2F4 23 05390 INC HL
F2F5 23 05400 INC HL
F2F6 23 05410 INC HL
F2F7 E5 05420 PUSH HL
F2F8 2ADEF1 05430 LD HL,(TEMP) ;CONVERT CHAR TO HEX
F2FB 23 05440 INC HL
F2FC 5E 05450 LD E,(HL) ;LOAD CHAR POINTER
F2FD 23 05460 INC HL
F2FE 56 05470 LD D,(HL)
F2FF EB 05480 EX DE,HL
F300 7E 05490 LD A,(HL) ;GET CHAR
F301 D630 05500 SUB 30H ;ASCII - HEX
F303 FE0A 05510 CP 10D ;CHECK FOR A-F
F305 FA0AF3 05520 JP M,JUMP2 ;GO IF 0-9
F308 D607 05530 SUB 7 ;CONVERT A-F
F30A E60F 05540 JUMP2 AND 0FH ;MASK OFF HIGH BYTES
F30C EF 05550 POP HL ;GET SPRITE COLOR ADDR
F30D 5F 05560 LD E,A ;STORE COLOR
F30E CDAEF3 05570 CALL WRTRAM ;LOAD INTO VRAM
F311 C9 05580 RET
F312 2F 05590 SPRNAM CPL ;CONVERT NEGATIVE NUMBER
F313 CDC9F1 05600 CALL SPRLOC ;FIND LOCATION OF SPRITE ATT
RIBUTE
F316 110200 05610 LD DE,02 ;RELATIVE BYTE OF SPRITE NAM
E
F319 19 05620 ADD HL,DE ;ADD INCREMENT
F31A 3ADEF1 05630 LD A,(TEMP) ;LOAD SPRITE NAME
F31D 3D 05640 DEC A ;CORRECT FOR OFF BY ONE ON S
PRITE PLANES
F31E F5 05650 PUSH AF ;SAVE ON STACK
F31F 3A9FF1 05660 LD A,(SPRTSZ) ;LOAD SPRITE SIZE
F322 FE00 05670 CP 0 ;IS IT AN 8X8*1
F324 CA30F3 05680 JP Z,NSHFT ;IF 8X8 WE DON'T HAVE TO SHI

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Listing 2 continues

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Listing 2 continued

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FT
F327 FE02 05690 CP 2 ;IS IT AN 8X8*2 SPRITE
F329 CA30F3 05700 JP Z,NSHFT ;IF 8X8 WE DON'T HAVE TO SHI
FT
F32C F1 05710 POP AF ;GET SPRITE NAME FROM STACK
F32D 87 05720 ADD A,A
F32E 87 05730 ADD A,A
F32F F5 05740 PUSH AF ;SHIFT TWICE
F330 F1 05750 NSHFT POP AF ;SAVE ON STACK
F331 5F 05760 LD E,A ;GET VALUE FROM STACK
F332 CDAEF3 05770 CALL WRTRAM ;SET UP NAME POINTER
F335 C9 05780 RET ;SEND NAME TO VRAM
;
;*****
05790 ;
05800 ;*****
05810 ;
05820 ;USR8 CLEAR SCREEN / CLEAR SPRITES
05830 ;FILL THE SCREEN WITH PATTERN ZERO / TURN OFF SPRITE PROCESS
ING
;
05840 ;1 = CLEAR SCREEN -1 = CLEAR SPRITES
05850 ;
F336 CD7F0A 05860 USER8 CALL 0A7FH ;LOAD VALUE PASSED FROM BASI
C
F339 CB7C 05870 BIT 7,H ;MINUS?
F33B 280F 05880 JR Z,CLS ;JUMP TO CLS IF +
F33D 0620 05890 CLRSPR LD B,32 ;LOOP COUNTER
F33F 1ED0 05900 LD E,208D ;SPRITE OFF INDICATOR IN VER
TICAL
F341 78 05910 LOOP4 LD A,B
F342 3D 05920 DEC A ;FORM SPRITE NUMBER
F343 CDC9F1 05930 CALL SPRLOC ;FIND SPRITE ATTRIBUTE LOCAT
ION
F346 CDAEF3 05940 CALL WRTRAM ;WRITE VALUE TO VRAM
F349 10F6 05950 DJNZ LOOP4
F34B C9 05960 RET
F34C 260F 05970 CLS LD H,NTBA ;LOAD NAME TABLE BASE ADDRES
S
F34E CB24 05980 SLA H
F350 CB24 05990 SLA H
F352 2E00 06000 LD L,0
F354 1E00 06010 LD E,0
F356 01C003 06020 LD BC,960D ;MAX NUMBER OF CHAR
F359 CDAEF3 06030 CALL WRTRAM
F35C 3E00 06040 CLR LD A,0
F35E D301 06050 OUT (1),A
F360 0B 06060 DEC BC
F361 78 06070 LD A,B
F362 B1 06080 OR C
F363 C25CF3 06090 JP NZ,CLR
F366 210000 06100 LD HL,0 ;RESET CURSOR POINTER
F369 22DEF1 06110 LD (TEMP),HL
F36C C9 06120 RET
;
06130 ;
06140 ;*****
06150 ;
06160 ;USR9 PRINT CHAR AT TEMP LOCATION
06170 ;PASS PATTERN NUMBER IN USR9
06180 ;TEMP HAS THE SCREEN LOCATION AND IS INCREMENTED
06190 ;
F36D CD7F0A 06200 USER9 CALL 0A7FH ;LOAD NAME OF PATTERN
F370 5D 06210 LD E,L ;MOVE NAME
F371 2ADEF1 06220 LD HL,(TEMP) ;LOAD PATTERN POSITION
F374 3E0F 06230 LD A,NTBA ;LOAD NAME TABLE BASE ADDRES
S
F376 CB27 06240 SLA A
F378 CB27 06250 SLA A
F37A B4 06260 OR H
F37B 67 06270 LD H,A
F37C CDAEF3 06280 CALL WRTRAM ;LOAD PATTERN NAME INTO VRAM
;
F37F 2ADEF1 06290 LD HL,(TEMP)
F382 23 06300 INC HL
F383 E5 06310 PUSH HL
F384 3AFDF0 06320 LD A,(MODE) ;GET MODE OF OPERATION
F387 E7 06330 OR A ;SET FLAGS
F388 2005 06340 JR NZ,NTEXT ;JUMP IF NOT TEXT MODE
F38A 1140FC 06350 LD DE,-960 ;NUMBER OF TEXT CHAR
F38D 1803 06360 JR WRAP ;WRAP AROUND FROM END OF SCR
EEN
F38F 1100FD 06370 NTEXT LD DE,-768D ;NONTEXT PATTERNS
F392 19 06380 WRAP ADD HL,DE
F393 7C 06390 LD A,H
F394 B5 06400 OR L
F395 E1 06410 POP HL
F396 2003 06420 JR NZ,NZERO
F398 210000 06430 LD HL,0
F39B 22DEF1 06440 NZERO LD (TEMP),HL
F39E C9 06450 RET
;
06460 ;
06470 ;*****
06480 ;
06490 ;OUTPUT ADR FOR VDP MEM READ OR WRITE
06500 ;BC = ADDRESS
F39F 7D 06510 OUTADR LD A,L ;LOAD LOW BYTE OF ADDRESS
F3A0 D302 06520 OUT (2),A ;SEND TO VDP
F3A2 7C 06530 LD A,H ;LOAD HIGH BYTE OF ADDRESS
F3A3 D302 06540 OUT (2),A ;SEND TO VDP
F3A5 C9 06550 RET
;
06560 ;
06570 ;WRITE VALUE TO VDP REGISTER
06580 ;
06590 ; C= REG# A = VALUE
F3A6 D302 06600 WRTRAM OUT (2),A ;SEND TO VDP THE VALUE
F3A8 79 06610 LD A,C ;GET THE REGISTER NUMBER
F3A9 F680 06620 OR 128D
F3AB D302 06630 OUT (2),A ;SEND TO VDP THE REGISTER #
F3AD C9 06640 RET
;
06650 ;
06660 ;WRITE TO VRAM
06670 ;HL= ADDRESS E = VALUE
F3AE 7C 06680 WRTRAM LD A,H
F3AF F640 06690 OR 64D
F3B1 67 06700 LD H,A
F3B2 CD9FF3 06710 CALL OUTADR
F3B5 7B 06720 LD A,E
F3B6 D301 06730 OUT (1),A
F3B8 C9 06740 RET
;
06750 ;
06760 ;READ VDP STATUS REG
06770 ;RETURN VALUE IN A REG
F3B9 DB02 06780 RDREG IN A,(2)
F3BB C9 06790 RET
;
06800 ;
06810 ;READ VDP RAM
06820 ;HL = ADDRESS RETURN VALUE IN A REGISTER
06830 ;
F3BC CD9FF3 06840 RDRAM CALL OUTADR
F3BF 3AC8F3 06850 LD A,(MICRO8)
F3C2 CDC9F3 06860 CALL DELAY
F3C5 DB01 06870 IN A,(1)
F3C7 C9 06880 RET
F3C8 01 06890 MICRO8 DEFB ID ;DELAY VALUE
;
06900 ;
06910 ;DELAY LOOP. 8 MICRO SEC FOR TRS-80 X2
06920 ;
F3C9 47 06930 DELAY LD B,A
F3CA E5 06940 PUSH HL
F3CB E1 06950 POP HL
F3CC 10FC 06960 DJNZ DELAY+1
F3CE C9 06970 RET
06980 ;*****
F000 06990 END USR0
00000 TOTAL ERRORS

```

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Buyer's Guide to Utilities

Utilities are a programmer's best friend. They can recover blown disks, make coding your program simpler, build versatility into a program, let you review and alter disk and tape files, and even let you improve your program's appearance.

Many different types of utilities exist

and each type has its own options. This buyer's guide will help you determine which utilities you need and suggests some options you might find handy.

Assemblers

An assembler is an indispensable utility for the machine-code programmer.

Programs written in machine code have to incorporate operation codes (op-codes), commands written in machine language. In a machine-language program listing, these commands are represented by a number.

For instance, to load the stack pointer register with the number 7000 hex,

Assemblers									
Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk	DOS(es) Supported	Separate Documentation	Back-up Possible	
Computer Applications	T-ZAL	\$49.95	III	16K	C	All	Y	Y	
Z500 A-D Software	Zilog Z-80 Reloading MACASM	\$49.95	II	64K	D	CP/M	Y	Y	
Program Innovations	Macro Assembler	\$74.95	II	64K	D	T	Y	Y	

Disassemblers									
Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk	DOS(es) Supported	Separate Documentation	Back-up Possible	
Instant Software	The Disassembler	\$14.95	I/III	16K	C	—	Y	Y	
Instant Software	DLDIS	\$24.95	I	32K	D	DP, T	Y	Y	
Instant Software	TLDIS	\$19.95	I/III	16K	C	DP, T	Y	Y	
MISOSYS	DSMBLR II	\$20.00	I/III	16K	D	L, T	Y	Y	
MISOSYS	DSMBLR III	\$40.00	I/III	48K	D	L5.1, L6.0	Y	Y	
PRO/AM Software	DISnDATa	\$24.95 \$29.95	I/III III	16K	C D	T	Y	Y	

C = Cassette
D = Disk
CP/M = Control Program for Microprocessors
DP = DOSPLUS

L = LDOS
N = NEWDOS
T = TRSDOS
Y = Yes

your program would stipulate the Z80 hexadecimal opcode for this procedure, 31. But you also have to indicate the address location with the opcode, here 7000 hex. The Z80 microprocessor requires that addresses be back-to-front. So, the machine code would appear in the program like this: 31 00 70. For a single command, this is a fairly simple procedure. But when you write a program with hundreds of commands, imagine the chance for error. A misplaced number here, an inadvertent deletion there—it could turn into a tortuous experience.

This is where an assembler comes in handy. Assemblers let you specify a mnemonic command followed by the address. For example, LD SP,7000H loads the stack pointer with 7000 hex. The assembler takes this code (known as the source program) and assembles it into the appropriate machine code (the object program), now ready for the microprocessor. The object code is stored

either in dynamic memory or on disk.

Assemblers perform other important functions. For one thing, they keep track of jumps in machine code. Say you hand-assembled a program with a command to jump to an opcode 10 bytes ahead. If you insert any code between the jump instruction and the jump destination, the microprocessor must take into account the inserted bytes to produce the appropriate jump. The assembler does this with labels. Signal the assembler that you want to jump to a specific, labeled opcode and the assembler inserts the correct number of bytes to do so.

Some assemblers, called conditional assemblers, let you skip over part of your source code under certain conditions. This is also done with labels, labels that stop the assembler's translation of the source code to object code for specified program lines.

To do this, set a label to a value somewhere in your source code. Then have

the assembler test that label and either produce machine code from the source code or ignore the source code. This feature lets you produce two or more versions of the same machine-code program without having to write more than one source code.

Another type of assembler, called a macro assembler, lets you use macro instructions, sets of machine-code instructions defined within the body of the source program. Assign a name to a given set of frequently used instructions. Every time you want to use those instructions, call them by their assigned name. Coupled with conditional assembly, macro assembly gives your program powerful versatility.

Disassemblers

As their name suggests, disassemblers do the opposite of assemblers. Where an assembler turns mnemonic opcodes into hexadecimal object code, a disassembler translates the object code into mnemonic text. The resultant text can even contain labels automatically generated by the disassembler so that you can reassemble at any time.

A disassembler makes machine code easier to follow and understand. You can also disassemble a machine-code routine and alter it according to your needs. For instance, you may want to upgrade a program from tape to disk operation. With a disassembler, you could go into the program and change all the I/O routines from tape to disk.

Disk Zappers

These are a requirement for disk users. Disk zappers make most blown disks usable (though some disks may be destroyed beyond repair). In instances where a disk file is intact but cannot be accessed for some reason, a disk zapper recovers the disk.

Blown disks result from a number of causes. Dust, smoke particles, hair and other foreign matter can collect on the disk and prevent a blemish-free write. Unless you have automatic write-verification, you won't know there's a problem until you try to read the disk. A disk zap finds the bad sector and allows you to write over it with dummy information so the program loads. Although the program then has some garbage in it, it is easier to replace the garbage than have to rewrite the entire program.

Another common disk problem is power surges that occur during write operations, erasing part of a disk track. Since the sector no longer exists, it can't be repaired. You could use the disk by reformatting it, but that would mean

	Warranty Information	Supports Macros	Conditional Assembly	Machine-Language Monitor	Object Code to RAM	Description
R	N	N	N	Y		Creates relocatable system tapes.
NA	Y	Y	N	Y		Includes Intel 8080 to Zilog Z80 source code converter and linker.
R	Y	Y	N	Y		Requires EDTASM.

	Warranty Information	Relocatable Labels	Output to Cassette, Disk, Printer or Screen	R/S Source Code Output	Description
R	Y	N	C, P, S	Y	
R	Y	Y	C, P, S	Y	Triple pass.
R	Y	Y	C, P, S	Y	Triple pass.
R	N	Y	C, D, P, S	N	Compatible with EDAS, M-80, Aparat, EDTASM+, MZAL, but not Series I.
R	N	Y	D, P, S	N	EDAS+ compatible; disassembles directly from disk.
NA	Y	Y	C, D, P, S	Y	Supports Radio Shack Series I and Aparat formats.

N = No
 R = Replace Defective Media
 M = Money-back guarantee
 NA = Not available

erasing every track and sector on the disk. Fortunately, utilities exist that reformat the disk without affecting recoverable data.

Perhaps the most common problem is accidentally killing files. This happens so frequently that some disk zappers do nothing but find the dead file directory

entry and restore it. This is done by altering a single bit on the disk utility and then restoring its entry in the directory hash index table (HIT). On many operating systems, the file itself remains intact after being killed, with only the directory entry being amended. Some disk zapper utilities provide the option

of completely restoring old files.

Editors

Text editors are used to enter and manipulate text files from the keyboard. They are basically stripped-down word processors. The best reason to use a text editor is that many com-

Disk Zappers								
Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk	DOS(es) Supported	Separate Documentation	Back-up Possible
Instant Software	Disk Editor	\$ 39.95	I	32K	D	D,T	Y	Y
PowerSoft	The Master Mechanic Set	\$ 39.95	I/III/MAX-80	32K	D	L	Y	Y
PowerSoft	The Toolbox	\$ 69.95	I/III/MAX-80	32K	D	L	Y	Y
RACET Computes	Superzap for CP/M	\$100.00	II/12/16	32K	D	CP/M 2.2 +	Y	Y
RACET Computes	Superzap 4.X	\$100.00	II/12/16	64K	D	T	Y	Y
RACET Computes	Utility Package	\$150.00	II/12/16	64K	D	T2.0	Y	Y

Editors								
Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk			
Alternate Source	KBE	\$ 39.95	I/III	32K	D			
Alternate Source	EDM	\$149.00	I/III	48K	D			
Computer Applications	XBE	\$ 29.95 \$ 34.95	I/III	16K	C D			

Editor/Assemblers								
Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk	DOS(es) Supported		
Computer Applications	M-ZAL	\$149.00	I/III	32K	D	All		
Instant Software	Assem/ZSIM	\$119.97	I	32K	D	DP, N, N80, T		
MISOSYS	EDAS-IV	\$100.00	I/III/IV	48K	D	L5.1, L6.0		
Mumford Micro Systems	Instant Assembler	\$ 39.95 \$ 49.95	I/III	16K	C D	All		
RACET Computes	Extended Development Package	\$125.00	II/12/16	64K	D	T2.0		

C = Cassette
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puter languages process their source input (the program to be compiled or assembled) from a file which has to be typed in initially. Text editors are an integral part of many language-development systems and the primary method of preparing input files. Like a word processor, a good editor moves, changes,

deletes, substitutes text and so on, and then saves it to a file for subsequent input to another program.

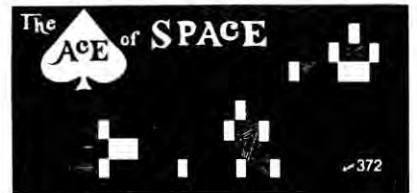
Screen editors are utilities offering distinct advantages over the line-editing process known to TRS-80 users. They allow cursor movement across the video screen without destroying any of the

Warranty Information	Modify by Track	Modify by File	Modify by Sector	Description
R	Y	Y	Y	Prints display, string search. ASCII or hex display.
R	Y	Y	Y	The best of the Toolbox (see below). Contains 10 machine-language programs.
R	Y	Y	Y	Contains many Super Utility Plus utilities, but Toolbox is unprotected and compatible with any floppy or hard drive.
M	Y	Y	Y	
M	Y	Y	Y	
M	Y	N	Y	Recovers blown disks.

DOS(es) Supported	Separate Documentation	Back-up Possible	Warranty Information	Full Cursor Control	Block Functions	Global Commands	Macro Keys	Search and Replace
All	Y	Y	M	Y	N	N	Y	N
All	Y	Y	M	Y	Y	Y	Y	Y
All	Y	Y	R	Y	Y	Y	Y	Y

Separate Documentation	Back-up Possible	Warranty Information	Supports Macros	Conditional Assembly	Renumberer	Search and Replace	Load RIS Source Code	Set Breakpoints
Y	Y	R	Y	Y	Y	Y	Y	N
Y	Y	R	N	Y	Y	Y	Y	Y
Y	Y	R	Y	Y	Y	Y	Y	N
Y	Y	M, R	N	N	N	N	Y	Y
Y	Y	M	Y	Y	Y	Y	Y	Y

N = No
 R = Replace Defective Media
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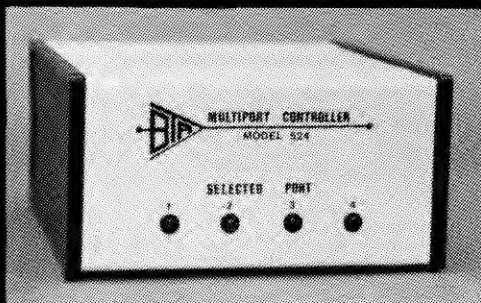
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text the cursor passes over. Characters may be inserted, deleted or otherwise moved, and the altered line may be entered as if it were typed at an input prompt. Thus if you type a Print command with a misspelled file name, you would move the cursor to the error, cor-

rect the typo using the screen editor, and hit the enter key—much simpler than retyping the whole line and risking a new error. Screen editors can also provide options like direct entry of graphics characters or other characters not normally available from the keyboard.

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Monitors

Monitors can be simple or sophisticated. They provide an interface between a machine-code program and the programmer. Unlike a Basic program (or any other interpreted language), a machine-code program executes directly on the microprocessor chip. Some method has to be found to prevent a program still in the evolution stages from crashing the system without leav-

“Monitors interface the machine-code program and the programmer.”

ing a trace as to why. This is where the monitor program is a lifesaver.

Probably the most important function of a monitor is allowing the insertion of breakpoints within the code. Whenever such a breakpoint is encountered, the monitor regains control from the program being debugged. At this point you can check the status of registers in the microprocessor or bytes in RAM to ascertain whether your program is functioning as it should. The monitor allows subsequent resumption of the target program, ensuring that all registers are in the state they held at the time of the breakpoint.

All monitors permit displays or print-

outs in various formats, including hexadecimal, octal, decimal, ASCII, or symbolic (where symbols are displayed instead of values). These symbols are the mnemonics referred to in disassemblers. Some monitors offer a disassembler as an option. The data displayed or printed can be altered from the monitor and might affect the results of any resumed execution of the main program.

Another monitor option is single-stepped code, which allows execution of one opcode at a time. On many computers this is a hardware option, but it is not available on micros due to chip architecture.

Sorts are an invaluable feature of monitor utilities that save you from rewriting your own sort routine every time you need to rearrange data in a program. Many different sorting methods exist, each with their own selling point. Trade-offs are usually involved; one method may be quicker but take more space, another may use a small amount of RAM but take longer to sort.

Sorts operate on data already in RAM or on a disk file. Generally, if a file fits into memory, it's quicker to sort it there, losing no time transferring data back and forth between disks. If a file is too large for memory, a disk sort has to be performed, an occasion when a well-written, efficient sort routine is required to minimize the input/output overhead.

Depending on program design, a

good sort utility allows you to specify how your records are broken into fields. Once this is done, you designate by which field you want to sort. This field is known as the key field and might be a city field within an address data base.

Some sorts let you specify more than one key field, allowing sorting within sorting. A file containing the companies arranged by city would also arrange the companies alphabetically within those cities.

It's sometimes necessary to join two files and ascertain that the resultant file is in some kind of order. This calls for a special utility called sort-merge. There is a conspicuous absence of this type of utility for the TRS-80 user.

Monitors									
<i>Company Name</i>	<i>Product Name</i>	<i>Price</i>	<i>For Model(s)</i>	<i>Minimum RAM</i>	<i>Cassette or Disk</i>	<i>DOS(es) Supported</i>	<i>Separate Documentation</i>	<i>Back-up Possible</i>	
Computer Applications	XBug	\$ 19.95	I/III	16K	C	All	Y	Y	
Howe Software	Monitor #3	\$ 39.95	I/III	16K	C	All	Y	Y	
Howe Software	Monitor #4	\$ 49.95	I/III	16K	D	All	Y	Y	
Howe Software	Monitor #5	\$ 59.95	I/III	16K	D	All	Y	Y	
Instant Software	ZSIM	\$ 29.95	I	16K	C	DP, N, T	Y	Y	
Mumford Micro Systems	Demon	\$ 29.95	I/III	16K	C, D	All	Y	Y	

Tape Utilities									
<i>Company Name</i>	<i>Product Name</i>	<i>Price</i>	<i>For Model(s)</i>	<i>Minimum RAM</i>	<i>Cassette or Disk</i>	<i>DOS(es) Supported</i>	<i>Separate Documentation</i>	<i>Back-up Possible</i>	
Kensoft	Leader Lapper	\$10.95	I	16K	C	—	Y	Y	
Modtec	Copy-Tape	\$11.95	I/III	16K	C	—	Y	Y	
Mumford Micro Systems	Clone	\$16.95 \$21.95	I/III	16K	C D	All	Y	Y	
Mumford Micro Systems	RESQ2	\$19.95	I/III	16K	C	—	Y	Y	

Disk Utilities									
<i>Company Name</i>	<i>Product Name</i>	<i>Price</i>	<i>For Model(s)</i>	<i>Minimum RAM</i>	<i>Cassette or Disk</i>	<i>DOS(es) Supported</i>			
Power Soft	Super Utility Plus 3.0	\$79.95	I/III	48K	D	All			
Pro-80 Systems	Procopy	\$50.00	II/12/16	64K	D	T			
ProSoft	RPM	\$24.95	I/III	32K	D	All			
RACET Computes	FASTBACK	\$75.00	II/12/16	64K	D	T			
RACET Computes	2.0 Speed-Up Kit	\$99.95	II/12/16	64K	D	T			

C = Cassette
D = Disk
CP/M = Control Program for Microprocessors
DP = DOSPLUS

L = LDOS
N = NEWDOS
T = TRSDOS
Y = Yes

Tape and Disk Utilities

Tape and disk utilities fall into two types: those that copy tapes and disks from one tape or disk to another, and those that dump tapes and disks in readable format so the user may view their

contents.

On many computers, tape and data files are structured in individual blocks that can be read in one at a time and output the same way. Although this is

Continues on p. 144

Warranty Information	Disassembler	RAM Editor	Single Step	Relocatable	Set Breakpoints in RAM	Set Breakpoints in ROM	Description
R	N	Y	Y	Y	Y	N	
R	Y	Y	N	Y	N	N	
R	Y	Y	N	Y	N	N	Includes disk zipper.
R	Y	Y	Y	Y	Y	N	Includes disk zipper.
R							
M, R	Y	Y	Y	Y	Y	Y	

Warranty Information	Description
R	Increases cassette I/O by up to 80% without requiring program or file changes.
R	Duplicates Basic, machine-language, and data tapes.
R, M	Duplicates tapes, changes baud rate of Model III tapes.
R, M	A tape zipper. Restores crashed tape programs, including system, data and Basic tapes.

Separate Documentation	Back-up Possible	Warranty Information	Description
Y	N	R	Back-up copy included. Disk zipper included.
Y	Y	R	Disk back-up copies.
Y	Y	R	Measures rotation speed and fluctuations of disk drives.
Y	Y	M	High-speed.
Y	Y	M	Eliminates diagnostics and date and time entry to speed boot-up.

N = No
 R = Replace Defective Media
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 NA = Not available

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File Utilities

Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk	DOS(es) Supported
Custom Software Services	Disk Status Utility	\$ 50.00	II/12/16	32K	D	T2.0
Custom Software Services	Programmable Menu	\$ 50.00	II/12/16	32K	D	T2.0
Data Associates	Compare	\$ 24.95	I/III	32K	C, D	T
Data Associates	Copyfile	\$ 24.95	I/III	32K	C, D	T
Instant Software	Basic Programming Assistant	\$ 19.95	I	16K	C	DP, N, T
Instant Software	Disk Scope	\$ 24.95	I	32K	D	DP, N, T
International Computer Products	Disk-Menu and Directory	\$ 29.95	I/III	32K	D	All
MicroTech Exports	Reformatter TRSDOS-CP/M	\$249.00	II/16	64K	D	T
MicroTech Exports	Reformatter CP/M-IBM	\$249.00	II	32K	D	CP/M
MicroTech Exports	Reformatter TRSDOS-DEC	\$249.00	II/16	64K	D	T
MISOSYS	PDS	\$ 40.00	I/III/IV	48K	D	L5.1, L6.0
RACET Computes	BLINK	\$ 30.00	I/II/III/12/16	32K	D	T
RACET Computes	DISCAT	\$ 50.00	I/III	32K	D	N+, N80
RACET Computes	Disk Sort Merge	\$ 90.00	I/II/III/12/16	32K	D	DP, N80, T
RACET Computes	6SF	\$ 30.00	I/II/III/12/16	16K	C, D	T
RACET Computes	KFS-80	\$100.00	I/II/III/12/16	32K	D	T
RACET Computes	XREF	\$ 50.00	II/12/16	64K	D	T2.0
Stewart Software	MCOPY	\$ 20.00	III	32K	D	T1.3
Vinzant & Assoc.	The Manipulator	\$ 29.95	I/III	48K	D	L, T

Compressors/Renumberers

Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk	DOS(es) Supported
Custom Software Services	Basic Program Packer	\$50.00	II/12/16	64K	D	T 2.0
Data Associates	Pack	\$24.95	I/III	32K	D	T
PROSOFT	Faster	\$29.95	I/III	16K	C, D	All
PROSOFT	Quick Compress	\$19.95	I/III	16K	C, D	All
PROSOFT	Trashman	\$39.95	I/III	32K	D	All
RACET Computes	Remodel and Proload	\$35.00 \$40.00	I/III	16K	C D	T

C = Cassette
D = Disk
CP/M = Control Program for Microprocessors

DP = DOSPLUS
L = LDOS
N = NEWDOS

Separate Documentation	Back-up Possible	Warranty Information	Description
Y	Y	R	Checks all drives; displays disk name, type, and free space.
Y	Y	M,R	Programmable menu system, chains to sub-menus.
Y	Y	R (C only)	Compares differences between two disk-based Basic programs.
Y	Y	R (C only)	Copies programs between disks, copies copy-protected programs on Model III disks.
Y	Y	R, C	Lists variables and GOTO, GOSUB, and IF... THEN commands. References by Basic keywords.
Y	Y	R, C	Computes file password, gives file locations, zaps disk by file.
Y	Y	S	Displays detailed description of each disk program, gives file specs.
Y	Y	R	Reads and writes CP/M single-density disks. Runs in 8-bit mode.
Y	Y	R	Lets CP/M users read and write IBM single-density disks on Model IIs with CP/M.
Y	Y	R	Lets TRSDOS users read and write DEC RT-11 disks on Model II/16s. Runs in 8-bit mode.
Y	Y	R	Provides partitioned data sets of executable programs, limited data member access.
Y	Y	M	Has Basic Linker program, retains all variables and files.
Y	Y	M	Keeps track of thousands of programs in a categorized library.
Y	Y	M	A multi-volume, multi-file disk sort merge.
Y	Y	M	High-speed machine-language sorts, memory moves, and data manipulation.
Y	Y	M	B-TREE ISAM utility. Handles up to 16.7 megabytes of data.
Y	Y	M	Basic cross references.
Y	Y	R	File copy utility.
Y	Y	R	Converts sequential files to random and vice versa, sort files, add/remove fields, change record length.

Separate Documentation	Back-up Possible	Warranty Information	Renumberer	Remove Blanks and Remarks	Produce Multi-Line Statements	Unpack	Duplicate Line Groups	Move Line Blocks
Y	Y	R	Y	Y	N	N	NA	NA
Y	Y	R	NA	Y	N	N	NA	NA
Y	Y	R	NA	NA	NA	NA		
Y	Y	R	NA	Y	N	N	NA	NA
Y	Y	R						
Y	Y	M	Y	NA	NA	NA	Y	Y

T = TRSDOS
Y = Yes
N = No

R = Replace Defective Media
M = Money-back guarantee
NA = Not available

General Utilities

Company Name	Product Name	Price	For Model(s)	Minimum RAM	Cassette or Disk	DOS(es) Supported	Separate Documentation	Back-up Possible
Absecon Software	Cobol Utility Program	\$ 34.95	II/III	48K	D T		Y	Y
Absecon Software	Cobol Utility Program II	\$ 49.95	II/III	48K	D T		Y	Y
Bulldog Software	ULTPLS	\$ 10.95	I	16K	C —		Y	NA
Data Associates	Pager	\$ 24.95	I/III	32K	D T		Y	Y
Data Associates	Rebackup	\$ 24.95	III	32K	D T		Y	Y
Data Associates	Toolset 1	\$ 89.95	III	32K	D T		Y	Y
Data Associates	Unlist	\$ 24.95	I/III	32K	D T		Y	Y
Allen Gelder Software	EDIT	\$ 40.00	I/III	16K	C, D All		Y	Y
HPB Vector Co.	Copy-Not 1.2	\$325.00	I/III	48K	D T		Y	N
Instant Software	Disk-Tape Exchanger	\$ 24.95	I	32K	D NA		Y	Y
Instant Software	TRS-80 Tests	\$ 14.95	I	16K	C NA		Y	Y
The Management	Locker	\$ 24.95	II/12/16	64K	D T2.0, T4.1, T4.2		Y	Y
MISOSYS	CON80Z	\$ 40.00	I/III/MAX-80	48K	D L5.1		Y	Y
MISOSYS	CONVCPM	\$ 40.00	I/III/MAX-80	48K	D L5.1		Y	Y
MISOSYS	SOLE	\$ 25.00	I	48K	D L5.0, L5.1		Y	Y
MISOSYS	ZSHELL	\$ 40.00	I/III	48K	D L5.1		Y	Y
Modular Software Assoc.	NEWBASIC 2.0	\$ 39.95	I/III	48K	D D, L, N, T		Y	Y
MTS Inc.	FORMAT/80	\$ 18.95	I	32K	D N, N80, T		Y	Y
PowerSoft	MAKE/80	\$ 19.95	I/III	32K	D NA		Y	N
RACET Computes	COMPROC	\$ 30.00 \$ 35.00	I/III	32K	C D T		Y	Y
RACET Computes	Utility Package	\$150.00	II	NA	D NA		Y	Y
David Ray, CPA	Fortran 510	\$120.00	II/12/16	64K	D T2.0, T4.1		Y	Y
David Ray, CPA	Fortran Utilities	\$ 70.00	II/12/16	64K	D T2.0, T4.1		Y	Y
David Ray, CPA	RS Cobol Utilities	\$120.00	II/12/16	64K	D T2.0, T4.1		Y	Y
Softshell	MAP	\$125.00	II/III	32K	D NA		Y	Y
Softshell	MINIMAP	\$ 25.00	II/III	32K	D NA		Y	Y
Tremont Associates	PRTPRO	\$ 35.00	II/12/16	64K	D T		Y	Y
Vinzant & Assoc.	LDOS Help Command	\$ 19.95	I/III	16K	D L		Y	Y

C = Cassette
D = Disk
CP/M = Control Program for Microprocessors
DP = DOSPLUS

L = LDOS
N = NEWDOS
T = TRSDOS
Y = Yes

Warranty Information	Description
NA	Transfers Cobol source programs from the Model II to the Model III.
NA	Transfers Cobol source programs from the Model III to the Model II.
R	Basic editor with monitor.
R (C only)	Gives paged listings of Basic programs from disk.
R (C only)	Makes unlimited copies of Scripsit and VisiCalc.
R	A collection of utilities permitting paged listings, program packing, program comparisons, and copying protected programs.
R (C only)	Modifies Basic programs from disk to make listing difficult.
R	Basic editor; full cursor control, block functions, global command, search and replace.
R	Protects Basic programs from copying; cannot be unlocked with pirating software. One back-up free with registration.
R	Transfers machine-language tape programs to disk and vice versa.
R	Tests Level II ROMs and RAMs for bad bits; tests keyboard for dirty keys; tests data and address lines.
NA	Protects Basic programs from LIST and LLIST by unauthorized users.
R	Converts 8080 mnemonic assembler source files to Z80.
R	Transfers files from selected CP/M media to LDOS.
R	Lets you boot a double-density LDOS system disk.
R	Provides UNIX-like shell facilities for LDOS.
R	Enhances Disk Basic with selectable commands.
R	Single-track formatting program.
NA	Makes a 35/40-track disk bootable in an 80-track drive.
M	Facilitates automatic command/data entry from a predefined process list file from a Basic disk.
M	Copies files, reads and modifies sectors, analyzes the Hash Index Table and Gran Allocation Table plus other features.
R	Fortran callable subroutines providing access to Model II/12/16 serial channels for I/O.
R	Provides Fortran direct-cursor addressing capability.
R	Utility subroutines callable from Cobol provide enhanced disk, printer, and screen capabilities.
R	Information storage and retrieval system for unstructured data.
R	Information storage and retrieval system for unstructured data.
M	Reduces development time for Cobol programs.
R	Adds Help command to LDOS-513.

N = No
R = Replace Defective Media
M = Money-back guarantee
NA = Not available

true of data files in the Models I and III, it's not true of Basic or machine-code programs, and specialized utilities are required to copy system tapes and disks.

The block format found in other computers allows single blocks to be read and the tape stopped between each to allow that block to be copied to another tape. This isn't possible with the TRS-80 program tapes; information would be lost as there are no inter-block gaps. Basic data tapes are saved a block at a time, however. Disks can be copied in their entirety with one command, or one file at a time.

Some tape and disk utilities let you view the stored data so its layout can be seen encoded. This is especially useful when debugging a piece of software that outputs a tape or data file, since a bug can intervene and cause output to be different than anticipated. A few copy utilities also allow the tape data to be viewed; this allows you to change portions of the data before dumping a new version.

File Utilities

Some file utilities work like tape and disk utilities on a smaller scale, copying individual files between disks rather than the entire contents of a disk. Some read and write files between different formats, such as TRSDOS and IBM, and some merge several files (like chapters of a book) into one.

Others concern themselves with examining and manipulating the contents of a file. These usually give more detailed information—such as an expanded menu or catalog of the disk's contents—than the utilities provided with an operating system. Finally, some imitate the editing features of a DBMS, letting you sort, add, or remove fields.

Compressors/ReNUMBERERS

Compressors simply remove blanks from your program so that it compiles faster and therefore reduces processing time. Say you write a string array that uses only 56 of the 256 bytes available per Basic line. A compressor utility directs the processor over the 200 blanks and brings it to the next data line.

ReNUMBERERS should be the last utility you use in developing a program. ReNUMBERER utilities reNUMBER the lines in a program. Instead of increments of 10 between lines, say, you might want increments of 20. Larger increments allow you to insert lines to enhance the program or install other features. A tested and neatly reNUMBERED program listing is aesthetically pleasing. ■

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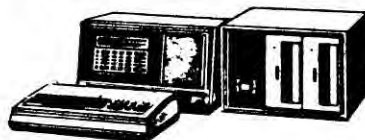
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- Full function keyboard
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DOSPLUS II

by Art Huston

Need a snazzy new operating system for your Model II, 12, or 16? DOSPLUS II and the Z80 give TRSDOS and CP/M a run for their money.

★★★★ ½

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 Model II, 12, 16
 \$249.95

DOSPLUS II is a Model II/12/16 operating system from Micro-Systems Software and Powersoft. It runs in the Z80 mode (not the 68000), but for these

applications it sets a new standard in power and ease of use. TRSDOS and CP/M, move over.

The operating system is a joint collaboration of the Model I/III DOSPLUS programmers and Kim Watt (of Super Utility fame), so you know the bloodlines are good. Their stated goal was to create a powerful, easy-to-use, device-independent system with little or no sacrifice in speed. For the most part they have succeeded admirably. Along the way they added such goodies as hard disk support and an extra 4K of memory.

This review will give you an idea of how DOSPLUS II differs from TRSDOS; it does not document the entire

operating system. If you don't see a TRSDOS feature mentioned, don't assume that DOSPLUS II doesn't have it. It also points out command differences between the two that may give you trouble.

Model I/III programmers take note: By the time you read this, DOSPLUS 3.5 will be on the market. The prerelease versions we've seen at *80 Micro* are very similar to DOSPLUS II.

Getting Started

When I buy a complex operating system, I want to feel that no expense has been spared to document it. DOSPLUS II gives me this feeling. It comes in an attractive simulated-leather binder with five colored dividers for quick access to the major sections of the manual. The print is tack sharp. The manual leads you through the preliminary process of booting the disk and immediately making a backup.

The time and date commands are bypassed by pressing enter. I have some qualms with this, feeling that a business system should always maintain the date. What are nice, however, are the various ways in which you can enter these items. DOSPLUS II recognizes many different delimiters. You can correctly enter the date in the following ways and more: 6:27:83, 06:27:83, 06:27:1983, 6-27-83, 6 27 83 and 6.27.83. This versatility is evident in most of the commands.

The DEMO/TXT file runs the first time you boot the system. It leads you through the highlights of operation, while showing you examples of command syntax along the way.

The manual, however, states that at first boot-up you go into the DOS command mode. At this point Model 12 and 16 owners must type MOD16 to configure the drives. Failure to do so before the drive light goes out generates an error message and the disk is unreadable until the next reset. It is a simple process

Device #	Device	Default Name	Class
0	Keyboard	KI	Input
1	Display	DO	Output
2	Printer	PR	Output
3	Serial Port A	CA	Input or Output
4	Serial Port B	CB	Input or Output
5	User-defined	U1	User-defined
6	User-defined	U2	User-defined
7	User-defined	U3	User-defined
8	First Drive	0	Input or Output
9	Second Drive	1	Input or Output
10	Third Drive	2	Input or Output
11	Fourth Drive	3	Input or Output
12	Fifth Drive	4	Input or Output
13	Sixth Drive	5	Input or Output
14	Seventh Drive	6	Input or Output
15	Eighth Drive	7	Input or Output

Table 1. List of Device Specs

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6. ZBASIC 2.2 compiles the ENTIRE PROGRAM into Z-80 machine language. (Not 8080 code or a combination of BASIC and machine language like some other compilers.) Clumsy LINKING LOADERS, and RUNTIME MODULES are not needed; ZBASIC 2.2 creates a ready to run MACHINE LANGUAGE program.
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12. BUILT-IN and much improved MUSIC and SOUND EFFECTS commands.
13. Improved CHAINING for disk users.
14. TIME\$ now available on DISK version. (Mod I only)
15. ZBASIC 2.2 now has an INPUT @ command (similar to PRINT @).
16. The TAB function will now tab 255 columns on a printer. (BASIC cannot tab past column 64.)
17. NEWDOS 80 2.0 USERS can use the CMD "dos command" function! (DOSPLUS may use name "dos command")
18. NEW and EASIER to use USER COMMANDS.
19. New math functions to calculate XOR and INTEGER REMAINDERS of a DIVISION.
20. Logical STRING COMPARISONS are now supported.
21. The disk commands INSTR, MID\$, ASSIGNMENT are now supported on both DISK AND TAPE ZBASIC.
22. DEFSTR is now supported.
23. Eight disk files may be opened simultaneously; random, sequential or mixed.
24. LINE INPUT#, is now supported.
25. Invoke the compiler by simply hitting these two keys: "; -"
26. NEW 60+ PAGE MANUAL WITH DESCRIPTIONS AND EXAMPLE.
27. ZBASIC 2.2 Comes with CMDFILE/CMD program from MISOSYS, to allow appending or merging compiled programs and machine language programs from tape or disk.

ZBASIC 2.2 DOES NOT SUPPORT THESE BASIC COMMANDS:

1. ATN, EXP, COS, SIN, LOG, TAN, and exponentiation. (However, subroutines are included in the manual for these functions.)
2. ERROR, ON ERROR GOTO, ERL, ERR RESUME.
3. No direct commands like AUTO, EDIT, LIST, LLIST ETC, although these commands may be used when writing programs.
4. Others NOT supported: CDBL, CINT, CSNG, DEFFN, FIX, FRE.
5. Normal CASSETTE I/O. (ZBASIC supports it's own SPECIAL CASSETTE I/O statements.)
6. SOME BASIC COMMANDS MAY DIFFER IN ZBASIC. For instance, END jumps to DOS READY, STOP jumps to BASIC READY etc.
7. MEMORY REQUIREMENTS: to approximate the largest BASIC program that can be compiled in your machine (at one time), enter BASIC and type: PRINT (MEM-6500)/2. Remember, you can merge compiled programs together to fill memory.

ZBASIC 2.2 SPEED COMPARISON DEMO

To help give you an idea how fast compiled programs are, we have included this demo program:

ZBASIC 2.2 DEMO PROGRAM

Time to compile and run complete program	: 0 MIN. 2 SEC.
BASIC Execution speed MOD 1, LEVEL II	: 7 MIN. 34 SEC.
ZBASIC Execution speed MOD 1, LEVEL II	: 0 MIN. 18 SEC.
BASIC Program size (WITHOUT VARIABLES)	: 895 BYTES
ZBASIC Program size (WITHOUT VARIABLES)	: 2733 BYTES

(Remember that the ZBASIC program includes an 1879 byte sub-routine package.) Program shown exactly as compiled and run in BASIC and ZBASIC.

```

10 '===== ZBASIC 2.2 EXAMPLE PROGRAM AND TIME TEST=====
20 CLS: CLEAR 100: DEFINT A-X: DEFSTR Z: DIM AA(64,24), Z(50): RANDOM
30 AA=100: BB=-1000: CC=3: DD=-3: EE=-9999: ST$="START TIME "+TIME$
40 FOR I=1 TO 127 STEP 2: FOR J=47 TO 1STEP-3: XX=POINT(I,J): SET(I,J)
50 XX=(I-J)/CC*(7+I+J): XX=ABS(INT(RND(I*J)-AA)+7): RESET(I,J)
60 XX=PEEK(I+J): POKE 15360+I+J, J: OUT 255, J AND (3*J): XX=INP(1)
70 AB$=STR$(I+J): BA$=LEFT$(AB$,2): AA(I/2, J/2)=VAL(BA$)+AA*3
80 BA$=BA$+RIGHT$(BA$, RND(3)): XX=INSTR(1, BA$, "9"): XX=SQR(I*J)
90 BA$=MID$(BA$, 2, 2): MID$(BA$, 1, 1)=2: IF XX THEN 100 ELSE CLS
100 IF LEN(BA$)>3 OR SGN(XX)=1 AND ASC(BA$)=32 THEN PRINT "+++"
110 IF POS(0) 62 THEN TRON: TROFF: PRINT ELSE XX=NOT(RND(99))+100
120 AS=INKEY$: IF AS="Y" OR AS="y" AND I 120 THEN PRINT "TRUE.."
130 RESTORE: READA, C, Z, J, D: GOSUB 170: GOSUB 170: GOSUB 170: GOTO 210
140 NEXT: PRINT "*": NEXT I: CLS: PRINT 0512, ST$, "STOP TIME ": TIME$
150 STOP' ===== END OF MAIN TEST LOOP =====
160 DATA 12345, -1, "TEST", -9999
170 ON RND(6) GOTO 180, 190, 200, 180, 190, 200
180 RETURN
190 RETURN
200 RETURN
210 ON RND(9) GOSUB 180, 190, 200, 180, 190, 200, 180, 190, 200
220 GOTO 140
    
```

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to disable DEMO/TXT (hold down enter after entering the time), but newcomers to the Model II/12/16 may have to call Micro-Systems or Power-soft for assistance.

Ease of Use

DOS commands and file names are recognized in both upper- and lower-case: stores/dat, STORES/DAT, and StORes/DaT are now the same file. In addition, many characters that were illegal in TRSDOS file names are legal with DOSPLUS II. The file names ACCT#/DAT and ME&YOU/BAS are examples.

More than one command is allowed on a single line if they are separated with semicolons. For instance, DIR :0 ; FREE :0 ; DIR :1 ; FREE :1, displays directories and free-space maps on drives zero and 1.

Help commands are available for all of the LIB commands and are more complete than those in TRSDOS. Error messages are printed out rather than expressed as numbers. The back-up utility performs both format and backup, eliminating a tedious step.

DOSPLUS II, however, is not always user-friendly. In some instances it fails to provide a list of possible prompt

answers, an area where TRSDOS shines. The date and time prompts, for example, are just 'DATE : ' and 'TIME : '. When backup encounters a destination disk that is already formatted, it asks 'Diskette contains data, use or not?'. You are not told that Y, U (for use), and N are the correct responses. What's worse is that F is a correct response, too, meaning "Use it, but reformat it first".

Device independence, although a powerful tool, is also confusing. Devicespecs replace switches, so that DIR @PR replaces DIR (P) as a command to print the directory. The Dual command under TRSDOS sends data to both the screen and the printer. Under DOSPLUS the command is replaced by LINK @DO @PR. These commands are fairly easy to learn, but are confusing initially. In addition, some device-independent commands can 'hang' the system if used improperly (more on this later).

Device Independence

The flow of data in a device-independent system can be altered. A sample application is to send the RS-232 input to the printer, or the keyboard input to a disk file. Data is filtered so that

certain characters are changed before they reach their destination.

The system defines 16 devices, listed in Table 1. Each is referred to by a name (changeable using the Rename command). The class of a device determines whether it is used for input, output, or both.

Devices zero through seven are referred to as devicespecs, or system devices, while devices eight through 15 are drivespecs, or drive devices. They are preceded in the command line by @ and :, respectively. An example of this is DIR (from) :0 (to) @PR, which sends the directory to the printer (from and to are optional).

You define devices five through seven. This gives you the option of adding peripherals like a joystick, mouse, or plotter. Note that the proper software must be stored in memory by the Set command, and that the hardware may require modifications.

The system devices process data 1 byte at a time, making it possible to send individual bytes from one device to another. The drive devices process data one file at a time. You can send individual bytes from RS-232 port A to the printer, but you cannot send them to drive zero. You could, however, send



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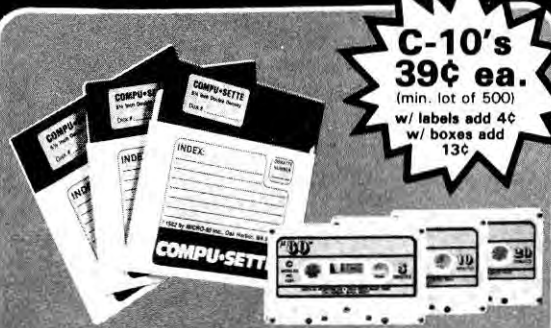
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them to a file on drive zero. This defines a third type of device, called a filespec. Filespecs process data 1 byte/one character at a time (COPY @KI KEY-INPUT/TXT:0), or one file at a time (COPY KEYINPUT/TXT:0 NEW-FILE/DAT:1).

Five keywords have been added, encompassing most of the device-independent capabilities. They are link, route, reset, filter and set. In addition, the other library commands have been made device-independent.

Link, Route, and Reset

Link connects two output devices to one another so that data going to one is simultaneously sent to the other. You can also link two input devices so that data requested from one can be supplied by the other.

The syntax is link (from) devicespec (to) channel. The devicespec must be one of the system devices (zero through seven); the channel must be byte-oriented (device zero through seven or a filespec). The system prevents you from taking the data from a file, or sending it to a disk. Link by itself displays the current link status of all the devices.

For example, LINK @DO @CA sends data slated for serial port A to the screen, letting you confirm that the ap-

propriate data is sent. LINK @PR PRINT/DAT stores all printer output on disk.

This command will not, however, prevent you from linking an input device to an output device or vice versa, the results of which are unpredictable. In this case, device independence gives you enough rope to hang yourself.

The Route command intercepts data going to a device and sends it elsewhere. Unlike link, the data go only to one device. The syntax is route (from) devicespec (to) channel. Like link, the devicespec must be a system device and the channel either a system device or filespec. Route by itself displays the current status of all the devices.

For example, ROUTE @PR @DO sends all printer data to the screen, and ROUTE @DO @CB intercepts data going to the screen and reroutes it to serial port B.

Reset cancels all linking and routing. The syntax is either reset, which resets all devices, or reset devicespec, which cancels an individual device. Resetting an individual device is also accomplished by linking and routing it to itself (LINK @DO @DO; ROUTE @DO @DO).

Filter

Filter is a powerful tool that captures

characters and changes them before they proceed to another device. The syntax is Filter (from) devicespec (to) filespec(on/off). The devicespec indicates which system device (zero through seven) is filtered; the filespec is the file denoting which characters are to be filtered; and the On/Off parameter enables and disables the filter.

Filter can also change your keyboard to the Dvorak configuration. This keyboard configuration, designed in the early 1900s to speed typing, never became popular (see *80 Micro*, December 1980, p. 66). Each character is trapped and assigned a new value before being processed. For instance, Q becomes D, W becomes V, and so on. A filter that does this is included on the DOS-PLUS disk.

DOSPLUS II also lets you customize a program to your printer's control codes. The characters that make one printer double-strike might put your printer into a graphics mode or worse. The Filter command lets you trap and change those characters.

Designing a filter file is easy once you decide which characters to trap, and how to change them. A filter-file format looks like this: trapchar = replace char. Trapped and replacement characters can be in ASCII itself or represented by ASCII values. For instance, A = a, 65 = 97, or 41H = 61H are all equivalent. The Build command provides a simple method to write the file.

You can turn a filter file on and off. But regardless of its status, it steals a little memory from your program.

Set

Set installs driver programs for non-standard peripherals. Usually this is a printer that is not Centronics-compatible or a user-defined device (lightpens and so on). The syntax is Set devicespec (to) filespec.

The driver must be written in machine-language and stored on disk. This is one of the few areas where DOS-PLUS requires considerable programming expertise. Its advantage, however, is that it automatically installs the driver, patches it into the system, and protects it from being overwritten. When left to the programmer, these tasks take longer than writing the driver.

Set also restores a device after it has been killed. An example is SET @PR @PR.

Changes in Library Commands

Most library commands are now device-independent. As mentioned earlier,

;	List first line of program
Left arrow	"
/	List last line of program
right arrow	"
down arrow	List next line of program
up arrow	List preceding line of program
!	SYSTEM (!"DIR")
L	LIST (L10-20)
D	DELETE (D10-20)
E	EDIT (E10)
A	AUTO (A10,5)
R or R"	RUN (R"PROGRAM/BAS")
L"	LOAD (L"PROGRAM/BAS")
S"	SAVE (S"PROGRAM/BAS")
K"	KILL (K"PROGRAM/BAS")
.	List current line of program
,	Edit current line of program

Table 2. List of Shorthand Basic Editing Commands

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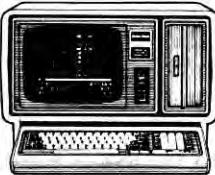
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DIR @PR sends the directory to the printer. DIR @CB sends the directory to serial port A, and DIR DIRFILE/DAT:3 sends it to a disk file. The commands CAT (file catalog, a short form of DIR), List, and LIB are similarly changed.

Commands previously file-oriented are now device-oriented. For instance, Kill now kills a device or drive as well as a file or group of files. If you KILL @PR, data sent to the printer simply disappears. If you KILL :3, data sent to drive three disappears. A subsequent request for data (DIR :3) evokes a 'Device not available' error.

If you Kill the keyboard, you hang the system, and nothing short of a physical reset recovers it.

Copy operates similarly. A device can now be copied to a device as long as both are byte-oriented (zero through seven or a file). You can COPY @KI KEYINPUT/TXT, which saves the keyboard input to a file. The manual claims that COPY @KI @PR turns the printer into a typewriter, but I couldn't get it to work.

A Copy is aborted by pressing the break key, but only after at least one character has been copied. If you copied from an input-only device, you

would hang the system. An example is COPY @DO @PR. Again the power of device independence is troublesome.

The Rename command now renames devices and drives as well as files. If you are a CP/M user, you might want to rename your drives A, B, C and D, thereby creating commands like DIR :B.

A few Library commands are dropped or replaced. The Again command is replaced by '/'. Move is replaced by a

wildcard option in Copy; Purge is replaced by a wildcard option in Kill. The Echo and Dual commands are gone, victims of device independence. The Receive command, which under TRSDOS receives object code via the RS-232 port, is gone. There are a few other commands dropped or replaced.

Some Library commands have extra options under DOSPLUS. The Auto command is made unbreakable, so you

	Subroutine	Subroutine
	is 10 lines	is 300 lines
	from 1st line	from 1st line

GOSUB 4000	1.28 minutes	1.53 minutes
GOSUB EXAMPLE	1.30 minutes	1.77 minutes
decrease in speed	1.5 %	16 %

Table 3. Comparing GOSUBs, using Name to GOSUBs using line number, 1,000 iterations



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cannot simply press break to get the DOS ready prompt. It can also be made invisible, so that you see only the results of the commands being executed, instead of the commands themselves. The DIR command can now alphabetically sort the directory before displaying it, and display files fitting a specified wildmask. A sample application takes a directory of all files with the extension /BAS and sorts them before printing them to the screen. The CAT command has the same options.

Copy has an option to copy without using all available memory, making it possible for a large machine-language program to not be overwritten. Forms lets you specify the spool buffer size.

Configuring the Floppy Drives

DOSPLUS II can be configured to use the original Model II drives or the newer, faster, double-sided Model 12 and 16 drives. In addition, you can custom configure the system to deal with almost any disk drive, from a single-density, 35-track, five-inch disk to a 12-megabyte hard disk. This makes DOSPLUS much more flexible than TRSDOS or CP/M, but increases the system's complexity.

The CONFIG command sets both the floppy- and hard-disk drive parameters. The syntax is: CONFIG drivespec (parameter, parameter, . . .), where drivespec is the drive being configured.

The floppy drive parameters include software write protect, motor on delay (used for the Model 12/16), head load delay, and step speed (the rate at which the drive moves between tracks). The density (single or double) and the number of sides (one or two) are set with the Format utility. The system also supports five- or eight-inch drives, although the hardware does not exist for attaching a five-inch drive to the Model II/12/16.

DOSPLUS II is configured for a Model II with four eight-inch drives and uses a slow step speed (30 milliseconds). Model II users with Radio Shack drives should change the step speed to 6 milliseconds.

The manual is confusing on the use of the head-load delay parameter, at one point stating that it's used with Radio Shack Model II drives and later reversing itself. Micro-Systems Software informed me that this parameter is necessary for the Model II Drive zero only.

Model 12/16 owners with standard Radio Shack drives must change the motor-on-delay to Y and can change the step speed to 3 milliseconds. This is made easy with the MOD16/CMD file

included on the disk. 80 Micro has tested this system on the Model 12 and it performed flawlessly.

The CONFIG command also changes the order in which your drives are scanned during a file search. This is useful if you are using hard disks and wish to search them before the floppies.

Configuring for Hard Disk

Hard disk drives are fully supported, and are usually referred to as drives four through seven. As shipped, these devices are set to NIL and must be turned on by setting them to themselves. For instance, SET :4 :4 enables drive 4.

The Rigid parameter of the CONFIG command informs the system that it is a hard disk. Both five- and eight-inch hard drives are supported in hardware and software. You can also indicate fixed or removable platters and software write-protection. You must specify the step, head count, and track size; these parameters are included in your hard-disk manual.

“DOSPLUS II can be configured to use the original Model II drives or the newer, faster, double-sided Model 12 and 16 drives.”

In addition, CONFIG partitions one physical hard disk drive into two or more logical drives. This is useful to double the directory size, thereby allowing for more, but shorter, files. Three parameters must be set to do this, and failure to set them correctly results in two logical drives accessing the same track, a disastrous situation.

The number of cylinders on a drive and the number of platters also have to be set when formatting the drives with the RFORMAT utility. If you format too many cylinders, you may invade the wrong logical drive and wreak havoc.

The instructions for using hard drives are scattered throughout the manual. The section on CONFIG gives you the actual parameters to set, while the technical section tells you how to use them most effectively. In addition, you are referred to the Set command to enable the drive, the RFORMAT command to format it, the SYSGEN command to make it an operating system disk, and

the System command to save the configuration to disk. At some point you must calculate the best values for all the hard disk parameters, being sure to use the disk effectively but not overlapping logical drives. This procedure is not for the faint-hearted.

The section on CONFIG does advise you on two configurations for the Radio Shack 8.4-megabyte drives, and Micro-Systems advised me that sample configurations for the new 12-megabyte units are on the way. The Do files, which initialize and configure the 8.4-megabyte drives, are included on the disk, but you must read the section on SYSGEN to realize this. If you miss this you'll have to type up to 13 commands, some of them quite long (four Sets, four CONFIG commands, four RFORMATs and one System command).

Using Different Configurations

The System command allows niceties like deleting the DOSPLUS II graphics display and Time and Date prompts at power up. In addition, a trace function displays the Z80 program counter in the upper right-hand corner of the screen. This is a godsend for the machine-language programmer who wants to know the memory address being executed. The alive function places a blinking graphics character in the upper right-hand corner, indicating that the interrupts are functioning and that the system is not “hung.”

The system (SAVE = file name) function is the most powerful feature of the DOSPLUS configuration system. It lets you save all of the system and CONFIG parameters, as well as the printer's forms setup, linking, filtering and routing, and device names.

In short, the current state of the system is saved to a /CMD file (MOD 16/CMD is an example). You can save as many of these files as you like, making it possible to configure your system for an endless number of situations.

For instance, if you do a lot of machine-language programming, you might save a file that turns on the trace function, protects 16K in high memory, and links the video to the printer so you have a printed record of the screen. If you want to use your system as a dumb terminal, set up the proper route and link parameters and save them in the file DUMB/CMD. The applications are endless.

Utilities

DOSPLUS II has 13 utilities to TRSDOS 2.0a's six. The added utilities

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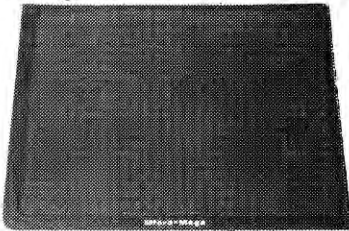
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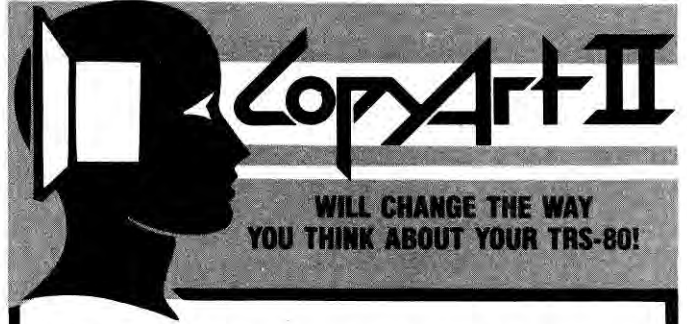
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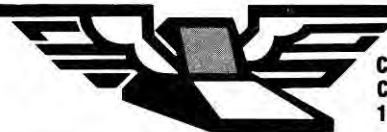
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include two disk-repair programs, a disk zapper, an editor/assembler, and a TRSDOS-to-DOSPLUS conversion program.

The old standbys Backup and Format are here, in addition to RFORMAT for formatting the hard drives. Backup only duplicates floppies; hard-disk backups are not possible. The manual suggests using the Copy command to copy files from a hard disk.

SYSGEN is familiar to Model I/III DOSPLUS users. It lets you make almost any disk an operating system disk. Specifically, it creates double-sided floppy system disks for Model 12/16 owners, and hard system disks for hard-disk owners. The utility is simple to use, and the instructions are explicit.

Two programs are included to repair disks that are damaged. They are DIRCHECK, which checks the directory for errors, and DIRFIX, which fixes them. These utilities require little or no knowledge of directory structure. They do not, however, fix unreadable sectors on the disk.

Directory failures are caused by operator errors or a bad disk, but they can also be caused by a faulty operating system. I encountered one directory error that DIRFIX fixed easily, but I could not blame it on the operator or a faulty disk. If this is due to a bug in DOSPLUS, then a patch should follow soon.

Diskzap is a disk zapper with seven options. You must use the Set option to inform Diskzap of the type of disk in each drive. The display option lets you display and modify sectors. Other options include fill sector with a specified byte, copy sector to sector, and verify sectors, which checks for unreadable portions of the disk. Used in the right hands, this zapper is a powerful tool for repairing blown disks.

The EDAS editor/assembler from Galactic Software is included free. Used in conjunction with the manual's technical section, it can write machine-language programs. Editing commands include search and replace. Assembly options include assembly to RAM, which allows you to execute newly created code, and immediate jump back to the EDAS. The original Galactic documentation is included.

TRSDOS Compatibility: CONV and SVCINT

The plethora of TRSDOS software for the Model II/12/16 makes TRSDOS compatibility a must for any new operating system. DOSPLUS II in-

cludes two utilities to make this possible.

The TRSDOS and DOSPLUS formats are different, making it impossible to read one with the other. The CONV utility, however, makes it possible to read TRSDOS 1.2 or 2.0 files and copy them to a DOSPLUS disk. Options include taking a directory of the TRSDOS disk and copying files back to TRSDOS. These two options are unique among DOS conversion programs.

The manual does not state the differences between the TRSDOS and DOSPLUS formats. Micro-Systems told me that DOSPLUS uses 30 sectors/track compared to TRSDOS' 25, yielding a 20 percent increase in disk space.

“Micro-Systems has informed me that future updates and releases will include TRSDOS Basic, making it possible for one-drive users to perform the patch.”

The SVC calls (similar to ROM routines on the Model I/III) are mostly TRSDOS compatible, but some existing programs require full compatibility. The SVCINT utility provides this by intercepting certain routines in DOSPLUS and making them conform to TRSDOS. This is sufficient in most cases. In addition, patches are provided for the ST80III (a terminal program), Profile Plus (a data-base manager), and VisiCalc.

Other utilities include Draw, enabling you to use the screen as a graphics scratchpad, and Offset, allowing you to relocate machine language in memory. The MEMTEST and terminal programs are not found on DOSPLUS II, but they might function correctly once you transfer them from TRSDOS.

Enhancements to Basic

Rather than supply their own version of Basic, the DOSPLUS creators opted to transfer Basic from TRSDOS to DOSPLUS and then patch it. This is a simple, well-documented process, but requires at least two drives. It only

needs to be done once. The improvements to Basic include more editing commands, the ability to reference line numbers with labels, and an increase of 4K in user space.

Micro-Systems has informed me that future updates and releases will include TRSDOS Basic, making it possible for one-drive users to perform the patch.

Model I/III users are familiar with most of the edit commands. They include one-character abbreviations like ‘!’ for System and ‘E’ for Edit. Table 2 provides a complete list.

Three utilities are called into Basic via SYSTEM“file name”. REF/CMD finds all references to variables, line numbers, and keywords. The SR/CMD utility lets you search and replace strings.

The SORT/CMD utility is the most powerful sort utility to be included on any TRS-80 operating system. It sorts variable, integer, and single- and double-precision arrays of any length. In addition, you may sort up to 30 specified arrays. The first 10 are key arrays that determine the order in which something is sorted.

If two items in the first key array are equal, the sort goes to the second array, and so on. You can specify up to 20 tag arrays, which are along for the ride. When two elements of a key array are swapped, the corresponding elements in the tag array are also swapped.

The Name command is used under TRSDOS to rename disk files, but under DOSPLUS II it enables you to assign a name to a line number, and then reference it by that name. GOSUB 12560 can now read GOSUB SORT, or GOSUB GETKEY. Use the name statement in the line number you wish to reference, then GOTO and GOSUB it by name instead of number. Program Listing 1 is a sample application. Use the SYSTEM“RENAME” command to rename files under DOSPLUS II.

Name eliminates the need to memorize important line numbers and makes the code easy to read. I have a couple of reservations, however. The documentation states that you can place the Name label statement anywhere in the program line, but I found that it must be the first statement in the line. Program execution is slowed down, because the GOTO and GOSUB search routines must search the code instead of just the line numbers.

This speed reduction is greater when the referenced line is farther from the first line of the program. Table 3 shows sample timings for subroutines that are the 11th and 301st program lines. Program Listing 2 tests the GOSUB Exam-

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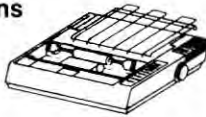
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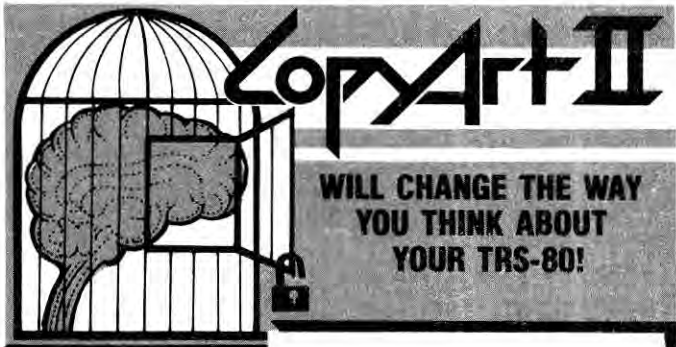


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ple statement when it is the 11th line.

The improved editing features and DOSPLUS-to-TRSDOS conversion make DOSPLUS II a great way to develop commercial Basic programs for use under TRSDOS. This is made difficult, however, by the Name command. A program to convert back to the standard line-number referencing would solve this problem as well as the speed problem. Its absence is puzzling in a system as complete as this one.

DOSPLUS makes an extra 4,000 bytes available to Basic programs, as well as to applications programs like VisiCalc. This feature alone may make DOSPLUS worth the price.

The documentation only covers TRSDOS Basic enhancements. Programmers have to keep the Tandy manual by their side.

Documentation

The documentation is attractively packaged, and lengthy, but suffers from poor organization and is sometimes inaccurate.

The manual is organized into DOS operations, library commands, utilities, Basic, and technical information. Each section is separated by a blank

```

10 '*** EXAMPLE OF NAME COMMAND IN ACTION ***
20 GOTO START
30 NAME FIRST:PRINT"FIRST SUBROUTINE":RETURN
40 NAME SECOND:PRINT"SECOND SUBROUTINE":RETURN
50 NAME THIRD:PRINT"THIRD SUBROUTINE":RETURN
60 NAME FOURTH:PRINT"FOURTH SUBROUTINE":RETURN
70 NAME FIFTH:PRINT"FIFTH SUBROUTINE":RETURN
99 '*** MAIN ROUTINE ***
100 NAME START
110 FOR X=1 TO 5
120 ON X GOTO GO1,GO2,GO3,GO4,GO5
130 NAME GO1:GOSUB FIRST:GOTO LOOP
140 NAME GO2:GOSUB SECOND:GOTO LOOP
150 NAME GO3:GOSUB THIRD:GOTO LOOP
160 NAME GO4:GOSUB FOURTH:GOTO LOOP
170 NAME GO5:GOSUB FIFTH
180 NAME LOOP:NEXT X
190 END
    
```

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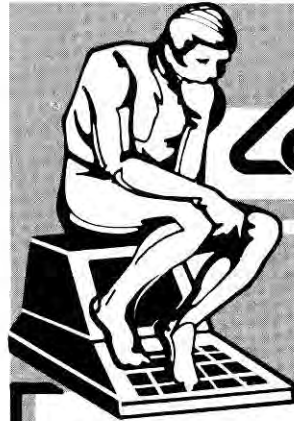
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page and a colored tab, and begins with a list of the features covered. A table of contents lets you look up individual commands.

After this, however, the organization suffers. A software product of this complexity needs an index referencing all commands. In addition, the com-

mands within each section are listed alphabetically, instead of in logical order. For instance, device-independent commands like Link, Route, Set, and Reset are scattered among 34 other commands. The hard-disk and configuration commands like CONFIG, Set, SYSGEN, System, and RFORMAT are spread throughout the manual. Concepts like these are abstract enough without poor organization making comprehension harder.

The first four sections of the manual are thorough, but have some inaccuracies. At one point the manual states that DOSPLUS II does not maintain the system date as a file attribute, but I found that it does. One of the suggested device-independent uses for Copy does not work, nor does the Name command unless it is the first statement in a line.

The technical section is one of the best I have seen. Twenty-six pages are devoted to general system operation, while a whopping 91 pages document the SVC calls. In all, this section is 127 pages long. It makes DOSPLUS II an excellent package for software development.

Technical Support

Micro-Systems and Powersoft are established companies with good track records in customer support. Once you send in the registration card, you are notified of any system upgrades. Both companies provide customer support, so you can call one of two phone numbers (neither toll-free) or write to one of two addresses.

Both companies can be reached on CompuServe's MicroNet and Special Interest Group (SIG) menus. In addition, Micro-Systems publishes *The DOSPLUS Quarterly* with hints and tips on using their operating system.

The Micro-Systems/Powersoft team will soon send out an updated disk to registered owners fixing all known errors, including bugs in the CONV and Diskzap utilities. This version should be even more TRSDOS-compatible than the last one.

DOSPLUS II is the most powerful Z80 operating system available for the Model II/12/16. Its device-independence makes it a superb programming tool, as does its editor/assembler and enhanced Basic. The documentation is thorough, though slightly disorganized. If you want more out of your II/12/16, try DOSPLUS II. ■

```
10 'BENCHMARK - NAME STATEMENT FROM DOSPLUS II VS. GOTO AND GOSUB LINE NUMBER
    THIS IS NAME VERSION, SUBROUTINE
    10 LINES FROM START
20 CLS:SYSTEM"TIME 00.00.00":GOTO 50000
'BYPASS DUMMY LINES AND SUBROUTINE
30 'LINES 40 - 100 ARE DESIGNED TO MAKE THE INTERPRETER LOOK FOR THE NAME
    IN AN AVERAGE LENGTH LINE
40 PRINT@0,CHR$(24):X=SQR(2):Y=INT(X*100/256):FORX=1TO100:PRINTA$(X):NEXT:A$=INPUT$(1):ONYGOSUB1000,2000,3000:GOTO4000:IFY>0THEN2000ELSEFORZ=1TOY:GET#1,Z:NEXT
50 PRINT@0,CHR$(24):X=SQR(2):Y=INT(X*100/256):FORX=1TO100:PRINTA$(X):NEXT:A$=INPUT$(1):ONYGOSUB1000,2000,3000:GOTO4000:IFY>0THEN2000ELSEFORZ=1TOY:GET#1,Z:NEXT
60 PRINT@0,CHR$(24):X=SQR(2):Y=INT(X*100/256):FORX=1TO100:PRINTA$(X):NEXT:A$=INPUT$(1):ONYGOSUB1000,2000,3000:GOTO4000:IFY>0THEN2000ELSEFORZ=1TOY:GET#1,Z:NEXT
70 PRINT@0,CHR$(24):X=SQR(2):Y=INT(X*100/256):FORX=1TO100:PRINTA$(X):NEXT:A$=INPUT$(1):ONYGOSUB1000,2000,3000:GOTO4000:IFY>0THEN2000ELSEFORZ=1TOY:GET#1,Z:NEXT
80 PRINT@0,CHR$(24):X=SQR(2):Y=INT(X*100/256):FORX=1TO100:PRINTA$(X):NEXT:A$=INPUT$(1):ONYGOSUB1000,2000,3000:GOTO4000:IFY>0THEN2000ELSEFORZ=1TOY:GET#1,Z:NEXT
90 PRINT@0,CHR$(24):X=SQR(2):Y=INT(X*100/256):FORX=1TO100:PRINTA$(X):NEXT:A$=INPUT$(1):ONYGOSUB1000,2000,3000:GOTO4000:IFY>0THEN2000ELSEFORZ=1TOY:GET#1,Z:NEXT
100 PRINT@0,CHR$(24):X=SQR(2):Y=INT(X*100/256):FORX=1TO100:PRINTA$(X):NEXT:A$=INPUT$(1):ONYGOSUB1000,2000,3000:GOTO4000:IFY>0THEN2000ELSEFORZ=1TOY:GET#1,Z:NEXT

40000 NAME EXAMPLE 'THIS IS THE EXAMPLE SUBROUTINE
40010 PRINTUSING"EXECUTING THE SUBROUTINE FOR THE ##### TIME";X
40020 RETURN
50000 '*** MAIN (CONTROLLING) ROUTINE **
*
50010 'GOSUB THE SUBROUTINE 1000 TIMES
50020 FOR X=1 TO 1000
50030 GOSUB EXAMPLE
50040 NEXT X
50050 PRINT"DONE"
50060 PRINT"TIME IS - "TIMES$
50070 END
```

Program Listing 2

Art Huston can be reached at 23 Granite St., Peterborough, NH 03458.

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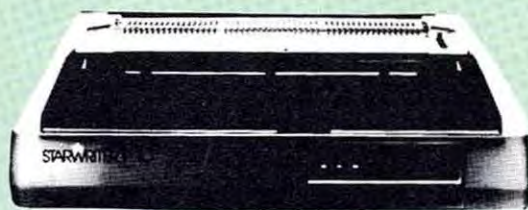


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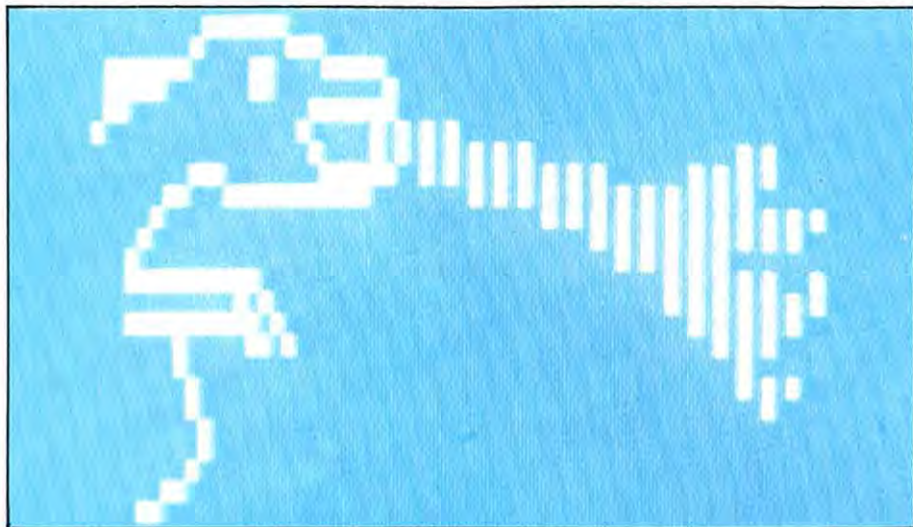


Photo 1

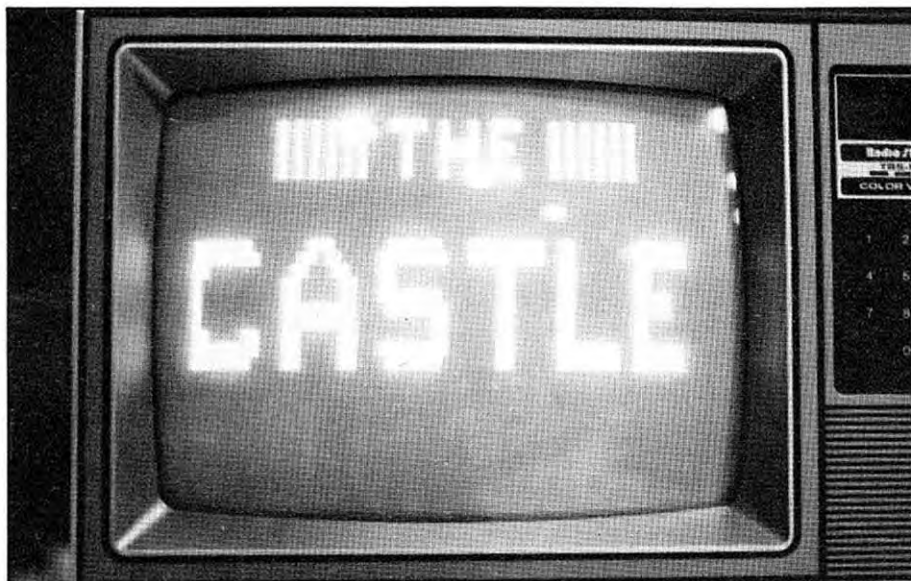


Photo 2

If your Color Computer screen can't handle detailed graphics, try this graphics editor.

I have written many graphics programs for my Color Computer, but until recently have had a hard time creating detailed graphics. I solved this problem by writing a graphics editor program designed for 32K computers.

My graphics program is simple in concept, but is a powerful utility. Drawings are created on the low-resolution screen and are then transferred to the 64-by-32-character area of the highest resolution screen. This is done with a For . . . Next loop that reads each point on the low-res screen and sets the identical pattern on the high-res screen.

The program consists mainly of two subroutines, one to locate an area of the high-res screen and one to edit the picture.

Before transferring the picture, an area is chosen in which to place the picture. The first subroutine positions the picture using the commands Get and Put. You will see a flashing rectangle

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NEWSLETTER

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The LAZYFONT package includes a program for creating the fonts, which lets you draw characters on the screen, then save them to disk. You can draw any sort of character, including logos and pictures. A bonus for users who don't want to draw their own fonts is that you can use GEAP/DotWriter fonts with this program.

LAZYFONT is available from AlphaBit Communications for \$49.95. The present version works only with the Epson MX-80 or MX-100 with Graftrax or Graftrax Plus. Versions for other dot matrix printers will be available soon.

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This revolutionary product is available from AlphaBit Communications, Inc. for \$49.95. You're reading a sample now, printed with the TITLE typeface.

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which is a 64-by-32 area of the high-res screen into which your picture will be placed. Move this area with the joystick until you have found the spot where you wish your picture to be placed, then press the joystick fire button and that portion of the screen is transferred to the low-res screen.

A picture is created by using arrow keys to move a flashing white dot around the screen, setting and resetting points where needed. As you draw the picture on the low-res screen, it is simultaneously transferred to the high-res screen. As your design takes shape, press the O key to see what your picture looks like on the high-res screen. When your picture is finished, press the O key to stop.

Your drawing is now on PMODE 4,1 with SCREEN 1,1. The colors for this mode are black and buff, but red and blue may also be created. In the low-res

*“Press the O key
to see what
your picture looks
like on the
high-res screen.”*

picture you see vertical stripes on either side of the word “THE.” These stripes, when transferred to the high-res screen, appear blue. To create the color red, reverse the stripes.

Two nice subroutines are available as you design your picture. If you press X, a text line appears at the top of the screen. This line provides the X and Y coordinates of the flashing dot on the high-res screen. If you press the B key, you see a line eight points long. By pressing the arrow keys, the line moves across the screen in intervals of eight and down the screen in intervals of one. This line represents the memory location or byte where the information is stored. If you press the X key, the text line appears giving you the memory location and the decimal value of this byte. This last subroutine may mean nothing to some of you but is very useful in working with memory areas of the graphics screen. To exit this subroutine, push the Q key and you return to the normal edit mode.

Program Listing

```

10 DIM VT(4,4),VU(4,4)
20 DIM GZ(32)
30 DIM VV(63,31)
40 PMODE 4,1
50 CLS
60 PRINT@224,"<1> EDIT PICTURE OR <2> TRANSFER"
70 A$=INKEY$:IF A$="" THEN 70
80 ON VAL(A$) GOTO 560,1000
90 GOTO 70
100 REM TRANSFER PICTURE
110 SCREEN 1,1
120 GOTO 140
130 PUT(L,M)-(L+4,M+4),VT,PSET
140 J=JOYSTK(0):K=JOYSTK(1)
150 L=J*3:M=K*2.5
160 GET(L,M)-(L+4,M+4),VT,G
170 PUT(L,M)-(L+4,M+4),VT,PRESET
180 P=PEEK(65280)
190 IF P=126 THEN 220
200 IF P=254 THEN 220
210 GOTO 130
220 REM GET NEXT POINT
230 LA=L:MA=M
240 J=0:K=0
250 GOTO 270
260 PUT(L+J-4,M+K-4)-(L+J,M+K),VU,PSET
270 J=JOYSTK(0)
280 K=JOYSTK(1)
290 IF K>31 THEN K=31
300 GET(L+J-4,M+K-4)-(L+J,M+K),VU,G
310 PUT(L+J-4,M+K-4)-(L+J,M+K),VU,PRESET
320 P=PEEK(65280)
330 IF P=126 THEN 360
340 IF P=254 THEN 360
350 GOTO 260
360 REM FIND TRANSFER POINT
370 PUT(LA,MA)-(LA+4,MA+4),VT,PSET
380 PUT(L+J-4,M+K-4)-(L+J,M+K),VU,PSET
390 REM J=J+4 ETC
400 GOTO 420
410 PUT(L,M)-(L+J,M+K),VV,PSET
420 JA=JOYSTK(0):KA=JOYSTK(1)
430 L=JA*3:M=KA*2.5
440 GET(L,M)-(L+J,M+K),VV,G
450 PUT(L,M)-(L+J,M+K),VV,PRESET
460 P=PEEK(65280)
470 IF P=126 THEN 500
480 IF P=254 THEN 500
490 GOTO 410
500 REM MOVE PICTURES
510 PUT(L,M)-(L+J,M+K),VV,PSET
520 GET(LA,MA)-(LA+J,MA+K),VV,G
530 PUT(L,M)-(L+J,M+K),VV,PSET
540 IF INKEY$="" THEN 540
550 RUN
560 REM ENLARGE PICTURE
570 CLS(RND(9)-1)
580 PRINT@43,"HELP MENU";
590 PRINT@101,"X - SHOW INFO WINDOW";
600 PRINT@133,"B - SHOW WHICH BYTE ";
610 PRINT@165,"S - SET A POINT ";
620 PRINT@197,"R - RESET A POINT ";
630 PRINT@229,"Q - QUIT ";
640 PRINT@261,"O - SEE SCREEN ";
650 PRINT@293,"CL- CLEAR SCREEN ";
660 PRINT@451,"PRESS ANY KEY TO CONTINUE";
670 IF INKEY$="" THEN 670
680 GOSUB 780:REM GET POSITION
690 SCREEN 0,0
700 CLS
710 FOR XX=0 TO 63
720 FOR YY=0 TO 31
730 IF PPOINT(LL+XX,MM+YY)=1 THEN SET(XX,YY.5) ELSE RSET(XX,YY)
740 NEXT YY,XX
750 SCREEN 0,0
760 REM TRANSFER PICTURE
770 GOTO 950
780 PMODE 4,1:REM GET POSITION
790 GET(LL,MM)-(LL+63,MM+31),VV,G
800 SCREEN 1,1
810 PUT(LL,MM)-(LL+63,MM+31),VV,PSET
820 SCREEN 1,1
830 JJ=JOYSTK(0)
840 IF JJ>25 THEN JJ=25
850 KK=JOYSTK(1)
860 LL=JJ*8:MM=KK*2.5
870 GET(LL,MM)-(LL+63,MM+31),VV,G

```

Listing continues

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Another program option is the ability to transfer portions of the screen to other areas. When you exercise this option, a flashing square appears on the high-res screen. Using the joystick, move this square to the upper left-hand corner of the area you wish to transfer and press the fire button. A second square then appears. Move this square to the lower left-hand corner of the area you wish to transfer. (There is a limit as to how far this second square goes. Too little memory exists to transfer larger areas with this method of transfer.)

Once you mark this second area, a large flashing rectangle appears. This rectangle is the same size you marked off for transfer. Move this rectangle to your transfer destination and press the fire button. The transfer appears: Push any key to return to the menu.

*"I produced
my castle and dragon
in one evening."*

Once you create some of your own pictures, you may wish to save them. To do so, first break from the program and then load a cassette tape for recording. Next, type CSAVEM"SCREEN", 1536,7679.0, press enter and your picture is recorded. To get your picture back again, type CLOADM"SCREEN" and press enter. You may find after you load the program that the colors blue and red have reversed. To correct this you may have to push the reset key several times, checking the color of the screen each time, to get the colors normal.

This program is easily modified to develop a personalized graphics program. Graphics can be created quickly; I produced my castle and dragon in one evening. I added this program to one of my screen graphics programs to create a powerful utility. ■

Wayne Thume can be reached at R2,
Box 119, Trappe, MD 21673.

Listing continued

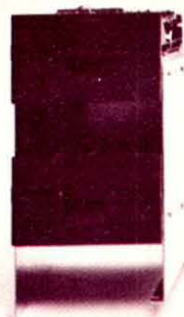
```

880 PUT(LL,MM)-(LL+63,MM+31),VV,PRESET
890 PP=PEEK(65280)
900 IF PP=126 THEN 930
910 IF PP=254 THEN 930
920 GOTO 810
930 PUT(LL,MM)-(LL+63,MM+31),VV,PSET
940 RETURN
950 REM CHANGE PICTURE
960 JJ=0:KK=0
970 CC=POINT(JJ,KK)
980 GOSUB 1550
990 FZ=0
1000 CB$=INKEY$
1010 SET(JJ,KK,5)
1020 RESET(JJ,KK)
1030 IF CB$="" THEN 1000
1040 IF CC=0 THEN RESET(JJ,KK) ELSE SET(JJ,KK,5)
1050 IF CB$=CHR$(94) THEN KK=KK-1
1060 IF CB$=CHR$(10) THEN KK=KK+1
1070 IF CB$=CHR$(8) THEN JJ=JJ-1
1080 IF CB$=CHR$(9) THEN JJ=JJ+1
1090 IF KK<0 THEN KK=31
1100 IF KK>31 THEN KK=0
1110 IF JJ>63 THEN JJ=0
1120 IF JJ<0 THEN JJ=63
1130 IF CB$="Q" THEN RUN
1140 IF CB$="O" THEN GOSUB 1600
1150 IF POINT(JJ,KK)=0 THEN CC=0 ELSE CC=1
1160 IF CB$="B" THEN GOSUB 1250
1170 IF CB$="P" THEN CC=1:PSET(LL+JJ,MM+KK)
1180 IF CB$="C" THEN GOSUB 1650
1190 IF CB$="R" THEN PRESET(LL+JJ,MM+KK):CC=0
1200 IF CB$="X" THEN GOSUB 1480
1210 IF CB$="H" THEN GOSUB 570
1220 IF FZ=1 THEN PRINT@0,"X=";INT(LL+JJ);"Y=";INT(MM+KK)
1230 SET(JJ,KK,5)
1240 GOTO 1000
1250 REM SHOW BYTE
1260 CZ=0:AX=0:BZ=0
1270 DZ=0
1280 JZ=1536+(INT(MM)*32)+(LL/8)
1290 FOR AX=0 TO 7
1300 IF POINT(DZ+AX,BZ)=5 THEN RESET(DZ+AX,BZ) ELSE SET(DZ+AX,BZ,5)
1310 NEXT
1320 DA$=INKEY$:IF DA$="" THEN 1320
1330 FOR AX=0 TO 7
1340 IF POINT(DZ+AX,BZ)=5 THEN RESET(DZ+AX,BZ) ELSE SET(DZ+AX,BZ,5)
1350 NEXT
1360 IF DA$=CHR$(94) THEN BZ=BZ-1:JZ=JZ-32
1370 IF BZ<0 THEN BZ=0:JZ=JZ+32
1380 IF DA$=CHR$(10) THEN BZ=BZ+1:JZ=JZ+32
1390 IF BZ>31 THEN BZ=31:JZ=JZ-32
1400 IF DA$=CHR$(8) THEN DZ=DZ-8:JZ=JZ-1
1410 IF DZ<0 THEN DZ=DZ+8:JZ=JZ+1
1420 IF DA$=CHR$(9) THEN DZ=DZ+8:JZ=JZ+1
1430 IF DZ>7*63 THEN DZ=DZ-8:JZ=JZ-1
1440 IF DA$="Q" THEN GOSUB 1480:RETURN
1450 IF DA$="X" THEN GOSUB 1480
1460 IF FZ=1 THEN PRINT@0,"LOCATION =";JZ;"VALUE =";PEEK(JZ)
1470 GOTO 1290
1480 IF FZ=1 THEN GOSUB 1500 ELSE GOSUB 1550
1490 RETURN
1500 FOR X=0 TO 31
1510 POKE 1024+X,GZ(X)
1520 NEXT
1530 FZ=0
1540 RETURN
1550 FOR X=0 TO 31
1560 GZ(X)=PEEK(1024+X)
1570 NEXT X
1580 FZ=1
1590 RETURN
1600 REM SEE HI-RES SCREEN
1610 SCREEN 1,1
1620 IF INKEY$="" THEN 1620
1630 SCREEN 0,0
1640 RETURN
1650 FOR HI=1 TO 100
1660 CB$=INKEY$
1670 IF CB$="L" THEN 1700
1680 NEXT HI
1690 RETURN
1700 CLS0
1710 LINE(LL,MM)-(LL+63,MM+31),PRESET,BF
1720 RETURN

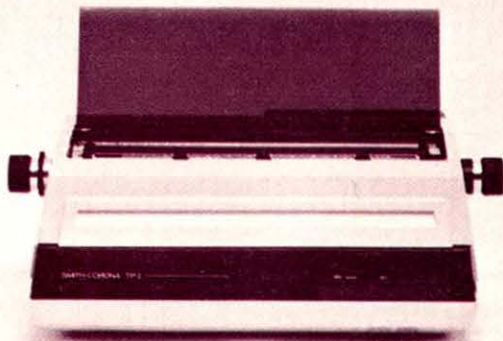
```


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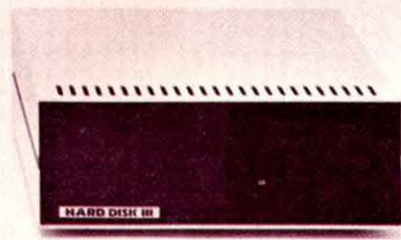
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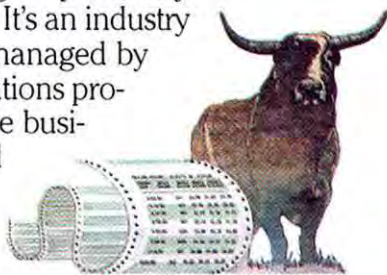
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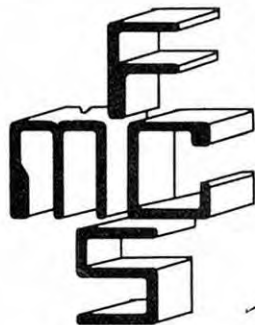
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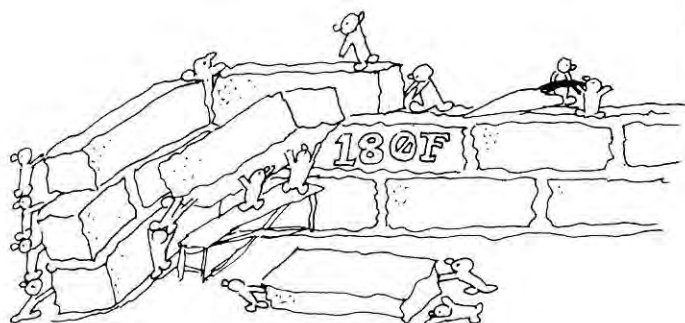
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Assembly-Language Shortcuts Part I

by Bob Bowker



Bowker introduces his series of articles with simple tricks and shortcuts to make writing Assembly-language programs an easier process.

I recently rewrote a disk-directory program that I coded two years ago. The awkwardness of that original

prompted me to share some of what I've learned. I had to fit a program in a finite number of bytes—in a 1K

```
016400 00100 DELAY LD BC,0064H ;Delay length
CD6000 00110 CALL 0060H ;ROM's delay loop
```

Program Listing 1

```
0664 00100 DELAY LD B,0CCH ;Delay length
10FE 00110 LOOP DJNZ LOOP
```

Program Listing 2

```
0E04 00100 PROG LD C,04H ;Counter = 4
06FF 00110 PROG1 LD B,00H ;counter = 256
7E 00120 LOOP LD A,(HL) ;Get character
FE80 00130 CP 80H ;Is it a graphic?
3802 00140 JR C,NEXT ;Go if not
3E2E 00150 LD A,2EH ;Substitute a dot
CDxxxx 00160 NEXT CALL PRINTR ;Print it
23 00170 INC HL ;Point to next one
10F3 00180 DJNZ LOOP ;...and loop
0D 00190 DEC C ;Count this one too
20EE 00200 JR NZ,PROG1 ;...and Keep going
```

Program Listing 3

EPROM, for example, or in the SYS overlay area—so I devised some shortcuts; byte-saving is the mother of many inventions. I don't claim to be the author of all these tricks, however, just a collector.

We'll start with a simple one; the ROM subroutine at 0060H is one of the best-known among Assembly-language programmers. Load a count in the BC register pair, and call 0060H; a delay will occur, depending on the value in BC. For example, see Program Listing 1. In a standard Model 1, this routine will cause a delay of 937.6 microseconds.

However, look at Program Listing 2. This routine will also cause a delay of 937.6 microseconds, and it's 2 bytes shorter. As long as your delays are under 1,175 μ s (B=0FFH), why not?

Again, and Again, and Again

DJNZ is a new command in the Z80; it doesn't exist in the instruction sets of the 8080 or its other ancestors. It allows you to loop through a section of code up to 256 times. To increase the number of loops, try Program Listing 3.

The Key Box

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This routine is a crude screen-print program. The DJNZ causes 256 loops through the code, while lines 190-200 reset the DJNZ counter, the B register, four times. As long as PRINTR doesn't destroy the BC register pair, this routine takes care of all 1,024 bytes on the screen.

Simple Arithmetic

The ROM routines for arithmetic are there and are relatively easy to use. Often, however, there's no need to save and set up all the registers necessary to simply double a number, or multiply it by another number, provided you're sure the result won't overflow the registers you're using.

For example, Program Listing 4 doubles a number. Program Listing 5 gives a result five times that same number. It's just 4 bytes long! Remember that your starting number can't exceed 51, or the A register will overflow and the results will be unpredictable.

Multiplying by 10 takes only 1 more byte. (See Program Listing 6.) Remember that your starting number must now be 25 or less to avoid overflow. If you just can't stay under 255, but 65535 is high enough, use the HL register in-

stead of A above, and BC or DE instead of B. This is a few more bytes, but still shorter than using the ROM routines.

Keep the Flags Flying

Basic has the command ON... GOTO, and for a time I wrote routines that were hundreds of bytes long to do the same thing in machine language. It

"You can use the Set command to make a single byte into eight flags for eight different parameters..."

was some time before I found the commands Set, RES, and RRCA, and learned how to use flags to do the job.

You can use the Set command to make a single byte into eight flags for eight different parameters or events. If the parameter or event is to happen, assign 1 bit to it and set it. Once it's happened, RES the same bit and the flag is off.

The tricky part is checking the bits to see if they're on or off. You could always use "BIT x,A", but that command is 2 bytes long. RRCA, however, is only 1, and has the added advantage of setting things up for a conditional Call or Jump.

For example, if bit zero of the flag's byte is set, the RRCA command will rotate it into Carry flag, which is one of the conditionals. You can then "CALL C,xxxx" or "JP C,xxxx".

Suppose you have a program that can pass parameters in the command line, such as "XDIR ISP". In this case, you want to run a program called XDIR, and print out the list of all invisible and system file names. If HL points to the "ISP," calling the subroutine in Program Listing 7 will set flags for each of the parameters requested. When it comes time to execute these parameters, you can do it via Program Listing 8.

The RRCA concept is not limited to the A register; you can use any register you want, such as "RRC B" or "RRC C". You can also apply it to the contents of a RAM address using "RRC (HL)," and "RRC (IX+d)" or "RRC (IY+d)". You don't have to go right all the time either: RLCA duplicates RRCA, but to the left—ditto for

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“RLC B”, “RLC C”, “RLC (HL)”, and so on.

More Bits and Bytes

My early attempts at Assembly-language programming avoided entire

groups of Z80 instructions because I didn't understand them. I would write the longest routines to avoid using such commands as “AND 6DH” and “OR E”. Eventually, I learned how to use the Boolean logical operators.

A real-estate broker friend asked me to write a data-base management program to file all the properties for sale or rent in his office. I managed to create a system, but was stumped for a time when he wanted cross-referenced print-outs of all houses for sale with a den, pool, three bedrooms, and assumable mortgage for under \$50,000. All my attempts were too long and slow. Enter the Booleans.

Step one was to assign 2 bytes to store this information; using 1 bit at a time, I could define 16 attributes. The bit assignment worked this way: If the house had a fenced back yard, bit zero was set; if it had a pool, bit 1 was set; if it had a two-car garage, bit 2 was set, and so on. As each house was logged into the system, all that information was stored in shorthand in 2 bytes.

87	00100	DUBL	ADD	A,A	;Add A to itself
<i>Program Listing 4</i>					

47	00100	XFIVE	LD	B,A	;Store the number
87	00110		ADD	A,A	;Double it...
87	00120		ADD	A,A	;Double double = ×4
80	00130		ADD	A,B	;...plus 1 makes 5.
<i>Program Listing 5</i>					

87	00100	XTEN	ADD	A,A	;Double it...
47	00110		LD	B,A	;Store 2X
87	00120		ADD	A,A	;...times 4
87	00130		ADD	A,A	;...times 8
80	00140		ADD	A,B	;...and 2 makes 10.
<i>Program Listing 6</i>					

0600	00100	PARSE	LD	B,00H	;Zero the flag
7E	00110	LOOP	LD	A,(HL)	;Get parameter
FE0D	00120		CP	0DH	;Carriage Ret?
281B	00130		JR	Z,DONE	;Done if yes
FE49	00140		CP	49H	;Is it an “I”?
280B	00150		JR	Z,ITSI	
FE53	00160		CP	53H	;Is it an “S”?
280B	00170		JR	Z,ITSS	
FE50	00180		CP	50H	;Is it a “P”?
280B	00190		JR	Z,ITSP	
23	00200	BACK	INC	HL	;Point to next one
18EC	00210		JR	LOOP	;...and check it
CBC0	00220	ITSI	SET	0,B	;Set the “I” flag
18F9	00230		JR	BACK	
CBC8	00240	ITSS	SET	1,B	;Set the “S” flag
18F5	00250		JR	BACK	
CBD0	00260	ITSP	SET	2,B	;Set the “P” flag
18F1	00270		JR	BACK	
78	00280	DONE	LD	A,B	;Store the flags
32xxx	00290		LD	(FLAGS),A	
C9	00300		RET		
<i>Program Listing 7</i>					

3Axxx	10000	DOIT	LD	A,(FLAGS)	;Get the flags
0F	10010		RRCA		;Move bit 0 into C
F5	10020		PUSH	AF	;Save the flags
CDxxx	10030		CALL	C,INVIS	
F1	10040		POP	AF	;Restore the flags
0F	10050		RRCA		;Move bit 1 into C
F5	10060		PUSH	AF	;Save the flags
CDxxx	10070		CALL	C,SYSTEM	
F1	10080		POP	AF	;Restore flags
0F	10090		RRCA		;Move bit 2 into C
F5	10100		PUSH	AF	;Save the flags
CDxxx	10110		CALL	C,PRINTR	
F1	10120		POP	AF	;Clean off the stack
<i>Program Listing 8</i>					

“Eventually, I learned how to use the Boolean logical operators.”

When my friend wanted his listing, he answered a series of questions establishing the type of house he was looking for. The questions set the bits in the DE register pair according to the assignments I had made; when he was finished, the program ran the routine in Program Listing 9.

The “AND E” instruction in line 120 compares the byte in A, bit by bit, with the byte in E; if both bits are on, that bit in A is left on, but if either is off, that bit in A will be left off.

A to start with: 0101 1101
E to start with: 1101 1111
A after “AND E”: 0101 1101

When the “AND E” is completed, A shows which bits match—which house attributes match the requested attributes. Next, that byte is compared to the original requested attributes in B, and if they match, you continue on to the second set; if not, you bail out and check the next house in the data base.

This method of checking attributes establishes a minimum; the house may very well have other attributes not requested, but at least it has all those requested. If an exact match is required in your application, try Program Listing 10. In this example, “XOR E” com-

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It's not just printer or a typewriter that comes complete with a deluxe carrying case, but a feature-packed, lightweight machine that doubles as an office typewriter. This printer is a simple, low cost, reliable unit which can be utilized with word processing systems, microcomputers, personal computers, and small business systems. The Microwriter's low noise level and slim modern styling allow it to blend with any decor.

The Microwriter's print quality is identical to the finest office typewriters on the market. This machine is not only perfect for letters and manuscripts, but with its 165 character, 12 inch print width, the machine is perfect for letter quality budget spread sheets, price lists, data sheets, and forms.

The Microwriter can tab, rule single lines both vertical and horizontally, underline and print at 10, 12, or 15 characters per inch (switch selectable)! Its ten character memory for automatic error correction, lift off correction ribbon, and fixed or programmable page formats are a few of the many features that make it a perfect office typewriter. Microwriter not only handles letter and legal size sheet paper in widths up to 12 inches wide, but also handles fanfold paper.

There's a wide selection of 21 interchangeable daisy wheels available. And ribbon cassettes that just drop in.

Its operation as a computer printer is simple. Just load it up with paper and you are ready to go. Centronics compatible parallel output cables are currently available from stock for the following computers: IBM PERSONAL COMPUTER™, OSBORNE 1™, ZENITH Z-100™, BURROUGHS B-20™, Convergent Technologies models IWS & AWST™, TRS-80 MODEL I, II, III™, APPLE II™... custom cables also available by special order.

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pare A bit by bit with E, and each bit in A is turned on if it is on in either A or E to begin with, but not both. Thus if A and E are an exact match, the result should be zero:

A to start with: 0101 1101
 E to start with: 0101 1101
 A after "XOR E": 0000 0000

If A and E were not an exact match, the following would occur:

A to start with: 0101 1101
 E to start with: 1101 1101
 A after "XOR E": 1000 0000

The "OR A" instruction compares A with itself, bit by bit; if any bit in A is on, it remains on after the instruction is completed. If no bits are on, the instruction sets the Z flag. In the last example, the byte in A would fail the test for zero, and the program would branch to the NOPE code. Thus, the program prints out house listings only if the attributes match those requested exactly.

```

3Axxxx 00100 CHECK LD A,(BYTE1) ;Get House Byte 1
47 00110 LD B,A ;Store for now
A3 00120 AND E ;Compare to request
B8 00130 CP B ;Match?
200B 00140 JR NZ,NOPE ;...go if not
3Axxxx 00150 LD A,(BYTE2) ;Get House Byte 2
47 00160 LD B,A ;Store for now
A2 00170 AND D ;Compare to request
B8 00180 CP B ;Match?
2003 00190 JR NZ,NOPE ;...go if not
CDxxxx 00200 CALL PRNTIT ;Print it out!
CDxxxx 00210 NOPE CALL NEXT1 ;Set up next House
18E8 00220 JR CHECK ;...and check it
  
```

Program Listing 9

```

3Axxxx 00100 EXACT LD A,(BYTE1) ;Get House Byte 1
AB 00110 XOR E ;Compare to request
B7 00120 OR A ;Is it zero?
2003 00130 JR NZ,NOPE ;...go if not
CDxxxx 00140 CALL PRNTIT ;Else print it out
CDxxxx 00150 NOPE CALL NEXT1 ;Get next House
18F1 00160 JR EXACT ;and check it out
  
```

Program Listing 10

The Teaser

In the next article, I'll tackle the stack and share a few tricks I've learned. To whet your appetite: If your program has not reassigned the stack, and has not abused it (i.e., no values are left at the end, nor have you POPed too many off), you don't have to write JP 402DH as your last command. Before DOS passed control to your program, the address 402DH was placed on the stack; thus, RET will accomplish the same thing and save 2 bytes in the process. ■

Robert Bowker is a free-lance television director. He can be reached at 11360 Sunset Blvd., Los Angeles, CA 90049.

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Set up/Program	5:20 min.	12:18:00 hrs.
Input 100 records	50:29 min.	1:27:50 hrs.
Sort & Print Labels	6:41 min.	4:18 min.
Totals	1:02:30 hrs.	13:50:08 hrs.

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The Postman's Second Ring

by Jim Heid

The second version of Soft Sector Marketing's Postman mailing list helps you make your appointed rounds with even greater efficiency.

★ ★ ★ ★

**Postman (Version 2), with Postwriter
Alger Software
Distributed by Soft Sector Marketing
P.O. Box 340
Garden City, MI 48135
Model I or III
Two disk drives
48K RAM
\$175**

Field Information

Nine fields per record, names and lengths as follows:

- Code: 10
- Last Name: 15
- First Name: 15
- Company: 26
- Address: 26
- City: 15
- State: 5
- Zip: 9
- Data 1: 2
- Data 2: 5

Field names and lengths cannot be changed by the user.

Sorting

Machine-language heap sort, one to ten keys
Sort time, approximately .021 seconds per name

Data File Specifications

Maximum size limited only by free disk space
Data Guard feature reconstructs mail list after a system crash
User can transfer data between disks
Hard-disk version available

Label Printing

Capable of printing up to six labels across
Multiple search criteria allowed
Two user-defined messages can be printed on each label
Label size is user definable

Form Letter Generation

Capable of printing up to 255 letters per record
Printing parameters are user definable
Multiple search criteria allowed

Table 1. Postman Specifications

It's been said that the postman always rings twice. Soft Sector Marketing has just sounded the second bell with a new version of their Postman mailing list. You'll want to answer it if you're looking for a package that's fast and easy to use.

Postman has some impressive features (see Table 1). It comprises ten machine-language programs, one sample data file, an 87-page manual, and a padded three-ring binder.

The Postman Software

Two Postman program disks come with the package. One is a single-density disk for the Model I; the other is a double-density disk for the Model III. You must copy the programs in both versions to a system disk. The Model III disk contains a Do file that does the copying automatically.

Postman advertisements recommend DOSPLUS or LDOS, but the program is also compatible with most other TRS-80 disk operating systems. For Model I users, this list includes TRSDOS 2.3, NEWDOS80 Version 2.0, VTOS 3.0 and 4.0, LDOS 5.0.3, and DOSPLUS 3.3D and 3.4D.

For Model III users, TRSDOS 1.3, LDOS 5.1, DOSPLUS 3.4D and 4.0,

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But you don't have to take our word for it. Here's what the critics said:

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- **COMPUTRONICS:** "Here's a program capable of outstanding performance in the preparation of any type of data base...without any previous computer software experience being required of the user. I recommend it without qualification."
- **80-US JOURNAL:** "The manual uses a learn-by-doing approach and is so effective that on the first try a complete and highly functional data base was set up. Reports and customized printouts can be generated in minutes."
- **COMPUERVE:** "What most distinguishes Data-Writer is that files can be created and maintained with an ordinary word processing program...The 80-page instruction manual is very well done and the whole system is easy to use."

Data-Writer is useful! Users around the world have discovered the power and flexibility of this extraordinary data base manager that works by itself or with a word processor. Data-Writer is used by managers in large corporations (Bechtel, Honeywell, Owens-Corning, Westinghouse, among others), by small manufacturers, doctors, lawyers, insurance agents, stockbrokers, universities, government agencies, police departments, churches, flower societies, stamp collectors, wine enthusiasts, software retailers, and many more.

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- 240 characters per field with a word processor
- 45 characters per field with Data-Writer's ENTRY program
- Search for any record with 1 second access time
- Select records based on multiple selection criteria
- Add fields to restructure your data base

If you have form letters to send to a large group or a subset, if you maintain mailing lists, bibliographies, or inventories with reorder levels, if you want to report accounts payable or receivable, expenses, orders, or any other list of numbers with totals and subtotals, then you will find Data-Writer invaluable. You can even create a subset of a larger list (say, all estate-bottled red wines produced in Napa Valley, St. Emilion and Barossa Valley in 1978, priced between \$8 and \$12, sorted in order of decreasing price). The possibilities are endless.

For the TRS-80 Models I, III (48K, 2 drives, lower case required), Data-Writer is available from software dealers or direct from Software Options, Inc., 19 Rector Street, New York, NY 10006. (212)785-8285. Toll-free order line: (800)221-4624. Price \$145 (plus \$3 shipping and handling). NY State residents add sales tax. Visa/Mastercard accepted.

Canada: For the name of a local dealer, contact J&J Electronics Ltd, 310 Notre Dame Avenue, Winnipeg R3B 1P4; (204)942-0963.
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Australia: Molymerx Pty Ltd, 11 Bourke Avenue, Gosford 2250
Dealer inquiries invited.



and NEWDOS80 Version 2 are all compatible. I tested the system using LDOS 5.1.2 on the Model I and III, and found the one minor incompatibility described below.

Using Postman

After you copy the Postman programs to a system disk, you use the system by typing POSTMAN at the DOS Ready prompt. You can protect any routines in high memory by typing POSTMAN (MEM = X), where X is the highest memory location that you want Postman to use. Postman honors the DOS HIGH\$ memory pointer, so if your high-memory routines set it, you do not need to specify a memory size.

When Postman executes, a title and copyright notice appear for a few seconds. Then the main menu slides in from the right side of the screen (see Fig. 1). This programming gimmick is interesting the first couple of times you use the system, but I tired of waiting for the menu to make its three-point landing every time I wanted to use a different Postman program.

Fortunately, pressing any key while Postman is loading overrides the menu's dramatic appearance and brings it to the screen immediately.

Your first step is to initialize a Postman data disk. To do this you select option six, "New Data Disk File Preparation," from the main menu. Postman asks you which drive contains a formatted data disk. The program does not let you select a nonexistent drive number.

Here I found Postman's only incompatibility with LDOS. If I enter an illegal drive number, the screen displays garbage for a few seconds before prompting me again. Apparently Post-

man cannot pick up the Illegal Drive Number error code from LDOS. While this bug does not cause the program to crash, it is an annoyance.

After you enter an appropriate drive number, Postman asks how many addresses you want to hold on the data disk. Most users will simply press the enter key, telling Postman to use all the free disk space. Postman then asks for a disk name, limited to 32 characters.

Finally, the disk is initialized and Postman indicates the maximum num-

```
The POSTMAN Mass Mailing System          Ver 2.29
.....                               Alger Software
```

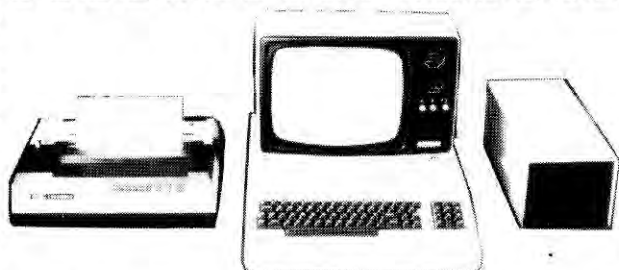
Please select the function you wish to use.

.Selection.....	Function
Key	Description
1	POSTEDIT Label Data Manipulation
2	POSTLIST Label Data Columnar Listing
3	POSTRITE Form Letter Generation
4	PSTFILES Allow Operator to Change Diskettes
5	PSTMERGE Move/Merge Labels to New Data Disk
6	POSTPREP New Data Disk File Preparation
@	Return control to the disk operating system

Enter selection -->

Fig. 1. Postman Main Menu

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Model II/16	53	34-pin DUAL-ROW-PLUG to 36-pin CENTRONICS CONNECTOR	17.00	18.50	20.00	21.50	23.00
MODEL II/16	54	34-pin DUAL-ROW-PLUG to 40-pin CARD-EDGE CONNECTOR	15.00	16.50	18.00	19.50	21.00
MODEMS	55	25-pin RS232 MALE PLUG to 25-pin RS232 MALE PLUG	15.50	17.00	18.50	20.00	21.50
MODEMS	56	25-pin RS232 FEMALE PLUG to 25-pin RS232 FEMALE PLUG	15.50	17.00	18.50	20.00	21.50
MODEMS	57	25-pin RS232 MALE PLUG to 25-pin RS232 FEMALE PLUG	15.50	17.00	18.50	20.00	21.50
INTERCONNECT	61	34-pin CARD-EDGE CONNECTOR to 34-pin CARD-EDGE CONNECTOR	13.50	15.00	16.50	18.00	19.50
INTERCONNECT	62	34-pin DUAL-ROW-PLUG to 34-pin DUAL-ROW-PLUG	14.50	16.00	17.50	19.00	20.50
INTERCONNECT	63	34-pin CARD-EDGE CONNECTOR to 34-pin DUAL-ROW-PLUG	14.00	15.50	17.00	18.50	20.00

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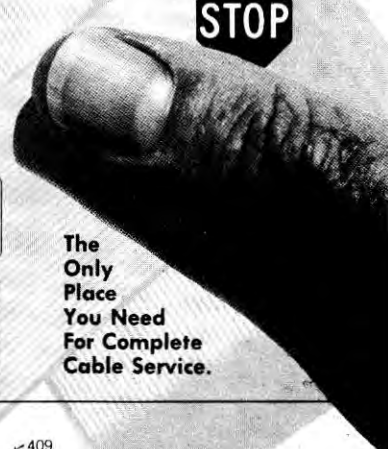


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ber of addresses allowed. A 40-track, single-density, LDOS-formatted data disk holds 742 records, and a 40-track, double-density disk also formatted under LDOS holds 1,348 records.

After readying a data disk, the program asks if you want to prepare another one. If you have more than two disk drives you might want to because a Postman data file artificially links disks. Postman searches all the drives in your system and connects their mail-list files together, forming what looks like one massive, continuous file. This feature makes Postman a natural for users with an especially large mailing list.

The data disk preparation program contains full error checking, and the program gives you several opportunities to abort the initialization process if, for example, you find that you've inserted the wrong data disk.

After you prepare as many data disks as you need, Postman's main menu slides in again from stage right. You begin entering names and addresses by selecting option one, "Address Data Manipulation."

The program then displays "LOAD-

ING Postedit" in the middle of the screen, an area used throughout Postman for error and status reporting. Every time a program loads, a boxed message appears. Any operator or system errors also appear there. Display formats are consistent and attractive.

Entering Data

The Postedit program is the workhorse of Postman. Using this program, you add, change, delete, print, search for, and view your mailing-list entries. The Postedit screen is shown in Fig. 2.

The top of the screen tells you how many records you have used and how many empty records remain. The center of the screen contains the fields that comprise one record. Each period represents a possible character, and the parenthesis at the end of each field denotes its length. The bottom of the screen contains Postedit's menu.

To add a new record to your list, choose the "Insert new label" option by pressing the I key. The periods disappear, a flashing block cursor appears at the first position of the Code field, and a summary of screen editor commands

appears at the bottom of the screen (see Fig. 3).

The arrow keys move the cursor within the fields; pressing enter tabs to the beginning of the next field. The remaining screen editor functions are delete character (shifted left-arrow key), delete to end of field (clear key or shifted clear key for LDOS/VTOS users), insert character (shifted right-arrow key), and apply the overlay contents (described below).

The screen editor is easy to use. The keyboard is fully debounced and keeps up with the fastest typists. You can also print the current record in label format by typing shift, down arrow (control), and the letter O.

The overlay is a time-saving feature. If you have a number of addresses that share common data—city, state, and zip code, for example—you can put the common data into an overlay. The contents of the overlay are then applied to every record by hitting two keys (control-V).

The Postedit menu contains an option to change the overlay. When you select it, a screen similar to the one in Fig. 3 appears, except that each field contains small graphics blocks to remind you that you are not entering label data.

After you type a complete record, there are two ways to exit the screen editor. Pressing the at key (@) stores the record on disk and clears the fields for another record. You use this method when entering more than one address record.

You use the other method when you are finished entering your list. Pressing shift and the at key brings a small menu to the bottom of the screen. From this menu you can write the current record and return to the Postedit menu, apply the overlay to the record, inspect the current overlay, or forget the current label and exit to the menu.

The overlay inspection option is interesting; when you hold down the I key, it displays the current contents of the overlay in the existing field positions. When you release the key, whatever was previously in each field pops back on the screen.

Some Postedit Options

You can select another of the options on the Postedit menu, "Edit current label," by pressing the E key. The cursor appears in the first position of the first field and the screen editor menu appears at the bottom of the screen.

At this point you can edit the record contents. The screen editor's functions

```

P O S T M A N  --  2.29
File Usage:      1-Used      1348-Max
.....
Code(.....)
Lname(.....)      Fname(.....)
Company(.....)
Address(.....)
City(.....)      State(.....)      Zip(.....)
Data1(..)      Data2(.....)
.....
..... Main Function Menu .....
<- Prior Label      <E>dit Current Label      <L>ocate Label
-> Next Label      <D>elete Current Label      <F>ast Search
<- (Shift) ->      <I>nsert New Label      <X> Set Up Printer
First -- Last      <V> Change Overlay      <O>ne Label Print
<@> Return to MENU      <S>ort Labels      <P>rint to File End

```

Fig. 2. Postedit Screen

```

P O S T M A N  --  2.29
File Usage:      2-Used      1348-Max
.....
Code(sales.....)
Lname(H.....)      Fname(.....)
Company(.....)
Address(.....)
City(Peterborough...)      State(NH...)      Zip(03458.....)
Data1(..)      Data2(.....)
.....
..... Screen Editing Controls .....
Move Cursor      Field Edit      Exit Editor
[      (Shift) ->      Insert Blanks      (@) Auto Upd/Ins
<- ->      (Shift) <-      Delete Chars
\      (Clear)      Clear to Field End      (Shift @) Exit
      (Enter)      Tab to Next Field

```

Fig. 3. "Insert New Label" Option

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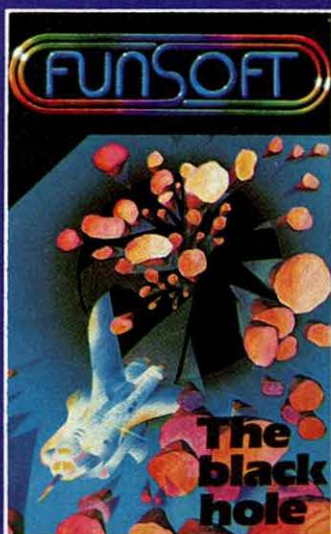


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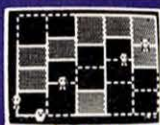
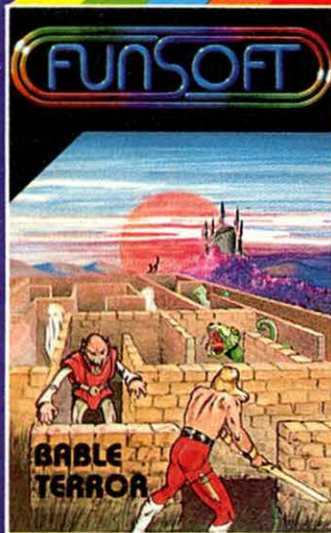


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and commands are identical to those described above. This design consistency throughout Postman makes the system easy to learn and use.

You delete a record currently on the screen using the "Delete current label" option. When you press D, the bottom of the screen displays a message asking, "Do you REALLY want to delete this label?" Pressing Y deletes the label; pressing any other key returns you to the Postedit menu.

A minor bug surfaces here. If a label is not displayed on the screen and you press D, the message "CANNOT do that until a label is on the" appears. The word "screen" is left out of the message.

Searching: Quick, Fast, or Selective?

Three other Postedit options let you search for a particular label. Two of the options are called "fast search" and "quick search." The third, called the selective search, is described below.

All three options operate similarly: type in the information you want to look for, called search criteria, and the program looks through your mailing list and displays the records that contain matching information. The primary differences between the options are the amount of information you can search for and the search speed.

The quick search is the fastest of the three. It lets you jump to an approximate location in your mailing list and searches only the primary sort field of each record.

If you want to search for the last name Heid, for example, your list would first have to be sorted by last name. You would then enter the name HEID (or a portion of it) and the quick search positions the mailing-list file to the first record that begins with the letters HEID in the last-name field.

If your list does not contain any last names that begin with HEID, the quick search positions the file to the location where HEID would be if it existed (between HARRIS and HONUS, for example). Quick search is a convenient way to get in the ballpark.

Use the fast search when you want to search a field other than the primary sort field. It also has several options. To begin, type what you're looking for, called the search key, and press enter. Unlike the quick search, you must type the entire search key. (If you want to look for the name HEID, you have to type the full name; typing only HE won't work.)

The program then searches your list for a record with a matching field. If it finds one, it displays the record above a small menu. This menu lets you continue the search, print the record that was just found, enter a new search key, or return to the Postedit menu. If a matching record is not found, the program tells you and returns to the Postedit menu.

The third method, called the selective search, allows multiple search criteria. When you select it, a screen called the search mask appears. The search mask looks like the normal screen-editor display, except that each field contains a small white square in each character position. Like the overlay mask, this reminds you that you are not entering new records.

Before you can perform a selective search, you have to tell the search mask what you are looking for. This is done by typing each criterion into the mask as if you were typing a normal record.

Assume you want to search for the address of every person who lives in Peterborough, NH, whose last name starts with H, and whose Code field starts with the word "sales." You must

first edit the search mask until it looks like Fig. 4, then you conduct the search.

When the program finds a matching record, it appears with a small menu below it. The menu lets you continue the search, print the record just found, enter new search criteria, or return to the main menu.

If no matching record is found, the program displays a message and gives you the opportunity to conduct the search again, to change or clear the search mask, or to return to the main menu.

The selective search has two interesting and valuable features. First, it compares only the characters you enter in the search mask to the characters in the corresponding fields. If you want to search for every record with a zip code field beginning with the digits 152, you enter only those numbers in the search mask's zip code field. Similarly, a search mask with the letters JO in the first-name field selects records with first-name fields containing JOHN, JOANNE, and JONATHAN.

Second, you can enter search criteria using upper- or lowercase letters; Postman considers them identical when searching.

Printing Data

Postman prints mailing labels three ways: for a single record, for all the records, or for only those records that match certain criteria. The last method uses the search mask described above.

Using the printer setup menu, you can change the default values for the width and number of lines of each label, the width of your paper in number of labels, and the number of labels to print for each record.

You can also tell Postman what fields to print, where to print them, and whether to print your records in all uppercase letters or upper- and lowercase letters. Postman lets you print two comment lines on each label.

The label-printing portion of Postman is easy to use and error-free. Printer setup and label design are cumbersome in some mailing-list systems, but Postman's menus make the entire label-printing job simple, even for inexperienced computer operators.

You can print your name-and-address data in what Postman's manual calls a columnar data listing. This is a printout of the contents of each record.

You can change the default values for page length and margins, and specify which fields to print. You can also send hexadecimal codes to your printer to select any special print styles that it

```

P O S T M A N  --  2.29
File Usage:      1-Used      1348-Max
.....
Code(45-A      )
Lname(Doe      )      Fname(John      )
Company(John Doe Co.      )
Address(123 Main Street      )
City(Notown      )      State(NH      )      Zip(03400      )
Data1(1A      )      Data2(sales)
.....
..... Screen Editing Controls .....
Move Cursor      Field Edit      Exit Editor
[      (Shift) ->      Insert Blanks      (@) Auto Upd/Ins
<- ->      (Shift) <-      Delete Chars
\      (Clear)      Clear to Field End      (Shift @) Exit
(Enter)      Tab to Next Field

```

Fig. 4. Edited Search Mask

might have.

Reliability

Postman has a trademarked feature called Data Guard. If your computer resets, crashes, or loses power while writing to a data disk, Postman automatically invokes a "reconstruction module" that rebuilds the mail-list index the next time you use it.

I tested this feature by entering 36 sample records and shutting off my computer during the disk write of the last record. When I restarted the system, the screen displayed a message saying that the program had invoked the reconstruction module. It gave me an opportunity to enter a new disk label in case the old one was scrambled, which it was.

The screen then displayed the message, "Index reconstruction in progress." A graphics display moved around the bottom of the screen to let me know that the computer was busy, and after a few minutes of disk activity, my mailing list was again complete.

Using Postwriter

Postwriter takes an existing file containing special "insert flags" and prints it, combining data from your mailing list with the contents of the file. Basic or any word processor that saves in ASCII format can create the file.

The purchase of Postwriter is optional (Postman costs \$125 without it), but I recommend it. If your mailing list application involves any type of form letter, you'll find it indispensable and as easy to learn and use as the rest of the Postman system.

Postwriter prints up to 255 copies for each record, right-justified or ragged right, on single sheets or continuous-feed paper. You can also specify other printing parameters, including page width, left margin, line length, page length, number of printed lines per page, and line spacing. Your letters can include two messages, each up to 63 characters long.

Postwriter's best feature is its ability to print letters for selected records. You can do this by filling out a select mask in the same way as the selective search, then instructing Postman to print letters for only those records.

The Postwriter search mask has an additional feature. If you enter a question mark in a given character position within a field, Postwriter doesn't compare that character position when searching. Entering H??D, for example, causes a match with HEID, HADD, and HERD. The question

?
?
?

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mark is called a wild-card character and it gives you even more flexibility when printing form letters.

You can divide one of the code fields so that each character position stands for a category. By assigning each letter a specific meaning, you could code a massive amount of information into each character position. Using the wild-card feature, you can then print letters for records that match certain categories.

Although Postwriter was not written by the same programmer who wrote the rest of the Postman system, its screen displays and menus look nearly identical. Its one annoyance is that the program only responds to uppercase letters in its menu selections. If you are typing in upper- and lowercase, you must hold down a shift key when making your selections.

The rest of the Postman system accepts either upper- or lowercase menu selections. Aside from this quirk, Postwriter is easy to use, error-free, and a natural extension of the Postman system.

Pigeon Holes Are for the Birds

Almost every software package has a flaw, and Postman's is its manual. It is poorly written, containing lines like,

"What FORMAT does is to fill the new diskette with little 'pigeon holes.' " (I kept wanting to feed them.)

The manual is also poorly organized. It goes off on tangents to explain concepts that should be introduced later, forcing the reader to perform mental GOSUBs and Returns in an attempt to follow the discussion.

Worst of all, the manual is incomplete. One of Postman's best features, the ability to apply a predefined overlay to every name-and-address record, is not even mentioned. Only by seeing the overlay options on the system's menus did I realize the feature existed.

To help you prepare a new data disk, the manual refers you to a chart in the back that indicates how many addresses fit on each disk. That chart doesn't exist.

Finally, the manual is unattractive and hard to read. Daisy-wheel printers are fine for letters, but not for documenting business software. The manual should have been typeset for greater legibility.

Is Postman for You?

Yes, if your application requires extensive searching capabilities, fast sorts, flexible print options, and mass storage.

Postman's ability to span disk drives and create what looks like one coherent file makes it ideal for owners of more than two disk drives. And for owners of hard disk drives, a special \$225 version of Postman puts you into the mailing-list management business.

Postman is not for you if your application requires saving a lot of other data along with each name and address. Postman's code fields hold only 17 characters combined. If you want to store additional information with each name and address, you should consider either a mailing list that allows more code fields or a data-base manager.

Postman is capable of maintaining and manipulating large mailing lists easily, quickly, and reliably. It requires little technical knowledge to use, and although it's poorly documented, the system is designed so well that learning it is simple.

The optional Postwriter program almost makes printing form letters fun and is a perfect companion to Postman. The Postman system is a quality software product. ■

Jim Heid is a technical editor for Wayne Green Books Inc. He can be reached c/o 80 Micro.

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Letter-Frequency Distribution—Cryptology, Part IV

by Karl Andreassen

Here's another article in the cryptology series. You'll learn how to use letter-frequency distributions to crack ciphertext.

Cryptanalysis is the art and science of finding plain language hidden in ciphers. In this article, the fourth in a continuing series (see the Anniversary, February and April issues of *80 Micro*), I will address letter-frequency distribution patterns in ciphertext and provide a

Model II program to help identify this pattern.

An analysis of common English text reveals a consistent, letter-frequency pattern known as the normal distribution of letters. The frequency with which letters appear in text is given

below, listed in descending order:

ETAONIRSHDLUCMPFYWGBVJKQXZ

Language in scholarly journals has a slightly different pattern, although the first few letters remain at the high-frequency end of the list. Professional specialty languages such as those used by attorneys, physicians, politicians and the military have distinctive letter-frequency distribution patterns.

An experienced cryptanalyst usually recognizes such patterns just as dialect experts pinpoint a person's geographical origin by listening closely to his speech inflections and words.

Figure 1 lists seven distributions from various texts. The last four lines demonstrate one use of the sampling feature included in the Program Listing, which lets you examine short portions of a longer ciphertext.

When you break down a single-stage substitution cipher to its letter frequencies and find it to be similar to the normal frequency pattern, you are ready to try a few letter substitutions. The pro-

From 100-letter samples from plaintexts:

E R A N T O S I P H M C D U F Y L W G V
 E T A O N I H D R W G S C U L P F B Y K M V
 E T H A S D N I L O R M G Y C F P K X B U V

From a 1024-letter sample of plaintext:

E T O A I R S N H C D U G M F L V W P B Y K J X Z

A 500-letter sample extracted from the above 1024:

E T A O N H I R S C U G F M V L D B W P K Z

100-letter samples from the 1024-letter plaintext:

E O R A T H D S P I G M N U B W C L F K
 E I S A T N R O D U C Y M H F P B L W G K

Fig. 1. Letter Distributions from Plaintexts

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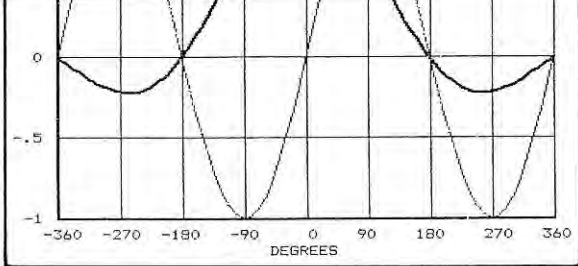
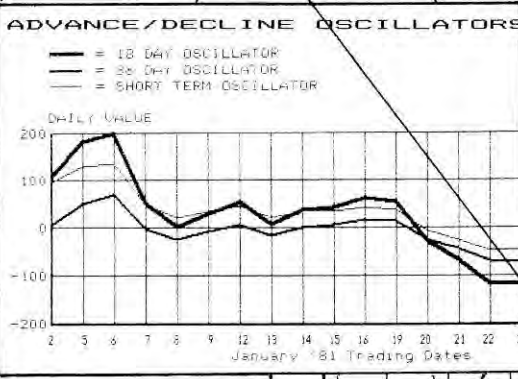
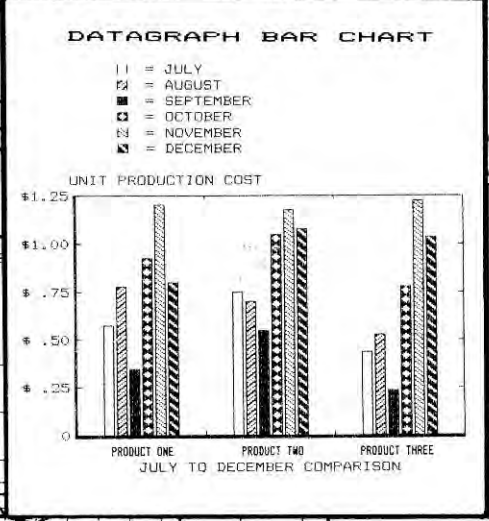
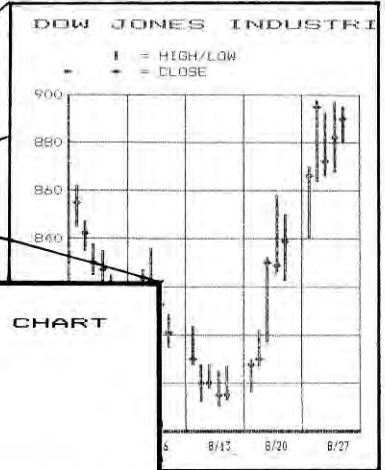
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105	78.00	992.35	400.77	117.81	137.89	1063	433	41,159	14,669	
106	79.14	1004.69	402.89	117.16	138.12	1049	640	30,463	23,759	
107	77.29	980.26	391.19	114.09	133.08	216	1555	37,993	85,844	
108	76.20	965.76	383.24	114.09	133.06	578	1028	11,759	39,073	
109	76.44	968.59	384.82	112.69	133.48	907	620	28,933	15,739	
110	76.52	963.77	380.34	112.69	133.52	928	633	23,813	19,192	
111	76.35	965.10	387.18	112.49	133.27	578	993	12,407	24,532	
112	76.55	966.47	389.55	112.38	133.47	744	612	23,382	13,773	
113	76.92	969.27	394.10	112.60	134.22	789	691	21,567	13,526	
114	77.33	973.29	401.78	113.22	134.77	880	642	25,222	14,423	
115	77.10	970.99	403.55	114.35	134.37	740	756	16,113	15,338	
120	75.81	950.68	394.88	113.80	131.05	371	1172	5,859		
121	75.91	945.25	392.46	113.80	131.36	547	554	15,797		
122	74.76	940.44	392.03	113.00	130.26	467	1024	11,057		
123	74.72	941.19	391.61	111.76	130.23	683	788	15,604		
126	74.45	938.01	387.19	111.47	129.84	554	890	11,694		
127	75.19	949.49	394.64	111.72	131.12	943	597	28,173		
128	74.79	942.53	395.43	112.49	130.34	686	788	17,433		
129	74.69	948.87	393.64	112.74	130.24	774	710	19,425		
130	74.27	947.27	402.22	112.82	129.55	727	776	16,777		

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105	38,74	77.78	893	-1172
106	67,40	78.92	499	277
107	93,89	77.89	-1339	-1062
108	55,35	77.59	-450	-1872
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gram in "The Art of Encoding and Decoding" (80 Micro, February 1983, p. 244) helps you solve ciphers.

This month's program reduces the labor of counting letter frequencies and displays the letter-frequency spread of an unknown ciphertext in both graphics and tabular form, on-screen and with hardcopy option. You are likely to refer to a particular ciphertext more than once, so the program saves the text on disk.

I enciphered a line of plaintext from a local newspaper using the program in "The Art of Encoding and Decoding."

I then entered the resulting ciphertext into the Program Listing in this article. The graph of Fig. 2 shows a characteristic profile for simple substitution ciphers. Letter-distribution profiles of various ciphertexts carry distinctive patterns, each becoming almost as familiar to a cryptanalyst as facial features of friends and relatives.

You may find the percentages listed in Table 1 helpful in working back from ciphertext to plain language (plaintext). You can learn more about the significance of this table and accompanying graphs in such notable books as Kahn's

The Codebreakers (Macmillan, 1967).

You can enter plaintext from many sources into this program to study text profiles and letter percentages and to familiarize yourself with known text patterns. If you first enter plaintext and then substitute ciphertext for that plaintext and compare hard-copy profile graphs, you will find them very close, even though the letter columns have changed. The descending-order graphs are identical.

This immediately shows you how the meaning of the language is preserved even though the spelling has undergone considerable crypto manipulation and, further, why substitution ciphers are relatively easy to crack.

As you become familiar with substitution ciphers, enter more complex ciphertext into the program to broaden your expertise. When you find a ciphertext that reveals an essentially flat letter-frequency profile, you have come across a deceptive random hash of letters, or a very tight cipher system.

If you enter a known random sample of more than 500 letters into the Program Listing and inspect the profile graph, the flatness of the profile reveals how close to true random your letters come. The larger the sample, the more nearly flat the profile.

The more letters you enter (up to the 1024 maximum), the taller your distribution graph. Text over 250 words causes the graph to scroll on the screen,

Program Listing

```

10 CLS :CLEAR 5000 :Z=160
20 DIM AS(1030), BS(30),B(30),CS(1030)
30 PRINT :PRINT :PRINT :PRINT :PRINTTAB(20) "CRYPTANALYST'S AIDE NO.2"
40 PRINTTAB(23) "by Karl Andreassen
50 PRINTTAB(21) "Copyright January 1983
60 FOR X=1 TO 1000 :NEXT X
70 PRINT :PRINTTAB(5) "Crypto Aide No.2 affords three functions:"
80 PRINT :PRINTTAB(30) "< A >"
90 PRINTTAB(5) "From file or keyboard, prepares an x-y graph of repetitions in
100 PRINTTAB(5) "alphabetical order, with option to screen or print the graph."
110 PRINT :PRINTTAB(30) "< B >"
120 PRINTTAB(5) "From file or keyboard, tallies and presents graphically cipher-
130 PRINTTAB(5) "text letter repetitions in descending order, plus optional
140 PRINTTAB(5) "table of letter percentages relative to total in text."
150 IF E=1 THEN PRINT "SELECT <A> OR <B> "; :LINEINPUT A0$
160 IF E=1 THEN 700
170 PRINT :PRINTTAB(30) "< C >"

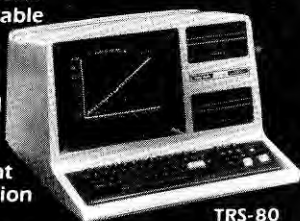
```

Listing continues

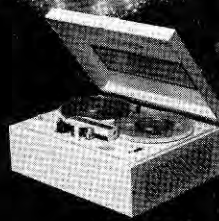
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Letter	Frequency	Percent
T	15	11.9048
E	14	11.1111
O	11	8.73016
R	11	8.73016
N	10	7.93651
A	9	7.14286
S	7	5.55556
I	7	5.55556
P	5	3.96825
F	5	3.96825
M	5	3.96825
L	4	3.1746
C	4	3.1746
Y	3	2.38095
U	3	2.38095
G	2	1.5873
H	2	1.5873
D	2	1.5873
W	2	1.5873
X	2	1.5873
B	1	.793651
K	1	.793651
Q	0	0
V	0	0
Z	0	0

Table 1. Descending Order Letter Count with Percentages


```

180 PRINTTAB(5) "Files ciphertext as entered from keyboard, for multiple
190 PRINTTAB(5) "or subsequent passes during analysis."
200 PRINT :PRINTTAB(11) "SELECT A, B, OR C: "; :LINEINPUT A0$
210 IF A0$<"A" AND A0$<"B" AND A0$<"C" THEN 70 "Error detector
220 IF E=1 THEN 700 "Toggle
230 IF A0$="C" THEN A1$="FILE" :GOTO 300
240 CLS :PRINT :PRINT "ENTER CIPHERTEXT FROM KEYBOARD < KEYB > "
250 PRINT ".....READ CIPHERTEXT FROM FILE < READ > "
260 LINEINPUT ".....ENTER ONE OF THE ABOVE: ";A1$
270 IF A1$="KEYB" THEN 490
280 IF A1$="READ" THEN 300
290 IF A1$<"KEYB" AND A1$<"READ" AND A1$<"FILE" THEN 240
300 PRINT :LINE INPUT "ENTER FILE NAME: ";CCS
310 IF A1$="READ" THEN 330
320 IF A1$="FILE" THEN 440
330 OPEN "D", 1, CCS, 1
340 FIELD 1, 1 AS BBS
350 PRINT "Total number of characters in file = "LOF(1)
360 INPUT "ENTER DESIRED BEGINNING NUMBER OF CHARACTER COUNT, 1 TO 1023 ";A
370 INPUT "ENTER DESIRED ENDING NUMBER OF CHARACTER COUNT, 2 TO 1024 ";B
380 CLS :I%=A :IF A=0 THEN I%=1 :A=1 "Set READ parameters
390 GET 1, I%
391 PRINT I%;
400 AS(I%)=BBS "Load array with file contents
410 IF I%=LOF(1) OR I%=B THEN 430
420 I%=I%+1 :GOTO 390
430 CLOSE :E=1
440 FOR X=1 TO 26
450 BS=BS+CHR$(X+64) "Make ref alphabet
460 B$(X)=CHR$(X+64) "Make alphabet array
470 NEXT X
480 IF A1$="READ" THEN GOTO 700
490 CLS :PRINTTAB(10) "ENTER THE CIPHER UNDER STUDY EXACTLY AS RECEIVED."
500 PRINTTAB(10) "SPACE BAR OK, BUT NO PUNCTUATION PERMITTED." :PRINT
510 PRINT :PRINT "IF ENTRY COMPLETE BEFORE 1024 CHARACTERS, TOUCH < * > ."
520 PRINT :PRINT
530 I%=I%+1
540 IF I%>1024 THEN 620
550 Z$=INKEY$ :IF Z$="" THEN 550
560 IF ASC(Z$)=32 THEN PRINT " "; :GOTO 550
570 IF ASC(Z$)=13 THEN PRINT CHR$(13) :GOTO 550
580 IF Z$="" THEN 620
590 AS(I%)=Z$
600 PRINT Z$;
610 GOTO 530
620 IF A1$="FILE" THEN 630ELSE 700
630 OPEN "D", 1, CCS, 1 "File ciphertext sequence
640 FIELD 1, 1 AS BBS
650 FOR X=1 TO I%
660 LSET BBS=AS(X)
670 PUT 1 :NEXT X
680 CLOSE :A1$="" :E=1
690 CLS :PRINT:PRINT "CIPHERTEXT FILED. PROCEED WITH A OR B: " :GOTO 80
700 FOR X=1 TO 26
710 AS=AS+CHR$(X+64) "Reference alphabets
720 B$(X)=CHR$(X+64)
730 NEXT X
740 PRINT :PRINT:PRINT "COUNTING LETTER REPETITIONS IN CIPHERTEXT..."
750 PRINT "WAIT PERIOD ENTRY DEPENDENT, 5 TO 60 SECONDS."
755 SYSTEM "CLOCK" :PRINT@146, TIMES
760 CLS :PRINT :PRINT :FOR X=1 TO I% :PRINT AS(X); :NEXT X
768 IF A1$<"READ" THEN A=1
769 FOR X=A TO I%
770 FOR Y=1 TO 26 "Count letter repetitions
780 IF AS(X)=MID$(AS,Y,1) THEN B(Y)=B(Y)+1
790 IF B(Y)>L THEN L=B(Y)+1 "Set graph vertical parameter
800 NEXT Y
805 PRINT@Z,"."; :Z=Z+1
806 PRINT X;
810 NEXT X
815 PRINT@226,TIMES :SYSTEM "CLOCK OFF"
820 IF A0$="A" THEN 1110
830 IF A0$="B" THEN 850
840 IF G=1 THEN PRINT "SORT PREVIOUSLY DONE." :GOTO980
850 PRINT "Sort proceeding in descending order of letter frequency. "
860 PRINT "Sort requires 5 to 15 seconds, dependent upon quantity entered. "
870 FOR X=1 TO 25 "Begin sort sequence
880 FOR Y=1 TO 25
890 IF B(Y)>B(Y+1) THEN GOTO 960
900 T=B(Y)
910 ES=B$(Y)
920 B(Y)=B$(Y+1)
930 B$(Y)=B$(Y+1)
940 B(Y+1)=T
950 B$(Y+1)=ES
960 NEXT Y
970 NEXT X :G=1 "End sort sequence
980 CLS :PRINT "RANKING BY REPETITION:"
990 CLS :PRINTTAB(20) "LETTER FREQUENCY TABLE" :PRINT
1000 PRINT "FREQ";TAB(8) "%";TAB(15) "FREQ"; TAB(24) "%";TAB(30) "FREQ";TAB(38) "%";
1010 PRINTTAB(45) "FREQ";TAB(53) "%"; TAB(60) "FREQ";TAB(68) "%
1020 FOR X=1 TO 5 "Lay in letter frequency % table
1030 PRINT B$(X);B(X);B(X)/I%*100;
1040 PRINTTAB(15)B$(X+5);B(X+5);B(X+5)/I%*100;
1050 PRINTTAB(30)B$(X+10);B(X+10);B(X+10)/I%*100;
1060 PRINTTAB(45)B$(X+15);B(X+15);B(X+15)/I%*100;
1070 PRINTTAB(60)B$(X+20);B(X+20);B(X+20)/I%*100
1080 NEXT X
1090 PRINT :INPUT "HARDCOPY THIS TABLE < Y/N >";A4$
1100 IF A4$="Y" THEN 1400ELSE 1110
1110 CLS :FOR X=1 TO I% :PRINT AS(X); :NEXT X :PRINT
1120 FOR X=L TO 1 STEP -1 "Print graph to screen
1130 FOR Y=1 TO 26
1140 IF B(Y)>X THEN PRINTTAB(10) CHR$(154) " "; ELSE PRINTTAB(10) ". ";
1150 NEXT Y
1160 PRINT X

```

Listing continues

clipping off the top. You should make hard copies of these graphs and fold or roll the paper to print the entire graph. Enter the System "FORMS P=0, L=0" call when using letter-sized paper to keep the printer from spacing six lines when the ordinary page length is exceeded.

The Program

The variables used are listed in Table 2.

The menu, lines 70-200, offers three options: an X,Y graph listing letter frequencies of the input text (either plaintext or ciphertext) in alphabetical order; a table of letter-to-total percentages in descending order; followed by an optional graph, also in descending order, of letter frequencies; and an option to file the input text.

If you choose the first option, the resulting profile graph is followed by an option to construct the descending order percentage table and graph. If you choose the second, the descending order table and graph are run without the profile. Both menu selections are followed by a KEYB, READ option, which lets you enter text from either the keyboard or from a previously recorded file.

The INKEY\$ function in lines 490-610 accepts keyboard text entry with auto jump to file or count, if the total text runs more than 1024 letters. If it is less, touching the asterisk key diverts the program to the subroutine.

If you choose to work with filed copy, you can select any portion or all of the file. When the AS array is completed the KEYB-READ selection appears. Counting letters can take from

Continues on p. 196

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```

1170 NEXT X
1180 FOR X=1 TO 26
1190 IF G=1 THEN PRINTTAB(10)B$(X) " "; :GOTO 1210
1200 PRINTTAB(10) MID$(A$,X,1) " ";
1210 NEXT X
1220 PRINT I
1230 INPUT "HARDCOPY PRINTOUT THIS GRAPH <Y/N> ";A5$ :A2$=A5$
1240 IF G=1 AND A5$="N" THEN END
1250 IF A5$="Y" THEN 1510ELSE INPUT "DESCENDING ORDER GRAPH <Y/N> ";A6$
1260 IF A6$="Y" THEN 850ELSE INPUT
1270 FOR X=L TO 1 STEP -1 '==Graph to printer
1280 FOR Y=1 TO 26
1290 IF B(Y)=X THEN LPRINTTAB(10) "*" ; ELSE LPRINTTAB(10) " ";
1300 NEXT Y
1310 LPRINT X
1320 NEXT X
1330 FOR X=1 TO 26
1340 IF A2$="Y" THEN LPRINTTAB(10) B$(X) " "; :GOTO1360
1350 LPRINTTAB(10) MID$(A$,X,1) " ";
1360 NEXT X
1370 LPRINT
1380 GOTO 1630
1390 END
1400 LPRINT"FREQ";TAB(8) "%";TAB(15) "FREQ"; TAB(24) "%";TAB(30) "FREQ";TAB(38) "%";
1410 LPRINTTAB(45) "FREQ";TAB(53) "%"; TAB(60) "FREQ";TAB(68) "%
1420 FOR X=1 TO 5 '==Hard copy, letter frequency table
1430 LPRINT B$(X);B(X);B(X)/I%*100;
1440 LPRINTTAB(15)B$(X+5);B(X+5);B(X+5)/I%*100;
1450 LPRINTTAB(30)B$(X+10);B(X+10);B(X+10)/I%*100;
1460 LPRINTTAB(45)B$(X+15);B(X+15);B(X+15)/I%*100;
1470 LPRINTTAB(60)B$(X+20);B(X+20);B(X+20)/I%*100
1480 NEXT X
1490 IF G=0 THEN 850
1500 IF G=1 THEN 1110
1510 FOR X=L TO 1 STEP -1 '==Hard copy graph
1520 FOR Y=1 TO 26 '==Hard copy, profile and descending graphs
1530 IF B(Y)=X THEN LPRINTTAB(10) "*" ; ELSE LPRINTTAB(10) " ";
1540 NEXT Y
1550 LPRINT X
1560 NEXT X
1570 FOR X=1 TO 26 '==Hard copy graph
1580 IF A2$="Y" THEN LPRINTTAB(10) B$(X) " "; :GOTO1600
1590 LPRINTTAB(10) MID$(A$,X,1) " ";
1600 NEXT X
1610 LPRINT
1620 IF G=1 THEN END
1630 CLS :INPUT "IS DESCENDING ORDER GRAPH DESIRED <Y/N> ";A5$
1640 IF A5$="Y" THEN 850ELSE END

```

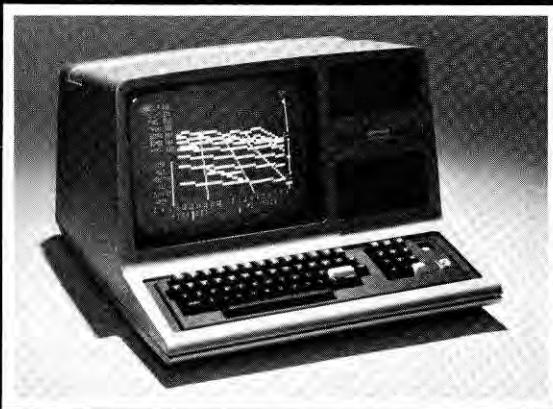
five seconds for a few letters to 5 $\frac{3}{4}$ minutes for a full 1024-letter text, so a preliminary run with a shorter sample saves time.

The clock readout is turned on during

Variables	Functions
A	Begin file records
B	End file records
E	File toggle
F	Graph toggle
G	Sort toggle
L	Graph limiter
A\$	Menu selection
B\$	A-Z alphabet string
Z\$	Input from keyboard
A0\$	Option input
A1\$	Option input
A2\$	Option input
A4\$	Option input
A5\$	Option input
A6\$	Option input
A\$()	Read ciphertext data
B\$()	A-Z alphabet array
BB\$	Data file field variable
CC\$	Data file name
I%	File record number

Table 2. Program Variables

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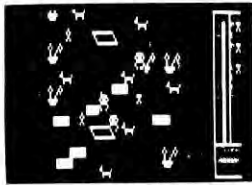
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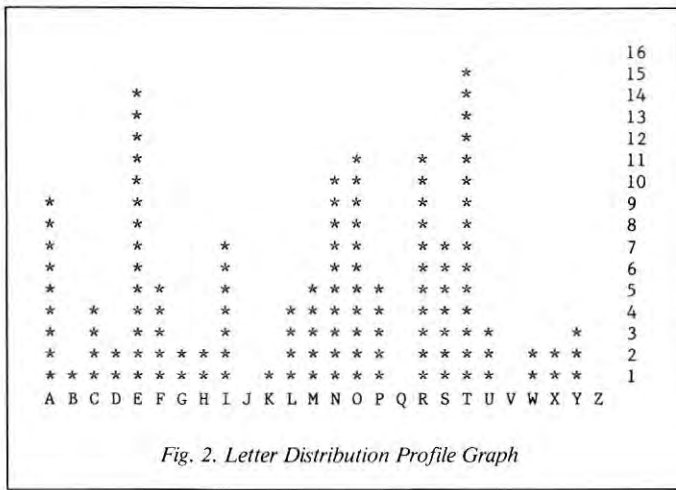


Fig. 2. Letter Distribution Profile Graph

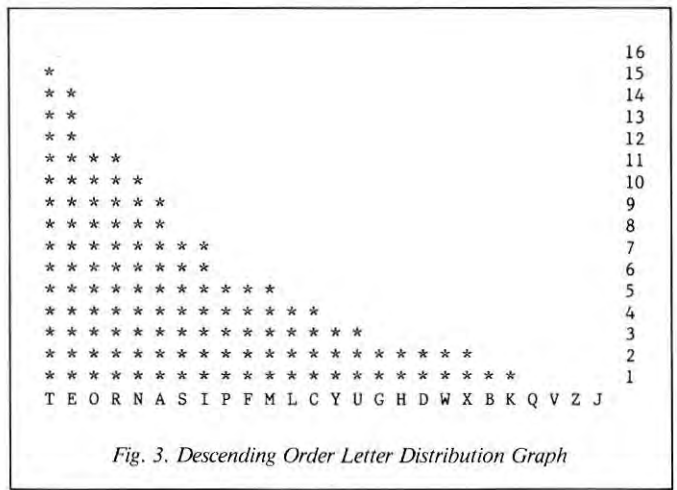


Fig. 3. Descending Order Letter Distribution Graph

the counting period and the starting time is recorded directly below it for comparison. The ending time is indicated momentarily for reference as the count function ends, and the clock is turned off. I included timing to give you some idea of when the count should be finished. The countdown is on the screen to provide visual activity during the wait period.

The sort subroutine of lines 850-970 completes a full text sort in the same time as a short entry—about 15 seconds.

```

BLF XZM VMGVI KOZRMGVCG UILN NZMB HLFIXVH RMGL GSRH KILTIZN ULI
HGFVB LU KILUROVH ZMW OVGVI KVIXVMGZTVH GL YVXLNV UZNRORZI
DRGS PMLDM GVCV KZGGVIMH RU BLF URIHG VMGVI KOZRMGVCG ZMW GSV
GSV HFYHGRGFRLM XRKSVIGVCG IVHFOGRMT UILN GSZG KOZRMGVCG ZMW
XLNKZIV SZIW XLKB KILUROV TIZKSH BLF DROO URMW GSVN EVIB XOLHV
VEVM GSLFTS GSV OVGVI XLOFNMH SZEY XSZMTVW GSV VVHXVMWRMT
LIWVI TIZKSH DROO YV RWVMGRXZO GSR
  
```

Fig. 4. Ciphertext Sample


The letter-frequency table is sent to the screen by lines 990-1080 and to the

printer by lines 1420-1480. The graph goes to the screen by lines 1110-1210 and to the printer by lines 1510-1570.

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Tips on Program Use

After using the program as a training aid or a refresher for recognition of ciphertext profiles, enter and save ciphertexts. Even though the tendency is to think you'll need only one run-through (and therefore don't need to save your work), you should save longer texts to reduce the work of running shorter excerpts from the text.

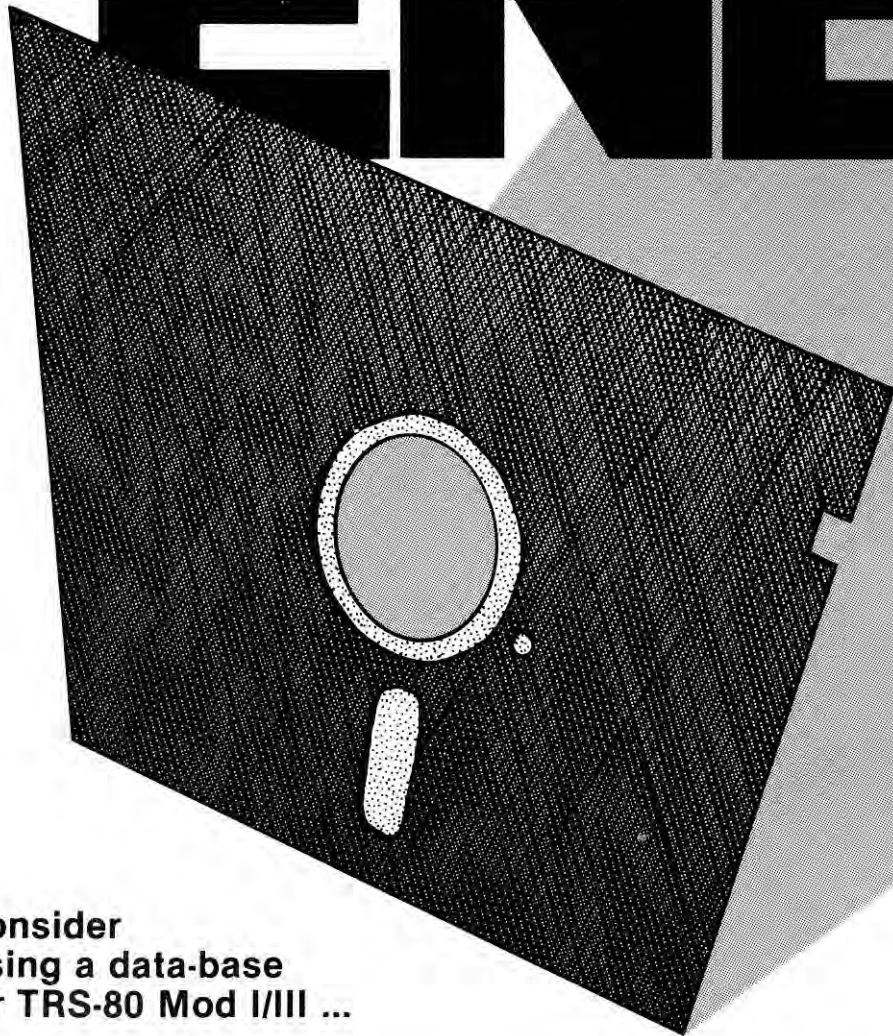
The more text you have to work with, the more likely you'll find a solution early. Short texts can produce misleading profiles, so if more than one message is available in what you believe is the same kind of cipher, enter as many of those short texts as possible.

Use this program in conjunction with that from "The Art of Encoding and Decoding" to form the beginning of your computer-assisted, crypto-lab aids.

Figure 4 is a rather long sample ciphertext; in practice it is better to keep a ciphertext as short as possible, although in cracking an unknown cipher you can thank the wordy originator for the longer sample. ■

Karl Andreassen can be reached at 24750 Chianti Road, Cloverdale, CA 95425.

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Scripsit™ Radio Shack, Visicalc™ Visicorp



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Build an EPROM Programmer

by William Mahoney

Wouldn't it be convenient to have all your favorite programs put into ROM packs? Doing it yourself can save time and money.

Commercially marketed Color Computer programs come in small, plug-in plastic cartridges called ROM packs. Program instructions are permanently burned into the ROM chips within each package.

Alternatively, user-developed programs are saved on cassette tapes and loaded from the tape when desired, a time-consuming process. It would be easier to have often-used or favorite

programs stored in ROM packs for fast, easy loading.

Some companies will burn programs into ROM chips for you, but it's costly and inconvenient. And if a program bug shows up afterward, the pack has to be reprogrammed, an expensive proposition.

Users can incorporate their programs on ROM chips with an EPROM (erasable programmable read-only memory)

programmer. I designed an EPROM programmer for the 2716, 2732, 2532, 2764, and 2564 EPROM chips.

In addition to saving programs in ROM packs, you can replace Radio Shack's 8K ROM operating system with a 2564 chip programmed to suit your own operating system needs.

The EPROM programmer I designed is easy to build and should cost under \$85. All the parts are obtained either at Radio Shack or through mail-order advertisements found in most computer or electronics magazines.

Software

The driver program, written in Assembly language, is about 1,454 (decimal) bytes long and is relocatable, menu-driven, and self-prompting. Although somewhat long, the program features complete error-checking of all user responses and lets you break from any operation that takes longer than a few seconds to execute. It has been thoroughly tested and should be crash-resistant and bug-free.

Program Listing 1 is configured to reside in a 2716 EPROM as part of the programmer. The program has 17 vari-

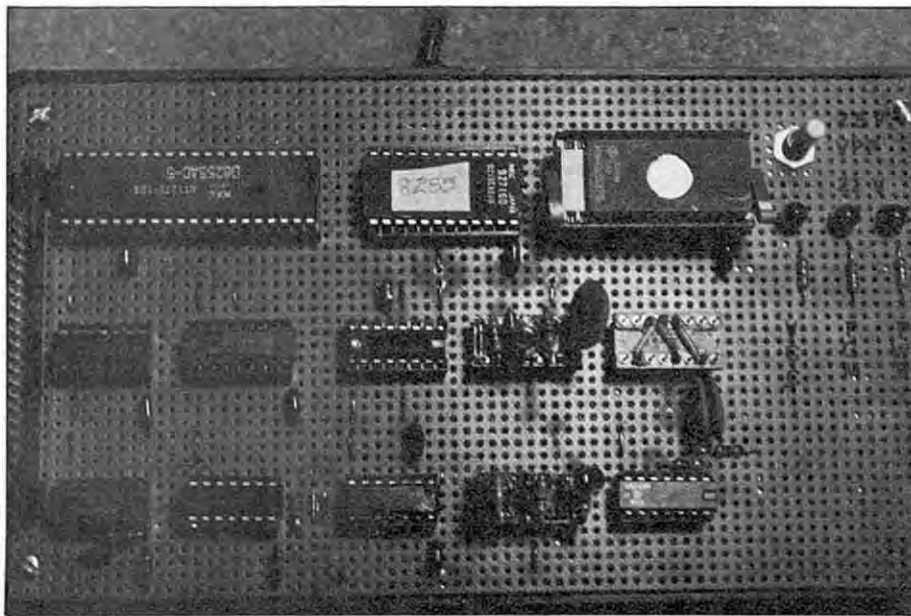


Photo 1

The Key Box

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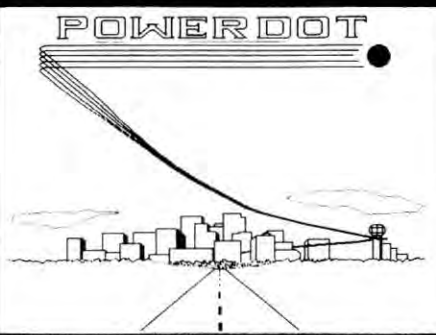
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ables placed in memory locations \$0600-\$0619. The rest of memory (up to the stack) is available for the buffer.

If you have a 4K system, the programmer is somewhat complicated to use since you have only enough buffer

space to program a 2716 EPROM in a single pass. You can program larger EPROMs in segments of about 2K each. Since you probably won't be able to use an editor/assembler to enter the program, you need either a monitor or a

hex loader to enter the machine code from the listing.

Features

The program confirms whether the EPROM is blank, and displays any incorrect locations. You can also program from a master ROM, input data from the keyboard, and program as few or as many locations as you wish. After any program ROM operation, the programmed locations are automatically verified. Any incorrect locations are displayed on the screen.

The EPROM programmer recognizes three commands in addition to prompted responses: down arrow, up arrow, and menu (M-key).

When you enter addresses, the up-arrow key erases the address you're working on and lets you reenter it. The down-arrow key lets you skip the current entry and use the last value entered for that request.

When entering hex data for the input routine, the up-arrow key displays the previous buffer location. When the down-arrow key is used, the next buffer location is displayed.

The M command is recognized any time you enter hex data or addresses, as well as during the program ROM operation. Pressing M immediately returns you to the menu. Any time a verify operation fails, the program displays the address, fail data (data that was incorrect), expect data (data that should be there but isn't), and gives you the option of continuing the verification. Answering no to this prompt returns you to the menu. (The M command is not recognized in this case nor is it accepted during the too-brief verify and learn ROM operations.)

Operation

The EPROM programmer is straightforward and simple to use. With both the computer and the programmer turned off, plug the programmer connector into the computer ROM pack port. Turn the programmer and computer on. You should start by checking that your EPROM is blank.

First turn S1 off, insert the proper personality module, put the EPROM in the programmer socket, and then select the proper voltage programmer (VPP) level (25 or 21 volts) with S1.

Select option 1 (Verify Blank ROM) and give the appropriate start and stop addresses in hex; prefixes such as \$ or &H are unnecessary and will be rejected. If you enter an invalid character, the line is erased and you must reenter the address. If you enter an incorrect

Programmer Integrated Circuits

AB1	8255-5	Programmable Peripheral Interface
A2	74LS74	Flip-flop
A3	74121	Monostable multivibrator (one-shot)
B2	74LS138	One-of-eight decoder
B3	74LS08	Quad 2-input and gate
C1	2716	2K X 8 EPROM
C2	7476	Dual J-K flip-flop
C3	556	Dual timer (555 can be used)
E3	7406	Hex inverting buffer, open collector
Q1,Q2	2N2222A	NPN transistor
D1-D4	1N914	Signal diode
D5	1N4731	Zener diode, 4.3 V
R1	12k	¼ watt 5 percent resistor
R2-R8	1k	¼ watt 5 percent resistor
R13	240k	¼ watt 5 percent resistor
R12	620k	¼ watt 5 percent resistor
R14	82 Ohm	¼ watt 5 percent resistor
R9	15k	¼ watt 5 percent resistor
R10	7.5k	¼ watt 5 percent resistor
C1	100 pF	Disk capacitor (50 V)
C3	.01 µF	Disk capacitor (50 V)
C4-C15	.1 µF	Disk capacitor (50 V)
C2	1.0 µF	Metal film capacitor (other values may also work)
S1	DPDT	Miniature switch, ON-OFF-ON

Sockets

Qty	Size	
5	16 pin	Wire-wrap socket
5	14 pin	Wire-wrap socket
1	24 pin	Wire-wrap socket
1	28 pin	Wire-wrap socket
1	40 pin	Wire-wrap socket
1	28 pin	Zero insertion force socket

Miscellaneous Three LEDs, chassis box (7 3/4" × 4 3/8" × 2 3/8"), perfboard (sized to fit chassis box), seven 16-pin DIP headers, solder, wire-wrap wire, hookup wire, 18" long 40-conductor ribbon cable, 40-pin ribbon cable connector socket, 40-pin wire-wrap ribbon cable DIP header, 40-pin male card-edge type ribbon cable connector (see text).

Power Supply

IC1	LM317T	Adjustable voltage regulator (TO220 case)
IC2	7805	5 V voltage regulator
D1,D2	1N4002	100 V, 1.0 A rectifiers
R2	3.9k	¼-watt 5 percent resistor
R1	240 Ohm	¼-watt 5 percent resistor
R3	2k	10-turn pot (1k should also work)
C3,C4	.1 µF	50 V disk capacitor
C5,C6	1.0 µF	50 V non-electrolytic capacitor (or 22 µF 30 V electrolytic)
C1,C2	1000 µF	50 V electrolytic capacitors
T1	12 V, 1.0 A	Wall plug transformer
F1	1/2 A	Quick-blo fuse
S2	SPST	Rocker switch

Miscellaneous 1 set coax plug/jacks (Radio Shack catalog number 274-1549, 274-1551), wire-wrap pins, four 3/4" standoffs, four 5/16" standoffs, eight screws to fit standoffs, two pair 3-pin Molex connectors, chassis mount fuse holder, epoxy, heat sink (see text), perfboard (2 3/4" × 3 3/4")

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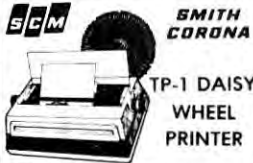
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number, press the up-arrow key and enter the correct number. To use the same address used in a previous operation, hit the down-arrow key and the program defaults to the previous number.

After entering the start and stop addresses, you are asked if you want to make any changes. Answer with a Y or N, or use the M command to return to the menu. The addresses you enter are checked; if the start address is greater than the stop address, the addresses are rejected.

Once you confirm that your EPROM

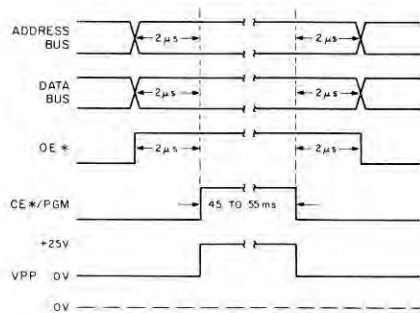


Fig. 1A. 2716 Program Timing

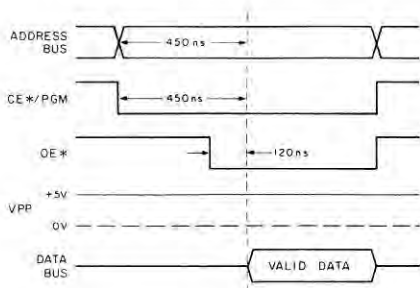


Fig. 1B. 2716 Read Timing

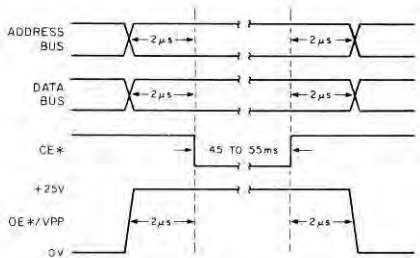


Fig. 2A. 2732 Program Timing

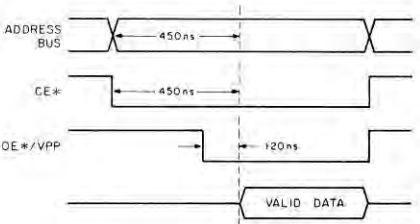


Fig. 2B. 2732 Read Timing

is blank, enter the data you want to program. If you use a master ROM (or EPROM), turn S1 off, put the master ROM in the programming socket, plug in the appropriate personality module, and turn S1 back on. Then select option 2, Learn ROM. You are asked to enter those addresses you wish to copy. The program reads the specified addresses, loads them into the buffer, and returns you to the menu.

If you are using a listing, select option 3 (Input Data) and enter the desired addresses. You are asked to enter hex data while the screen displays each address and its contents. If you don't want to change the contents of a location, the down-arrow key skips to the next location. Use the up-arrow key to revert to a previous location. The program does not let you step back beyond location zero. When you reach the stop address, you are returned to the menu. The rules of address entries apply to wrong or invalid entries as well.

After you enter the data, you are ready to program the EPROM. Turn switch S1 off, and put your blank EPROM back in the programming socket. Turn S1 back on and select option 4, Program ROM.

If you want to use the same start and stop addresses used previously, use the down-arrow key to answer address requests. After answering no to the change address question, the programming operation begins and the VPP LED comes on.

Programming takes about two minutes and 24 seconds for 16K; four minutes and 40 seconds for 32K; and nine minutes and seven seconds for 64K EPROMs. The EPROM is verified after the programming operation is finished, and then returns to the menu.

Long cassette tape programs can be put in EPROMs by using option 5, Move Buffer. CLOADM your program as you normally would. If necessary, add an offset address to put the program above \$0619 so it doesn't get partially overwritten by the EPROM programmer variables.

Type the command EXEC &HC000, and control passes to the programmer. Select option 5 and enter the first (start) address of your program. Stop addresses are not used, but you should still enter any number higher than the start address. Then, when you return to the menu, select option 4, Program ROM. This time, enter the EPROM start and stop addresses you want to use. Note that these are not the start and stop addresses of your program as it resides in the computer memory.

For example, assume you have a program that is 1232 decimal (\$4D0) bytes long that you want to program into the first 1232 locations of your EPROM. Assume also that, when loaded from tape, the program's start address is \$0F00 while the last address is \$13D0. When you run option 5, Move Buffer, enter 0F00 for the start and stop addresses. Under option 4, you would enter 0000 for the start address, and 04CF for the stop address. When programming from location 0000, stop addresses are always one number less than the length of the data because location 0000 is the first actual address.

EPROM Programming

Figures 1-5 are simplified timing diagrams of the EPROMs for which the programmer was designed. Figure 1A shows the essential timing requirements for programming a 2716 5-volt EPROM. This device requires a set of address lines, a set of data lines, an output enable (OE) signal, a chip enable/program (CE*/PGM) signal, and a VPP input. As shown, the address and data lines, as well as the OE* signal, must be valid and stable for a minimum of 2 μ s (microseconds) before the programming signal (CE*/PGM) goes high. Additionally, the VPP line must be set to 25 V prior to pulsing the CE*/PGM signal.

After meeting these requirements, the CE*/PGM line pulses high for 45 ms (milliseconds) to 55 ms. After the CE*/PGM pulse goes low, the address, data, and OE* lines must remain valid and stable for at least 2 μ s. The VPP line can remain high if another location is to be programmed. At this point the data present on the eight data lines is programmed into the location specified by the address lines.

To read the contents of a 2716 EPROM, you must follow the waveforms shown in Fig. 1B. The address lines must be valid and stable, and the CE*/PGM line has to be low for 450 ns (nanoseconds). The OE* line must be low for at least 120 ns. Once these conditions are met, the data output from the EPROM is valid and can be read. Data out remains valid until one of the input signals changes.

To program a 2732 EPROM (Fig. 2A), the VPP level is applied to the OE*/VPP pin instead of a separate pin, and the CE* signal must pulse from a high to a low during programming. In this case, the OE*/VPP line has to go to the VPP level (25 V) at least 2 μ s prior to pulsing the CE* signal, and must remain at that level for at least 2 μ s after

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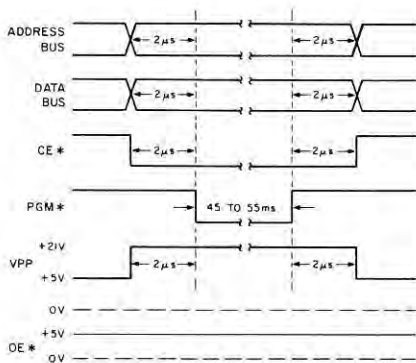


Fig. 3A. 2764 Program Timing

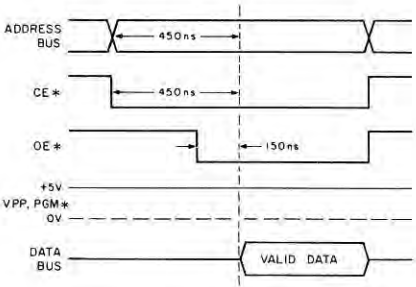


Fig. 3B. 2764 Read Timing

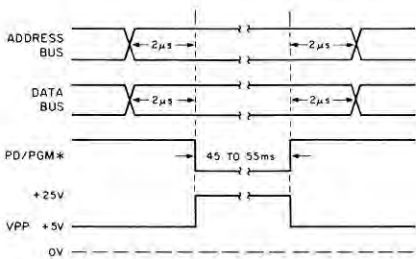


Fig. 4A. 2532 Programming Timing

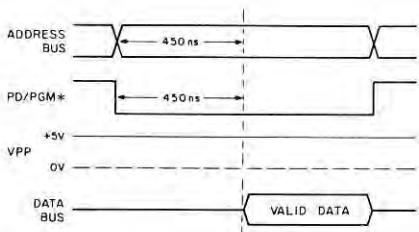


Fig. 4B. 2532 Read Timing

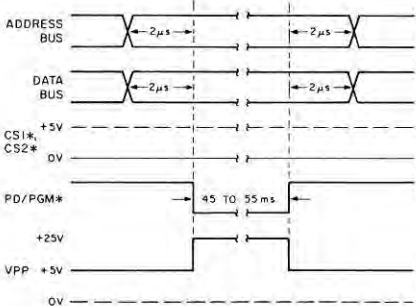


Fig. 5A. 2564 Program Timing

CE* returns high. As with the 2716, CE* must be active for 45 ms to 55 ms. Read timing of the 2732 is identical to that of the 2716.

There are no dual function pins with the 2764. One important difference with

“You can construct a simple programmer which, with the use of personality modules, lets you program [all five EPROMs].”

the 2764 is that the VPP is $21 \pm .5$ V, as compared to the 25 ± 1 V maximum for the 2716 and 2732 chips. The CE* line must now go from high to low (Fig. 3A), and VPP must go to 25 V at least $2 \mu\text{s}$ prior to the programming pulse (PGM*). OE* should be high during the entire operation.

To read a 2764 EPROM, the OE* line must go from high to low 150 ns before data out is valid. In addition, the VPP and PGM* pins have to be pulled high to enable the read operation. All other read timing is the same as for the other EPROMs.

The 2532 EPROM has one less control line (Fig. 4A) than the other devices. The timing requirements for address and data lines remain the same, as does the programming pulse (PD/PGM*). Reading a 2532 is simply a matter of ap-

plying address signals and putting PD/PGM* low. Then, 450 ns later, valid data is available at the output pins.

Figure 5A shows that the 2564 EPROM has a few more control signals than the 2532. Address and data timing are once again unchanged, and the programming pulse (PD/PGM*) is identical to that of the 2532. VPP has its own pin, as in the 2764, but there are two additional select lines, CS1* and CS2*. These lines must be low for both programming and reading. Reading is done as in the 2532 except that the two select lines have to be held low during the entire read cycle.

With all the similarities between these five EPROMs, you can construct a simple programmer which, with the use of personality modules, lets you program all these devices. Personality modules let you connect each EPROM's control, programming, and upper address lines to the proper signal from the programmer.

Theory of Operation

The heart of the EPROM programmer is the 8255 PPI IC (programmable peripheral interface integrated circuit). The PPI provides three bidirectional ports and is nearly ideal for this application. The 8255 PPI has one control register and three basic operating modes.

In mode zero, the simplest of the three ports is programmed to be either an input or output register. Since the EPROM programmer needs only one bidirectional port, I programmed ports A and B as outputs only while port C is used for both read and write (programming) operations. The PPI uses two address lines (A0 and A1), a low true chip select (CS*) signal, a high true reset (RST), a low true read (R*) signal, and a low true write (W*) signal.

When the PPI is selected, address 00 selects port A, address 01 selects port B, and address 02 selects port C, while address 03 selects the control register. Writing \$89 to the control register makes ports A and B outputs, and makes port C an input used to read the EPROM. Writing \$80 to the control register makes all three ports outputs, and is used to program the EPROM.

I soon discovered that the timing relationship between the Color Computer R/W* signal and address lines is incompatible with the PPI. During a write cycle, the R/W* line of the Color Computer remains low for about 10 ns after the address lines change for the next instruction cycle. According to the 8255 specifications, the address lines should not change until 20 ns after the W* line

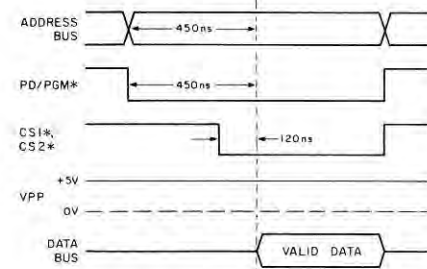


Fig. 5B. 2564 Read Timing

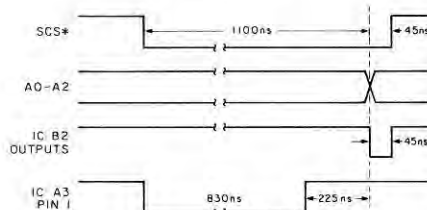


Fig. 6. SCS* Timing

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returns high. By reducing the amount of time that the R/W* signal from the computer is low, I programmed the PPI without difficulty.

I used a 74LS74 (IC A2, Fig. 7) flip-flop and the Color Computer Q clock signal to reduce the amount of time the R/W* signal is low during a write cycle. R/W* is connected to the set input while the Q clock is applied to the reset input of the flip-flop. The flip-flop Q output is used for the PPI R* signal, and the flip-flop Q* output is used for the PPI W* signal.

Using the 74LS74 flip-flop in this manner produces a W* pulse for the PPI that ends about 300 ns before the addresses change. There is no change in the R* signal (other than being inverted), but this is no problem since the critical part of a read operation is at the beginning of the cycle.

In Fig. 7, IC B2, a one-of-eight decoder, uses address lines A0-A2 and SCS* (spare chip select) to select the de-

sired function of the programmer. Unfortunately, the SCS* signal (Fig. 6) stays true, or low, for about 44 ns after the address lines changes. This causes IC B2 to generate a pulse on whatever output is decoded from the new information on address lines A0-A2. This, in turn, causes spurious setting and resetting of the flip-flops used in the programmer. Using a 74121 (IC A3) one-shot reduces the SCS* width enough to avoid this problem.

By using SCS* with the programmer, I eliminated the need for any further decoding circuitry. SCS* is generated when address locations between \$FF40 and \$FF5F are selected. The EPROM programmer uses only addresses \$FF40 through \$FF47, but since other locations decoded by SCS* aren't addressed, this partial decoding causes no problems.

Gates B3-B, B3-C, and B3-D provide CS* to the PPI for addresses \$FF40-\$FF43, the PPI port and control

addresses. \$FF44 produces ROMEN* (ROM enable), while \$FF45 produces PLEN* (pulse enable—the programming pulse). VPPEN* (VPP voltage enable) is produced by address \$FF46, and RST* (reset) is generated by address \$FF47. Since the PPI requires a high true reset, E3-B inverts the low true RST* produced by IC B2. ROMEN*, when decoded, sets C2-A. The resulting low from pin 14 produces OE* for reading the 2716 and 2764 EPROMs. This same signal also provides a low by way of B3-A (PD/PGM* and CE*) to enable 2532, 2564, and 2732 EPROMs for reading.

IC C2-B, when set by VPPEN*, produces a low on pin 10. This low is inverted by E3-C, and turns on transistors Q1 and Q2. When Q1 and Q2 are on, the VPP programming voltage is available at the emitter of each transistor. Two separate VPP outputs are provided because the 2732 EPROM requires its OE*/VPP pin to be low for a read,

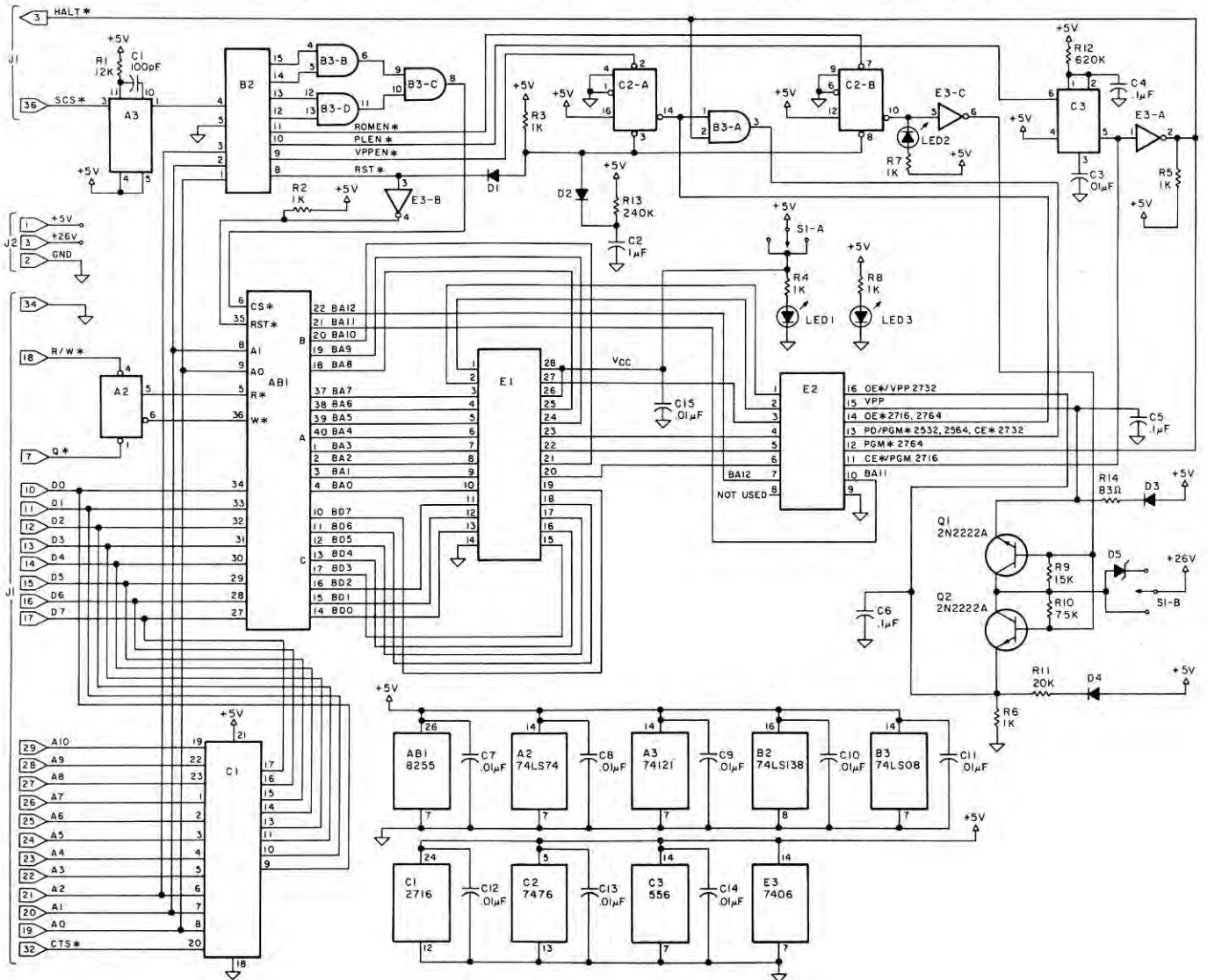
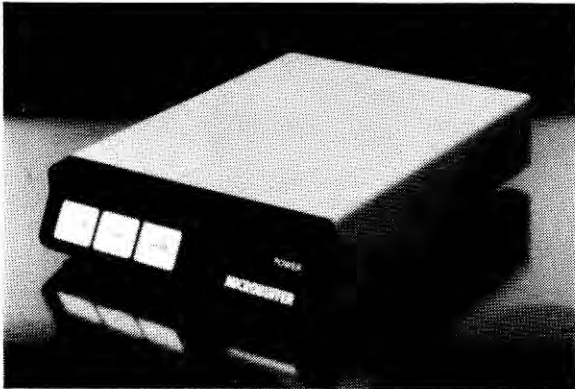


Fig. 7. EPROM Programmer Schematic

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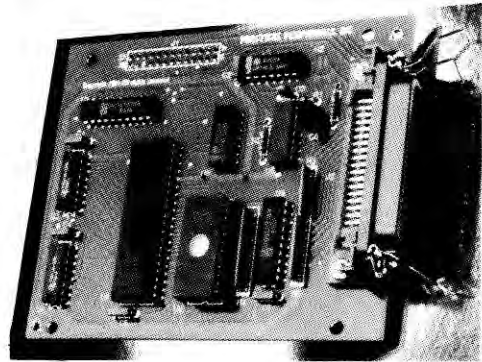
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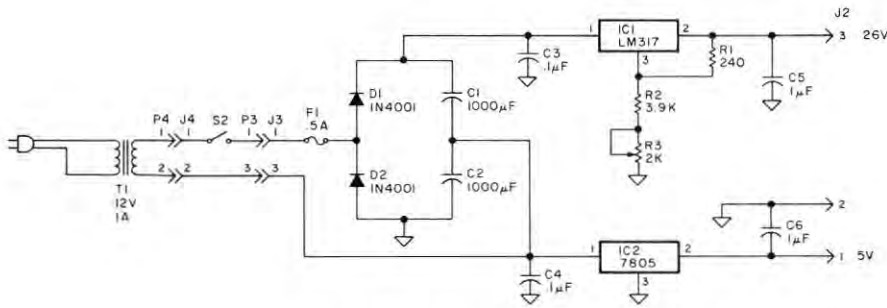


Fig. 8. Power Supply Schematic

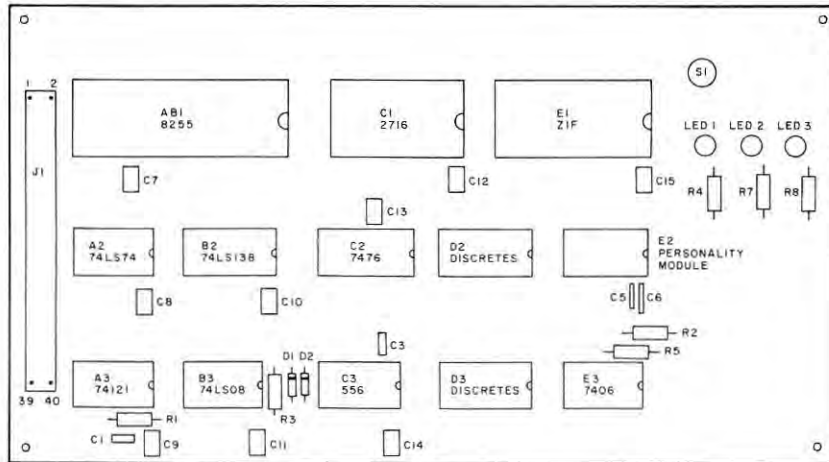


Fig. 9. Programmer Parts Layout

with 25 V applied for programming. The other EPROMs require their VPP pins to be pulled high for a read.

When Q1 is turned off (Q1 and Q2 are always off when you aren't programming), the VPP input is slightly less than 5 V through D3 and R8. When Q2 is turned off, its emitter voltage is less than a volt due to the voltage divider consisting of R11 and R6. Diodes D3 and D4 provide isolation between the 5 V and 26 V power supplies. Capacitors C5 and C6 at the emitters of Q1 and Q2 reduce overshoot of VPP that could damage the EPROMs. LED2 (light emitting diode) indicates when the VPP programming voltage is applied to the EPROM.

IC C3 is a 556 dual timer used to provide the programming pulse for the EPROMs. Resistor R12 and capacitor C4 are selected to provide a 50 ms low-to-high pulse. This pulse is used directly for the 2716 (CE*/PGM), and is inverted for the 2764 (PGM*) by IC E3-A. This same inverted pulse is applied to the 2732, 2564, and 2532 (CE* and PD/PGM*) by way of B3-A. In addition, the inverted pulse is also applied to the Color Computer HALT* line which causes the computer to cease ex-

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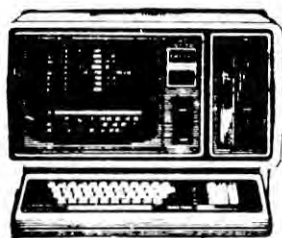
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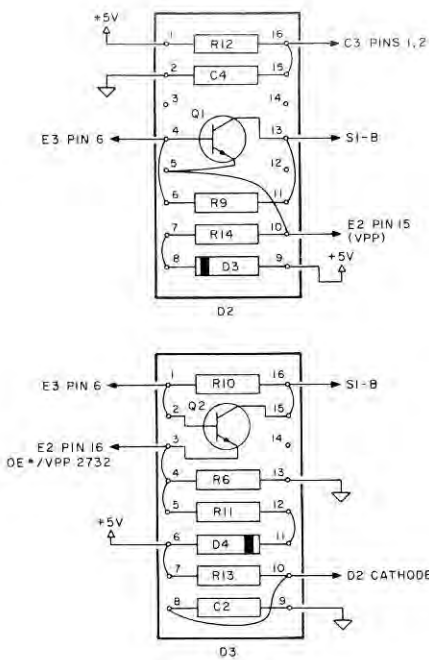


Fig. 10. Discrete Headers

cutting instructions until the HALT* line returns high.

R13 and C2 provide a power-on-reset function. D1, D2, and R3 provide an AND function to gate the power-on-reset and the decoded RST* for IC C2.

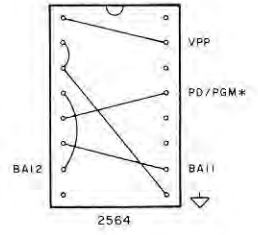
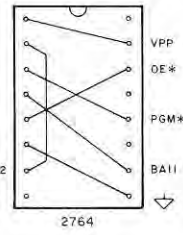
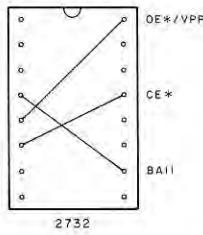
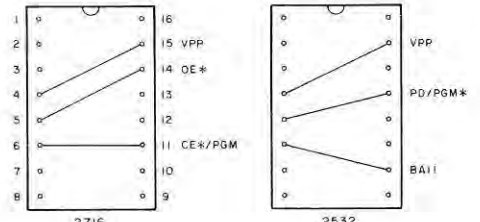
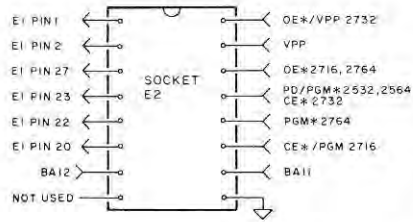


Fig. 11. Personality Modules

Using discrete components in this way creates a needed AND gate without having to add another IC.

E2 is an 18-pin socket used to hold the personality modules. Pins 1-7, 9, and 10 are outputs to the EPROM programming socket E1, while pins 11-16 are inputs from the control circuitry. IC C1 is a 2716 EPROM that contains the program to control the programmer. This EPROM uses CTS* (cartridge

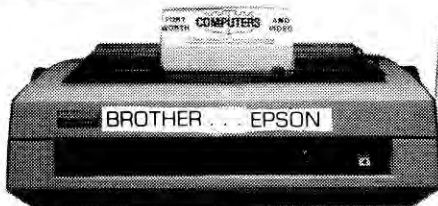
select) from the computer, and is addressed starting at \$C000.

S1 removes VCC from the EPROM programming socket so the EPROMs can be removed and inserted without turning off the programmer. S1 also removes the 26 V supply from Q1 and Q2 to prevent an accidental application of VPP to the EPROM when VCC is off, and allows selection of the correct VPP level. Zener diode D5 reduces

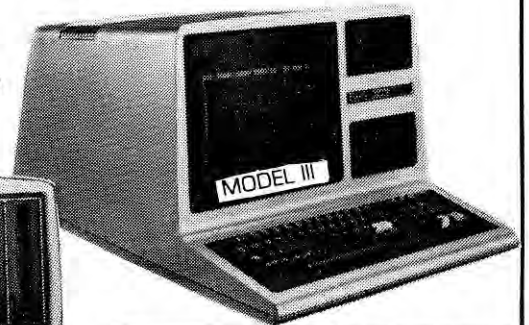
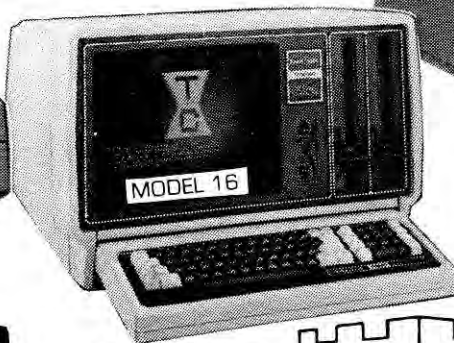
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VPP to 21 V for the 2764 EPROM. LED1 turns on whenever VCC is applied to the EPROM programming socket. LED3 is the power-on indicator.

Power Supply

Figure 8 shows the power supply used for the EPROM programmer. T1 is a 12 V 1.0 A (ampere) wall plug transformer. D1, D2, C1, and C2 form a full-wave voltage doubler that produces approximately 34 V. A tap at the junction of C1 and C2 applies 15 V to a 7805 voltage regulator that generates 5 V. This 5 V supply powers all the logic used in the programmer. IC1 is an LM317 adjustable voltage regulator that uses resistors R1, R2, and variable resistor R3 to provide the necessary adjustment to obtain 26 V. Capacitors C3, C4, C5, and C6 provide transient (voltage spikes or noise) suppression for the regulator ICs.

Selecting Parts

The only component that might be difficult to find is the 40-pin male card-edge type connector. This connector mates with the Color Computer ROM-pack socket, and the only thing I could find in the mail-order catalogs was a 34-pin version used to make disk-drive extender cables. I finally found one at a local outlet after I had completed the project. If you cannot find such a connector, you can build one out of a 40-pin ribbon cable edge connector (Radio Shack catalog number 276-1558) and a small piece of two-sided PC (printed circuit) board stock.

All other parts are available from either Radio Shack or mail-order outlets. I purchased my chassis box from Radio Shack (catalog number 270-232), while my perfboard is a Vector 163677-6DP. This board has a set of power and ground buses, and is nice to use, if expensive. If you use this board, you should cut the buses away from a portion of one end to prevent shorting the 40-pin DIP header pins together.

You can also use plain perfboard and wire-wrap all power and ground connections. If you use this method I suggest you solder the bypass capacitors to wire-wrap pins or directly to the IC socket pins. The discrete AND gate parts and the 74121 timing components are installed the same way.

Building the Programmer

Using the top that comes with the chassis box as a pattern, trim your perfboard and drill four screw holes to fit the top of the box. Then install the IC sockets. Parts layout is not critical,

“Connectors make life easier if you have to remove the board for any reason.”

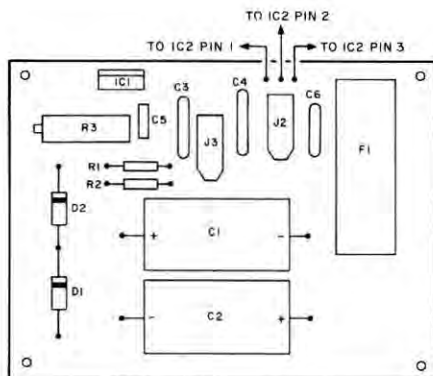


Fig. 12. Power Supply Layout

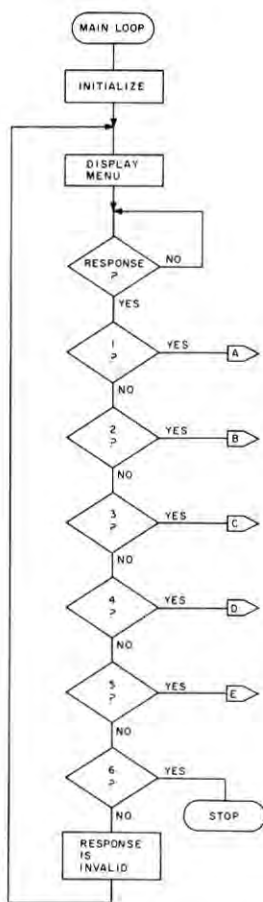


Fig. 13. Main Loop Flowchart

and you can use either my layout (shown in Fig. 9) or any layout convenient for you.

If you are using plain perfboard, a super-glue will hold the sockets and wire-wrap pins in place. Next, install the bypass capacitors, the discrete AND gate, the 74121 timing components, S1, and the three LEDs with their current-limiting resistors (R4, R7, R8). Mount pull-up resistors R5 and R2 as shown in Fig. 9.

Install the 40-pin wire-wrap DIP header as shown, noting the location of pin 1. As each wire-wrap is made, be sure to check it off on the diagram to avoid confusion. Connections to switch S1 are soldered, and the LED connections are either soldered or wire-wrapped using wire-wrap pins. When you finish wire-wrapping, use hookup wire and one of the 3-pin Molex connectors to make a three- to four-inch power supply cable. You should have a connection to ground, 5 V, and 26 V.

Next, assemble the discrete components on the DIP headers that plug into sockets D2 and D3. Refer to Fig. 10 for component placement. Solder these components as quickly as possible and use a low-wattage iron to avoid melting the headers. Pay special attention to mounting the two transistors to ensure that the leads don't touch each other. Now, using an ohmmeter, check your wiring against the schematic. Be sure that the ground and power buses are not shorted together, and that ground is connected to the correct pin on J1.

Personality Modules

Now is a good time to build the personality modules. These modules are simple 16-pin DIP headers with jumper wires soldered to the appropriate pins. Follow the pictorial in Fig. 11, and you should have no problems.

Power Supply Assembly

Next, the power supply is constructed on the 2¾-by-3¾ perfboard. I used a grid board from Radio Shack (catalog number 276-158), but plain perfboard will do. The power supply board is constructed by soldering each component to wire-wrap pins and then wire-wrapping the underside. Refer to Fig. 12 for the layout. I use two 3-pin Molex connectors to make connections to the power supply board. You can solder these connections directly to the board, but connectors make life easier if you have to remove the board for any reason.

The connector that brings 12 V ac (alternating current) onto the power

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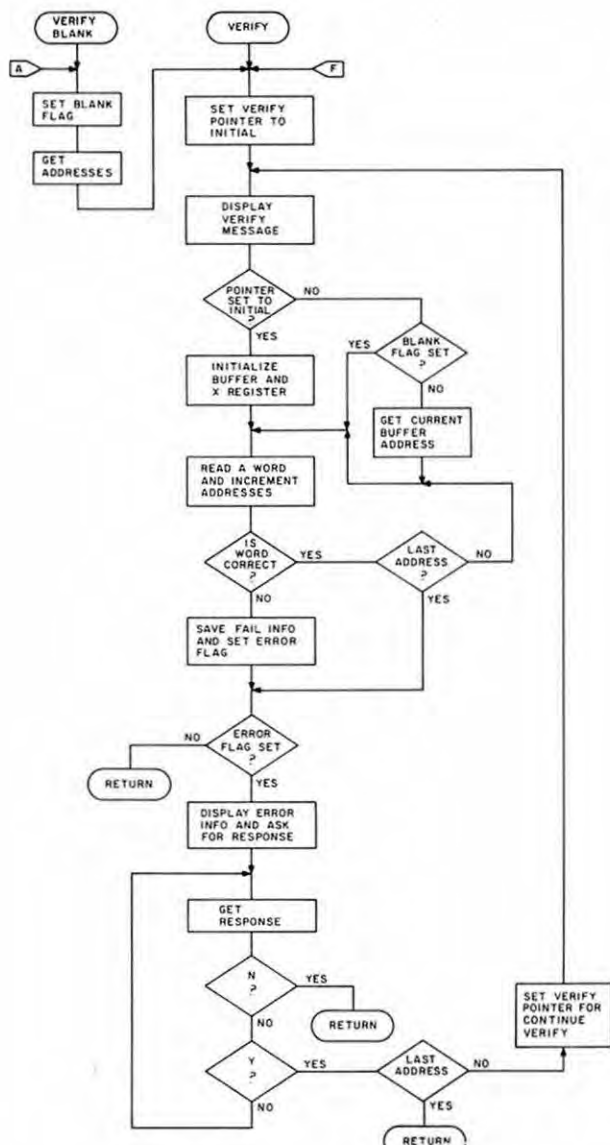


Fig. 14. Verify Routine Flowchart

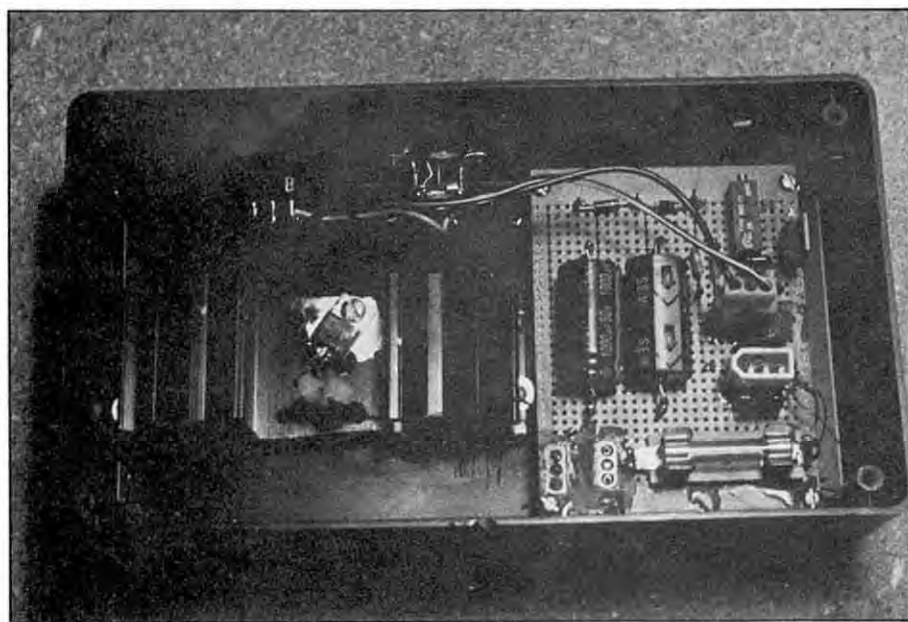


Photo 2. Interior View

supply board uses only two pins, while the connector supplying power to the programmer board uses all three pins. To avoid plugging the cables into the wrong place, make one of the connectors on the power supply board a male connector and the other a female connector. Since the pin spacing does not exactly match the grid spacing on the board, you must slightly squeeze together or stretch apart the solder tails to get them to fit. If your Molex pins are the crimp-on style, you can use 1/4-inch bare hookup wire crimped or soldered into each pin as a solder tail. Use epoxy to anchor the connectors to the board, as solder connections alone are not strong enough to stand up to repeated use of the connectors. Epoxy can also fasten the fuse holder in place. IC2, the 5 V regulator, needs to be well heat sunk. I used a large heat sink (similar to Radio Shack catalog number 276-1361) cut in half to fit inside the chassis box (see Photo 2). Don't forget to check your wiring against the schematic with an ohmmeter. Pay special attention to the voltage regulators. If these are wired wrong, they could be destroyed when you apply power.

Prepare the Chassis Box

Mounting holes are cut in the back of the chassis box for the SPST rocker switch S2 and the chassis-mounted coax power jack. Note also the access hole in the rear of the chassis box to allow adjustment of the 26 V power supply. I used 3/4-inch nylon standoffs to mount the power supply board and 5/16-inch standoffs for the heat sink. These standoffs are attached to the power supply board and heat sink with small screws and epoxied to the box. Be sure to roughen the bottom of the chassis box with coarse sandpaper or the epoxy won't adhere well to the bakelite material.

When the epoxy is dry, finish wiring the power supply. Following the power supply schematic, wire IC2 to the three tie points on the power supply board. Connect the chassis-mounted coax power jack, switch S2, and the remaining Molex connector to the power supply board. Wire the inline coax power plug to the wall plug transformer, and check your wiring. Connect the wall plug transformer to the chassis-mounted jack, plug the transformer into an ac outlet, and turn on S2.

Measure the voltage at the output Molex connector. The 5 V output pin should measure true. The 26 V pin read-

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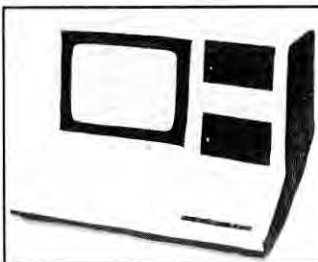
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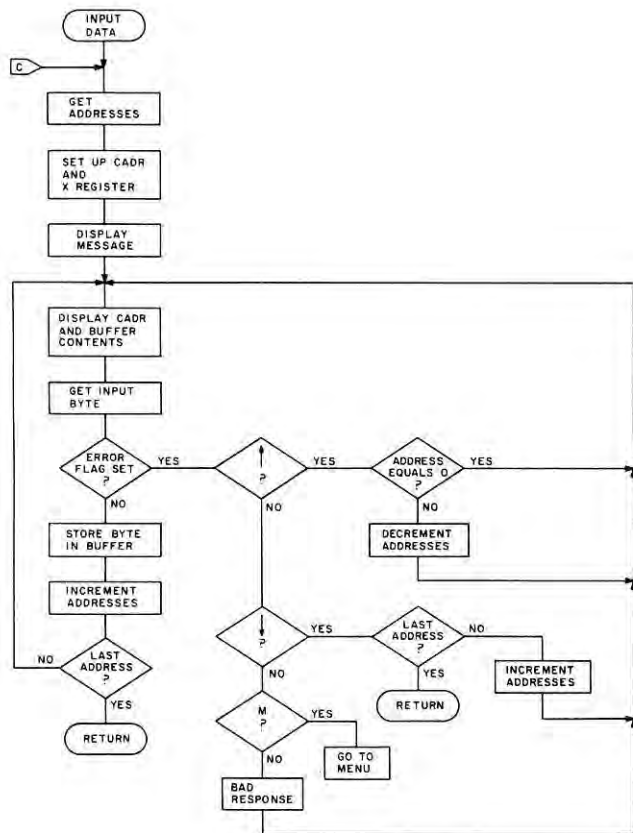


Fig. 15. Input Routine Flowchart

ing varies, but you should be able to get 26 V using the pot (potentiometer or variable resistor). If you don't get either of these voltages, or if the fuse blows, immediately remove power and recheck your wiring. Do not attempt to connect the power supply to the programmer board until you have found and corrected any problems in the power supply.

Once you're sure the power supply is working properly, remove power and connect the programmer board power connector to the power supply output connector. You should not have any ICs or DIP headers plugged into the board. Turn the unit on and make sure that LED3 (power-on) is on. Turn S1 on and verify that LED1 (VCC) is on. Use a voltmeter to ensure that you have the ground and correct voltages at the appropriate pins of each IC socket. When you are sure that the power and ground connections are correct, turn off the power and disconnect the programmer board from the power supply.

The Computer Connection

Now you need that 40-pin ribbon-cable connector mentioned earlier. If you haven't found one, then get a female card-edge ribbon cable connector

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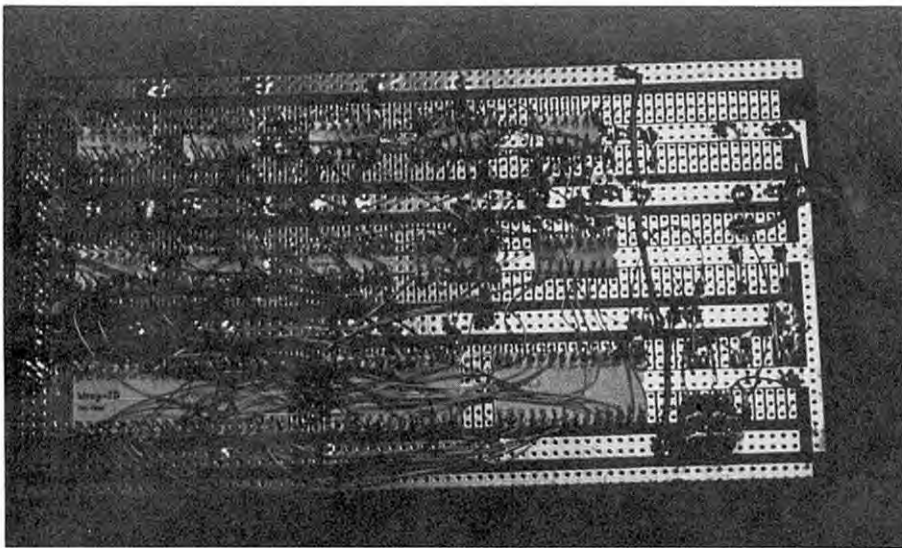


Photo 3. Wiring Side of Programmer

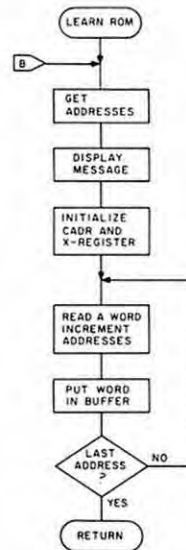


Fig. 16. Learn ROM Routine Flowchart

(Radio Shack catalog number 276-1558) and a piece of two-sided, copper-clad PC board. The board has to be about 2 3/32 inches wide and at least 3/4 inch long. If you make the board longer, it will be easier to plug it into the computer ROM-pack port, but you must be sure that it doesn't touch any metal surfaces.

Once you cut the board down to size, check it for fit by inserting it into your ribbon-cable connector. You may have to file the edges and to bevel or round off all four corners to ease the fit.

Next, mask off 40 traces on the board—20 on each side. Use etch-resistant dry transfers made by Datak Corp. Their assortment package of dry

transfers includes a sheet of straight-line traces perfectly spaced to match the ROM-pack port connector.

Follow the directions included with the transfers and apply 20 traces to each side of the board, making sure each is centered. It should take only about 15 or 20 minutes to etch the board with Datak's etchant; another brand might

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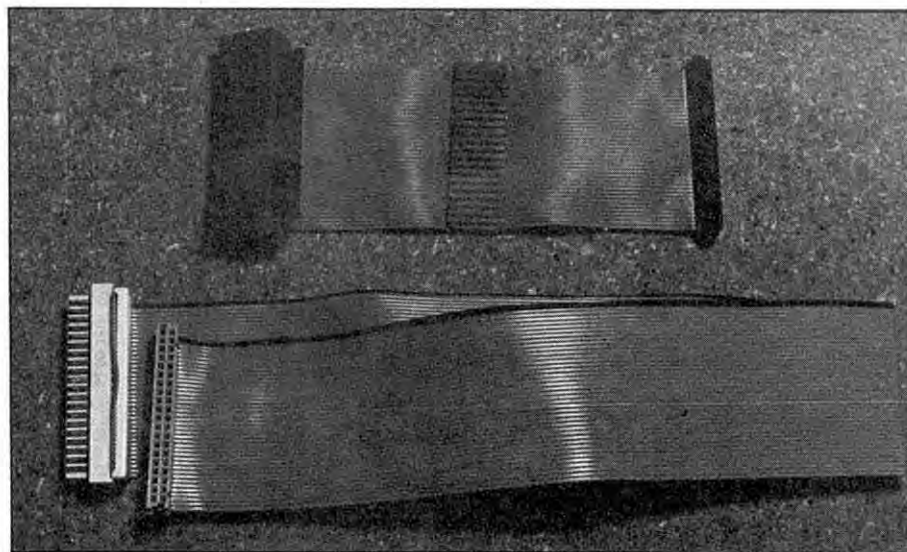


Photo 4. Two Types of Programmer-to-Computer Cables

take longer. Be sure you are in a well-ventilated area when working with the etchant.

If you can't find Datak transfers, you can use a roll of printed circuit tape or a resist-ink pen and a straight edge to make the traces. Measure carefully to get the correct contact spacing for the board. You can measure either the ribbon cable card-edge connector or a ROM-pack edge connector to get the dimensions.

If you don't like etching boards, try one of the blank ROM packs offered by some of the companies that support the Color Computer. You can't use Radio Shack ROM-pack boards because they don't have all the necessary contacts.

Once you finish your connector, you're ready to build your cable. If you are using a male card-edge type connector, you need something to hold the contacts in place while you press the connector onto the cable. A female connector works fine for this. Simply insert the male connector into the female connector and use a vise to press the male connector onto the 18-inch ribbon cable. Remove the female connector and carefully inspect the contacts of the male connector. If they appear pushed out of position, use a pencil or needle-nosed pliers to push them back into place. If you are using the female connector and PC board, simply press the connector onto the cable and insert the board. Next, press the 40-pin socket connector onto the other end of the cable. Make sure that the contacts of each connector are on the same side of the ribbon cable (see Photo 4).

Check It Out

Test the programmer in stages. Any

time you don't get the proper indications, you should turn off all power to the computer and programmer immediately and refer to the troubleshooting section.

With the Color Computer off, plug the male connector into the ROM-pack port. The cable should come out from beneath the connector. As you plug in the male connector, the pin on top and nearest to the back of the computer is pin 1. You can use an ohmmeter to be sure that this pin connects to pin 1 of the 40-pin header on the programmer board. The other end of the cable plugs into the programmer board and should not be twisted or folded over the top of the connector. The programmer board should still have no components plugged into the sockets, and should not be connected to the power supply board. Place the programmer board bottom-up on a nonconducting surface.

Connect a voltmeter between pins 1 (-12 V) and 34 (ground) of the 40-pin header on the programmer board. Be certain that the meter leads don't touch adjacent pins. Turn on the computer and the meter should indicate -12 V. If you measure any other voltage, or if the computer does not start up as usual, immediately remove the power and locate the problem.

Final Assembly and Checkout

You can now install the ICs and the DIP headers with the discrete components. With the programmer disconnected from the computer, turn S1 off and turn on the programmer. Check the ICs for any signs of overheating. While they may get warm, none of them should be hot to the touch. If anything is getting hot, remove the power and find the problem before continuing. When everything seems in order, turn S1 on. The VCC light (LED1) should be on. Measure the transistor cases and you should have +26 V; if not, adjust the 26 V supply accordingly.

Turn off power to the programmer and connect it to the computer. Turn on the programmer first and then turn the computer on. If the computer doesn't start up properly, you have a problem that must be resolved before you continue.

Once the computer turns on without any problem, and it should at this point, set S1 to the 25 V position and enter the command POKE &HFF46,0. The VPP light (LED2) should come on. Measure the VPP voltage at the emitter of Q1, and adjust the 26 V power supply to get a reading of about 25.5 V. The OE*/VPP output at the emitter of Q2

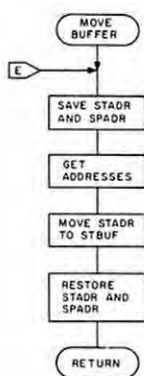


Fig. 17. Move Buffer Routine Flowchart

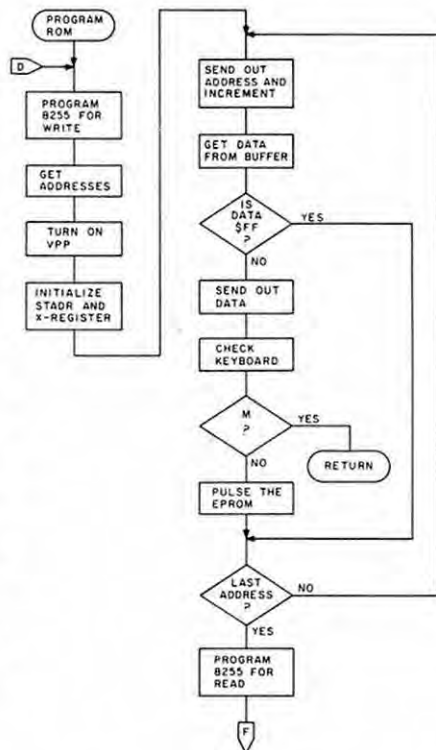


Fig. 18. Program ROM Routine Flowchart

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should read about 25 V. Enter the command POKE &HFF47,0, and the VPP light should go out.

You are now ready to try out your EPROM programmer. Load and assemble the program, and connect the programmer to the computer with the power off. Then turn everything on. Load the program from tape and enter the command EXEC \$3000 (or whatever start address you used).

If everything is running properly, the menu appears. Try running the verify blank ROM routine. I get 00 at every location with an empty socket. Then make sure S1 is off and insert the appropriate personality module and a 2716 EPROM. Select 25 V VPP with S1 and run the verify routine again. If your EPROM is fully erased, the test passes. If your EPROM is not erased, the fail data displays the EPROM contents at the location displayed. The expected data is \$FF for this test. If you have a programmed EPROM and know what the contents should be, this is a good check of the address and data bus lines.

Resolve any problems before continuing.

Your First EPROM

From the main menu, select the

*“If you must
troubleshoot for
defective parts,
a scope is your
most valuable tool.”*

Move Buffer option and set the start address for \$3000 and the stop address to any number equal to or greater than \$3000. When the menu returns, select the program ROM option. It prompts you for addresses and you should enter 0000 for the start and 05AD for the stop

address. After two minutes, the EPROM is programmed and verified.

Did everything work as expected? If so, congratulations! You have done well. Now that you have your EPROM programmed, turn S1 off, remove the EPROM, and turn everything off. Put the EPROM in socket C1 and turn everything except S1 back on. Type in the command EXEC &HC000, and the program should be back up and running. To check out the rest of your programmer, obtain a sample of each of the other EPROMs and try programming them. If you can't afford one of each, at least try to get a 2732. If this device works properly, you have verified every signal except EPROM address line BA12, which is used only with the 64K EPROMs.

Troubleshooting

If you have problems at any point, always correct the problem before going any further to prevent possible damage. Check your wiring before looking for defective parts. If you must troubleshoot for defective parts, a scope is your most valuable tool. A logic probe is less helpful, but will probably do in a pinch. Small routines like those shown in Listing 2 help troubleshoot the programmer one section at a time.

If at any time the computer does not start up properly after being turned on with the programmer attached, then the problem is likely in one of two areas: first, check to be sure you aren't shorting out any of the computer power supplies. Since the programmer provides its own power, you should not have any wire-wrap connections to pins 1, 2, and 9 of the 40-pin DIP header.

If this checks out, then the 8255 PPI has probably seized control of the computer. Check pin 6 (CS*) to see if the PPI is being selected. This pin should always be high unless addresses \$FF40-\$FF43 are selected. These addresses don't appear to be selected during the power-up sequence of the non-disk computer. If the CS* line is low, or has pulses on it, then check ICs B3, B2, and A3 for miswiring or faulty components.

Once the computer is turned on and initialized properly, use the routines shown in Listing 2 should the programmer not work properly. ■

William R. Mahoney can be reached at 145 Laureba Ave., Stratford, NJ 08084.

Program Listing 1

```

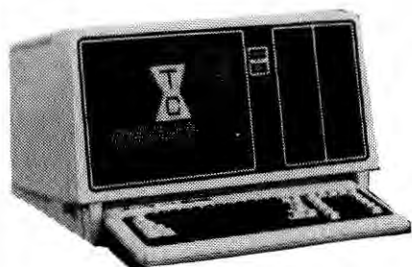
0001      NAM  EPROM  LISTING 1
0002
0003  * BY WILLIAM R. MAHONEY
0004
0005  * VARIABLES START AT $600
0006  * BUFFER STARTS AT $61A
0007
0008  STADR  RMB  2      EPROM START ADDRESS
0009  CADR  RMB  2      EPROM CURRENT ADDRESS
0010  SFADR  RMB  2      EPROM STOP ADDRESS
0011  STBUF  RMB  2      BUFFER START ADDR.
0012  CBUF  RMB  2      CURRENT BUFFER ADDR
0013  ERR   RMB  1      ERROR FLAG
0014  FLADR  RMB  2      EPROM VERIFY FAILED ADDRESS
0015  FLDAT  RMB  1      EPROM VERIFY FAILED DATA
0016  EXDTA  RMB  1      EPROM VERIFY EXPECTED DATA
0017  TEMP  RMB  1      MISCELLANEOUS VARIABLE
0018  MSGPT  RMB  2      MESSAGE POINTER
0019  BLNK  RMB  1      VERIFY BLANK EPROM FLAG
0020  VERPT  RMB  2      VERIFY POINTER
0021  STACK  RMB  2      STACK STORAGE
0022  UPFLG  RMB  1      "U" FLAG
0023  DNFLG  RMB  1      DOWN ARROW FLAG
0024  MFLG  RMB  1      "M" FLAG (MENU)
0025  BUFFER  RMB  2      BEGIN BUFFER
0026
0027      ORG  $3000
0028
0029  CURSOR  EQU  $0080  SCREEN CURSOR LOCATION
A002  CHROUT  EQU  $A002  PUT A CHARACTER OUT TO SCREEN
A928  CLS    EQU  $A928  CLEAR SCREEN
A000  POLCAT  EQU  $A000  CHECK KEYBOARD
0033
0034  * HARDWARE ADDRESSES
0035
FF40  LSRN   EQU  $FF40  EPROM LEAST SIGNIFICANT BYTE
FF41  MSBN   EQU  $FF41  EPROM MOST SIGNIFICANT BYTE
FF42  DATA  EQU  $FF42  EPROM DATA PORT
FF43  CTRL   EQU  $FF43  8255 PPI CONTROL REGISTER
FF44  ROMEN  EQU  $FF44  ENABLE EPROM OUTPUT
FF45  PLEN   EQU  $FF45  50 ns EPROM PROGRAMMING PULSE
FF46  VPPEN  EQU  $FF46  EPROM VPP ENABLE
FF47  RST    EQU  $FF47  RESET EPROM PROGRAMMER FLIP-FLOPS.
0044
0045
0047
0048
0049  * MENU AND MAIN LOOP
0050
0000 12 0051  START  NOP
0052
0001 CE0600 0053  LDU   ##600  VARIABLE SPACE STARTS AT $600
0054
0004 20CB1A 0055  LEAX  BUFFER,U  SET UP DEFAULT BUFFER-
0007 AF46   0056  STX   STBUF,U   START LOCATION
0009 10EFCB15 0057  STS   STACK,U  SAVE STACK ADDRESS
000D B7FF47  0058  MENU  STA   $FF47  RESET PROGRAMMER
0010 8689   0059  LDA   ##89   MAKE 8255 A, B REG. OUTPUTS
0012 B7FF43  0060  STA  CTRL   MAKE 8255 C REG. AN INPUT PORT

```

Listing continues

PERSONAL COMPUTERS

WE HAVE THE NEWEST TRS-80 MODEL 12

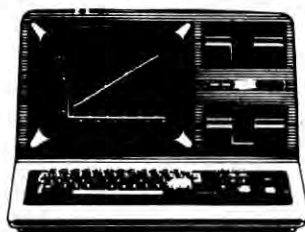


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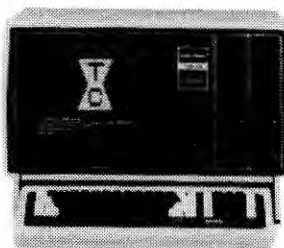
MODEL 16 — 1 DRIVE

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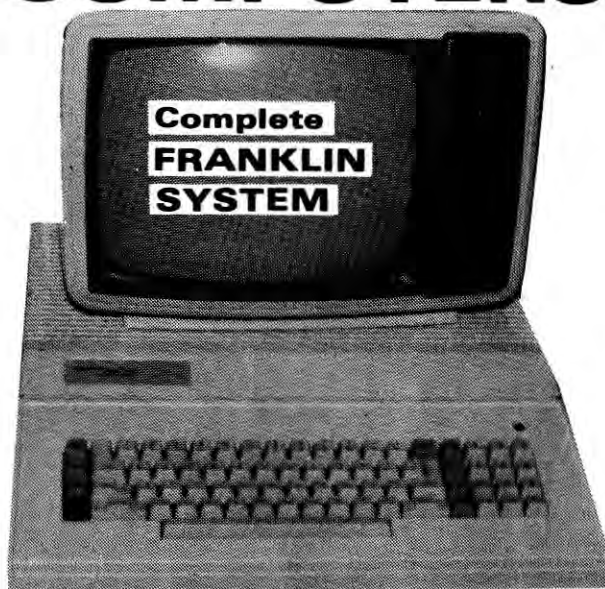
MODEL 16 — 2 DRIVE

\$4779

DT-1 Video **\$620**



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Listing continued

```

3015 6F4A 0061 CLR ERR,U CLR ERROR FLAG
3017 6FCB12 0062 CLR BLNK,U CLR BLANK ROM FLAG
301A 30BD03C4 0063 LDDP LEAX MSGM,PCR GET FIRST MESSAGE FROM TABLE
301E AFCB10 0064 STX MSGPT,U MESSAGE POINTER
3021 17026C 0065 LBSR DISPL1 GO PRINT MESSAGE TO SCREEN
3024 17024B 0066 LBSR KINPUT GET KEYBOARD INPUT
3027 8136 0067 CMPA #336 IS IT EXIT ?
3029 2716 0068 BEQ .B1 IF YES, GO QUIT.
302B 30BD03A0 0069 LEAX CMT-3,PCR SET UP FOR COMMAND JUMP TABLE
302F 3003 0070 .A1 LEAX 3,X GET COMMAND
3031 6D8A 0071 TST 0,X LAST COMMAND?
3033 270B 0072 BEQ MENU YES, BAD RESPONSE
3035 A184 0073 CMPA 0,X MATCH ?
3037 26F6 0074 BNE .A1 IF NO MATCH
3039 EC01 0075 LDD 1,X GET OFFSET FOR JUMP
303B 3001 0076 LEAX 1,X ADJUST X REGISTER FOR JUMP
303D ADBB 0077 JSR D,X GO DO IT
303F 20CC 0078 BRA MENU
3041 39 0079 .B1 RTS
0080
0082
0083 * VERIFY ROM
0084
3042 6CCB12 0085 BLANK INC BLNK,U SET BLANK ROM FLAG
3045 170259 0086 LBSR ADDR GET ADDRESSES
3048 30BD0027 0087 VERIFY LEAX VER1,PCR
304C AFCB13 0088 STX VERPT,U SET POINTER FOR INITIAL VERIFY
304F 30BD0492 0089 LEAX MSGM,PCR
3053 AFCB10 0090 STX MSGPT,U MESSAGE POINTER
3056 170237 0091 LBSR DISPL1 OUTPUT MESSAGE TO SCREEN
3059 17036C 0092 LBSR DLY
305C 6F4A 0093 CLR ERR,U CLEAR ERROR FLAG
305E ADD813 0094 JSR IVERPT,U CLEAR ERROR FLAG GO DO IT
3061 6D4A 0095 TST ERR,U FAILED ?
3063 2601 0096 BNE .B2 IF YES
3065 39 0097 .A2 RTS
3066 17017E 0098 .B2 LBSR ERRDSP SHOW THE FAIL
3069 39 0099 RTS
0100
306A 6DCB12 0101 VER2 TST BLNK,U BLANK FLAG SET
306D 2607 0102 BNE .A3
306F AE48 0103 LDX CBUF,U CURRENT BUFFER
3071 2003 0104 BRA .A3
3073 17014A 0105 VER1 LBSR INIT SETUP CADR,X
3076 170133 0106 .A3 LBSR READ GET WORD
3079 6DCB12 0107 TST BLNK,U BLANK FLAG SET
307C 2704 0108 BEQ .B3 IF NO
307E 81FF 0109 CMPA #3FF FOR BLANK
3080 2002 0110 BRA .C3
3082 A100 0111 .B3 CMPA ,X+ FOR PROGRAM ROM VERIFY
3084 1026014A 0112 .C3 LBNE ERROR IF DIFFERENT, GO PROCESS ERROR
3088 17013E 0113 LBSR CHECK LAST ADDR ?
308B 26E9 0114 BNE .A3 IF NO
308D B7FF47 0115 STA RST
3090 6FCB12 0116 CLR BLNK,U RESET BLANK ROM FLAG
3093 39 0117 RTS
0118
0119 * LEARN ROM ROUTINE
0120
3094 17020A 0121 LEARN LBSR ADDR GET ADDRESSES
3097 30BD04D7 0122 LEAX MSGM,PCR
309B AFCB10 0123 STX MSGPT,U MESSAGE POINTER
309E 1701EF 0124 LBSR DISPL1
30A1 17011C 0125 LBSR INIT SET UP CADR,X
30A4 170105 0126 .A4 LBSR READ GET A WORD
30A7 A780 0127 STA ,X+ PUT IT IN BUFFER
30A9 17011D 0128 LBSR CHECK LAST ADDRESS ?
30AC 26F6 0129 BNE .A4 IF NO
30AE B7FF47 0130 STA RST ALL DONE.
30B1 39 0131 RTS AND GO BACK TO MENU
0132
0134 * INPUT ROUTINE
0135
30B2 1701EC 0136 INPUT LBSR ADDR
30B5 17010B 0137 LBSR INIT
30B8 AF48 0138 STX CBUF,U CURRENT BUFFER
30BA 30BD04A1 0139 LEAX MSGM,PCR

```

```

30BE AFCB10 0140 STX MSGPT,U MESSAGE POINT
30C1 1701CC 0141 LBSR DISPL1
30C4 8680 0142 LP LDA ##0D
30C6 8D3A 0143 BSR .B5
30C8 A642 0144 LDA CADR,U GET CURRENT-
30CA 8D2C 0145 BSR .A5 ADDRESSES-
30CC A643 0146 LDA CADR+1,U FOR-
30CE 8D28 0147 BSR .A5 DISPLAY.
30D0 8620 0148 LDA ##20
30D2 8D2E 0149 BSR .B5
30D4 AE48 0150 LDX CBUF,U GET CURRENT BUFFER ADDRESS
30D6 A684 0151 LDA ,X GET THE DATA THAT'S THERE
30D8 8D1E 0152 BSR .A5 GO PRINT IT
30DA 8620 0153 LDA ##20 GIVE IT A SPACE
30DC 8D24 0154 BSR .B5
30DE 170278 0155 LBSR GETHEX GET A BYTE FROM KEYBOARD
30E1 6D4A 0156 TST ERR,U WAS ERROR FLAG SET ?
30E3 2622 0157 BNE TEST IF YES, GO SEE WHY
30E5 A780 0158 STA ,X+ STORE BYTE IN THE BUFFER
30E7 EC42 0159 LDD CADR,U ADVANCE 16 BIT EPROM-
30E9 C30001 0160 ADDD ##1 CURRENT ADDRESS-
30EC ED42 0161 STD CADR,U AND SAVE IT
30EE AF48 0162 STX CBUF,U SAVE THE CURRENT BUFFER ADDRESS
30F0 1700DB 0163 LBSR CHECK GO SEE IF WE ARE AT STOP ADDRESS
30F3 1026FFCD 0164 LBNE LP IF NOT, GO DO ANOTHER ONE
30F7 39 0165 RTS DEPART.
30F9 17017B 0166 .A5 LBSR ASCII CHANGE TO-
30FB 8D05 0167 BSR .B5 ASCII AND PRINT.
30FD 1E89 0168 EXG A,B
30FF 8D01 0169 BSR .B5
3101 39 0170 RTS
3102 AD9FA002 0171 .B5 JSR [CHROUT]
3106 39 0172 RTS
0174
0175 * CONTROL CHARACTER CHECK
0176
3107 6DCB17 0177 TEST TST UPFLG,U IS IT "^" ?
310A 2611 0178 BNE .B6 IF YES
310C 6DCB18 0179 TST DNFLG,U DOWN ARROW ?
310F 2624 0180 BNE .C6 IF YES
3111 6DCB19 0181 TST MFLG,U IS IT "M" ?
3114 27AE 0182 BEQ LP IF NO, THEN IS A BAD RESPONSE
3116 10EECB15 0183 LDS STACK,U IT WAS M SO RESTORE
311A 16FEF0 0184 LBRA MENU STACK AND LEAVE
311D EC42 0185 .B6 LDD CADR,U BACK UP CURRENT -
311F 27A3 0186 BEQ LP DON'T BACK UP PAST LOCATION 0
3121 830001 0187 SUBD ##1 EPROM ADDRESS
3124 ED42 0188 STD CADR,U CURRENT ADDRESS
3126 EC48 0189 LDD CBUF,U BACK UP CURRENT-
3128 830001 0190 SUBD ##1 BUFFER ADDRESS
312B ED48 0191 STD CBUF,U ADDRESS.
312D 170099 0192 LBSR CHECK IS IT LAST ADDRESS ?
3130 1026FF90 0193 LBNE LP IF NO
3134 39 0194 RTS
3135 EC42 0195 .C6 LDD CADR,U ADVANCE CURRENT-
3137 C30001 0196 ADDD ##1 EPROM ADDRESS
313A ED42 0197 STD CADR,U
313C EC48 0198 LDD CBUF,U ADVANCE CURRENT-
313E C30001 0199 ADDD ##1 BUFFER ADDRESS
3141 ED48 0200 STD CBUF,U ADDRESS.
3143 170083 0201 LBSR CHECK IS IT LAST ADDRESS
3146 1026FF7A 0202 LBNE LP DO IT AGAIN IF NO
314A 39 0203 RTS
0204
0206
0207 *PROM PROGRAM ROUTINE
0208
3148 8680 0209 PROG LDA ##80 MAKE C REGISTER-
314D B7FF43 0210 STA CTRL AN OUTPUT PORT FOR DATA
3150 17014E 0211 LBSR ADDR GET ADDRESS
3153 30BD0376 0212 LEAX MSGM,PCR
3157 AFCB10 0213 STX MSGPT,U MESSAGE POINTER
315A 170133 0214 LBSR DISPL1
315D B7FF46 0215 STA VPPEN TURN ON VPP
3160 8D5E 0216 BSR INIT INITIALIZE CADR AND X REGISTER
3162 EC42 0217 .A7 LDD CADR,U GET CURRENT ADDRESS
3164 B7FF41 0218 STA MSBN OUTPUT ADDRESS TO EPROM-
3167 F7FF40 0219 STB LSBN VIA 8255 PORTS A AND B

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Listing continues

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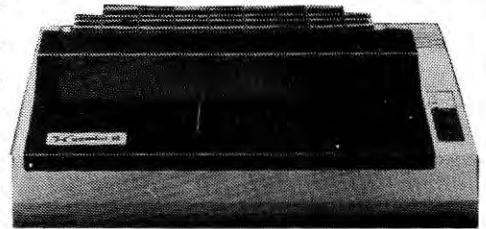
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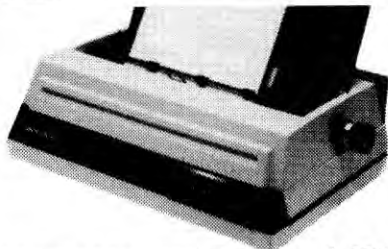
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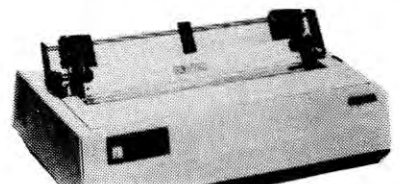
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```

0380 * DISPLAY MSG ROUTINE
0381
3290 B0A92B 0382 DISPL1 JSR CLS
3293 30B010 0383 DISPL2 LEAX [MSGPT,U] POINT TO THE DESIRED MESSAGE
3296 10AEB1 0384 .A11 LDY ,X++ SET UP THE SCREEN LOCATION POINTER
3299 2705 0385 BEQ .B11 IF IT'S AT END OF MESSAGE
329B 17FFC1 0386 LBSR OUTPUT GO PRINT THE STRING
329E 20F6 0387 BRA .A11 GO PRINT THE NEXT STRING
32A0 39 0388 .B11 RTS
0389
0391 * ADDRESS ROUTINE
0392
32A1 B0A92B 0393 ADDR JSR CLS
32A4 30B01AB 0394 STMSG LEAX MSGD,PCR ASK FOR START ADDRESS
32A6 AFCB10 0395 STX MSGPT,U MESSAGE POINTER
32AB 17FFE5 0396 LBSR DISPL2
32AE 6F4A 0397 CLR ERR,U
32B0 1700A6 0398 LBSR GETHEX RESET ERROR FLAG
32B3 6D4A 0399 TST ERR,U GET BYTE
32B5 260D 0400 BNE .A12 IS ERROR FLAG SET ?
32B7 A7C4 0401 STA STADR,U IF YES, GO SEE WHY
32B9 17009D 0402 LBSR STADR,U START ADDRESS (MSB)
32BC 6D4A 0403 TST GETHEX GET SECOND BYTE
32BE 2604 0404 BNE .A12 IS ERROR FLAG SET ?
32C0 A741 0405 STA STADR+1,U IF YES, GO SEE WHY
32C2 2016 0406 BRA SPMSG START ADDRESS (LSB)
0407 ASK FOR STOP ADDRESS
32C4 6DCB17 0408 .A12 TST UPFLG,U IS IT "^^" ?
32C7 26D8 0409 BNE ADDR IF YES,ASK FOR START ADDRESS AGAIN
32C9 6DCB18 0410 TST DNFLG,U <ENTER> OR DOWN ARROW ?
32CC 260C 0411 BNE SPMSG IF YES,DEFAULT START,AND GET STOP
32CE 6DCB19 0412 TST MFLG,U IS IT "M" ?
32D1 27CE 0413 BEQ ADDR IF NO, THEN IT WAS A BAD RESPONSE
32D3 10EECB15 0414 LDS STACK,U RESET STACK POINTER
32D7 16FD33 0415 LBRA MENU
0416
32DA 30B01AE 0417 SPMSG LEAX MSGD,PCR ASK FOR STOP ADDRESS
32DE AFCB10 0418 STX MSGPT,U MESSAGE POINTER
32E1 17FFA0 0419 LBSR DISPL2
32E4 6F4A 0420 CLR ERR,U RESET ERROR FLAG
32E6 170070 0421 LBSR GETHEX GET BYTE
32E9 6D4A 0422 TST ERR,U ERROR FLAG SET?
32EB 260D 0423 BNE .A13 IF YES, GO SEE WHY
32ED A744 0424 STA SPADR,U STORE STOP ADDRESS MSB
32EF 170067 0425 LBSR GETHEX GET SECOND BYTE
32F2 6D4A 0426 TST ERR,U ERROR FLAG SET?
32F4 2604 0427 BNE .A13 IF YES GO SEE WHY
32F6 A745 0428 STA SPADR+1,U STOP ADDRESS (LSB)
32F8 2023 0429 BRA CHNG DD YOU WANT TO CHANGE ADDRESSES
0430
32FA 6DCB17 0431 .A13 TST UPFLG,U IS IT "^^" ?
32FD 270B 0432 BEQ .B13 IF NO
32FF CC060 0433 .D13 LDD ##6060 ERASE STOP-
3302 FD04C1 0434 STD *4C1 ADDRESS -
3305 FD04C3 0435 STD *4C3 ON SCREEN
3308 20D0 0436 BRA SPMSG
330A 6DCB18 0437 .B13 TST DNFLG,U IS IT DOWN ARROW ?
330D 260E 0438 BNE CHNG IF YES
330F 6DCB19 0439 TST MFLG,U IS IT "M" ?
3312 2707 0440 BEQ .C13 IF NO
3314 10EECB15 0441 HOME LDS STACK,U RESET STACK POINTER
3318 16FCF2 0442 LBRA MENU
331B 20E2 0443 .C13 BRA .D13 BAD RESPONSE
0444
0445
0446 * CHANGE ADDRESS ROUTINE
0447
331D ECC4 0448 CHNG LDD STADR,U START ADDRESS
331F 10A344 0449 CMPD SPADR,U STOP ADDRESS
3322 221C 0450 BHI .A14 IF START > STOP, IT'S NO GOOD
3324 30B01B5 0451 LEAX MSGD,PCR
3328 AFCB10 0452 STX MSGPT,U MESSAGE POINTER
332B 17FF65 0453 LBSR DISPL2
332E 17FF3E 0454 LBSR KINPUT GET RESPONSE
3331 8140 0455 CMPA ##4D IS IT "H"
3333 27DF 0456 BEQ HOME IF YES
3335 B159 0457 CMPA ##59 IS IT "Y" ?
3337 1027FF66 0458 LBED ADDR
    
```

```

333B 814E 0459 CMPA ##4E IS IT "N" ?
333D 24DE 0460 BNE CHNG BAD RESPONSE
333F 39 0461 RTS
3340 30B023B 0462 .A14 LEAX MSGD,PCR
3344 AFCB10 0463 STX MSGPT,U MESSAGE POINTER
3347 17FF46 0464 LBSR DISPL1 TELL THEM THE ADDRESSES NO GOOD
334A 3402 0465 PSHS A
334C 86FF 0466 LDA ##FF
334E 170077 0467 .B14 LBSR DLY
3351 4A 0468 DECA
3352 26FA 0469 BNE .B14
3354 3502 0470 PULS A
3356 16FF48 0471 LBRA ADDR
0472
0473 * ROUTINE TO TAKE ASCII INPUT
0474 * AND CONVERT TO HEX BYTES
0475
3359 17FF13 0476 GETHEX LBSR KINPUT GET KEYBOARD INPUT
335C 170021 0477 LBSR HEXCHK MAKE IT HEX AND CHECK FOR ERROR
335F 6D4A 0478 TST ERR,U ERROR FLAG SET ?
3361 261C 0479 BNE .C15 WASN'T HEX, GET OUT
3363 AD9FA002 0480 .A15 JSR [CHROUT] ECHO ASCII CHARACTER
3367 58 0481 ASLB
3368 58 0482 ASLB SHIFT NIBBLE
3369 58 0483 ASLB LEFT
336A 58 0484 ASLB
336B E74F 0485 STB TEMP,U SAVE THE ASCII BYTE
336D 17FEFF 0486 .B15 LBSR KINPUT GET OTHER ONE
3370 17000D 0487 LBSR HEXCHK CONVERT IT
3373 6D4A 0488 TST ERR,U ERROR FLAG SET ?
3375 C10B 0489 BNE .C15 IF YES, LEAVE
3377 AD9FA002 0490 JSR [CHROUT] GO ECHO THE CHARACTER
337B EB4F 0491 ADDB TEMP,U COMBINE IT WITH THE OTHER NIBBLE
337D 1F98 0492 TFR R,A PUT IN PROPER ORDER
337F 39 0493 .C15 RTS
0494
0495 * HEXCHK USED TO CHECK INPUT
0497 * FOR VALID HEX INPUT
0498
3380 6F4A 0499 HEXCHK CLR ERR,U RESET ERROR FLAG
3382 6FCB17 0500 CLR UPFLG,U RESET "^^" FLAG
3385 6FCB18 0501 CLR DNFLG,U RESET DOWN FLAG
3388 6FCB19 0502 CLR MFLG,U RESET MENU FLAG
338B 1F89 0503 TFR A,B SAVE ASCII FOR LATER USE
338D C030 0504 SUBB ##30 MAKE IT BINARY
338F 2D0F 0505 BLT .B16 IF IT'S LESS THAN "0"
3391 C109 0506 CMPB ##9 IF IT'S BETWEEN 0 AND 9, IT'S GOOD
3393 2F0A 0507 BLE .A16 LEAVE
3395 C007 0508 SUBB ##7 PUT IT IN ALPHABET RANGE
3397 C10A 0509 CMPB ##A IS IT BETWEEN #A AND #B ?
3399 2D05 0510 BLT .B16 IT'S NOT ASCII
339B C10F 0511 CMPB ##F
339D 2E01 0512 BGT .B16 IT'S NOT ASCII
339F 39 0513 .A16 RTS
33A0 6C4A 0514 .B16 INC ERR,U SET ERROR FLAG
33A2 8D01 0515 BSR CNTRL IS IT A CONTROL CHARACTER ?
33A4 39 0516 RTS
0517
0518 * CONTROL CHARACTER CHECK
0519
33A5 815E 0520 CNTRL CMPA ##5E IS IT "^^" ?
33A7 2605 0521 BNE .A17 IF NO
33A9 6CCB17 0522 INC UPFLG,U SET "^^" FLAG
33AC 2019 0523 BRA .D17
33AE B10A 0524 .A17 CMPA ##A IS IT DOWN ARROW
33B0 2605 0525 BNE .B17 IF NO
33B2 6CCB18 0526 INC DNFLG,U SET DOWN FLAG
33B5 2010 0527 BRA .D17
33B7 B10D 0528 .B17 CMPA ##0D IS IT <ENTER>
33B9 2605 0529 BNE .C17 IF NO
33BB 6CCB1B 0530 INC DNFLG,U SET DOWN FLAG
33BD 2007 0531 BRA .D17
33BF 814D 0532 .C17 CMPA ##4D IS IT "M" ?
33C1 2603 0533 BNE .D17 IF NO
33C3 6CCB19 0534 INC MFLG,U SET MENU FLAG
33C7 39 0535 .D17 RTS
    
```

Listing continues

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```

0536
0537 * DELAY ROUTINE
0538
33CB 3402 0539 DLY PSHS A
33CA 86FF 0540 LDA *$FF
33CC 4A 0541 .A18 DECA
33CD 26FD 0542 BNE .A18
33CF 3502 0543 PULS A
33D1 39 0544 RTS
0545
0547 * COMMAND/JUMP TABLE
0548
33D2 31 0549 CMT FCC /1
33D3 FC6F 0550 FDB BLANK-*
33D5 32 0551 FCC /2
33D6 FCBE 0552 FDB LEARN-*
33D8 33 0553 FCC /3
33D9 FCD9 0554 FDB INPUT-*
33DB 34 0555 FCC /4
33DC FD6F 0556 FDB PROG-*
33DE 35 0557 FCC /5
33DF FDB5 0558 FDB MOVE-*
33E1 00 0559 FCB 0
0560
0561 *MESSAGE TABLES
0562
33E2 0486 0563 MSGA FDB $486
33E4 31 0564 FCC /1.VERIFY BLANK ROM/
33E5 2E56455249
33EA 465920424C
33EF 414E4B2052
33F4 4F4D
33F6 00 0565 FCB 0
33F7 04A6 0566 FDB $4A6
33F9 32 0567 FCC /2.LEARN ROM/
33FA 2E4C454152
33FF 4E20524F4D
3404 00 0568 FCB 0
3405 04C6 0569 FDB $4C6
3407 33 0570 FCC /3.INPUT DATA/
3408 2E494E5055
340D 5420444154
3412 41
3413 00 0571 FCB 0
3414 04E6 0572 FDB $4E6
3416 34 0573 FCC /4.PROGRAM ROM/
3417 2E50524F47
341C 52414D2052
3421 4F4D
3423 00 0574 FCB 0
3424 0506 0575 FDB $506
3426 35 0576 FCC /5.MOVE BUFFER/
3427 2E4D4F5645
342C 2042554646
3431 4552
3433 00 0577 FCB 0
3434 0526 0578 FDB $526
3436 36 0579 FCC /6.EXIT/
3437 2E45584954
343C 00 0580 FCB 0
343D 0566 0581 FDB $566
343F 54 0582 FCC /TYPE SELECTION/
3440 5950452053
3445 454C454354
344A 494F4E
344D 00 0583 FCB 0
344E 0000 0584 FDB 0
0585
3450 0403 0586 MSGB FDB $403
3452 54 0587 FCC /TYPE START ADDRESS /
3453 5950452053
3458 5441525420
345D 4144445245
3462 535320
3465 49 0588 FCC /IN HEX/
3466 4E20484558
346B 00 0589 FCB 0
346C 0444 0590 FDB $444
346E 54 0591 FCC /TYPE <ENTER> TO /
346F 595045203C
3474 454E544552

```

```

3479 3E20544F20
347E 44 0592 FCC /DEFAULT/
347F 454641554C
3484 54
3485 00 0593 FCB 0
3486 0460 0594 FDB $460
3488 3E 0595 FCC />/
3489 00 0596 FCB 0
348A 0000 0597 FDB 0
0598
348C 04A3 0599 MSGC FDB $4A3
348E 54 0600 FCC /TYPE STOP ADDRESS /
348F 5950452053
3494 544F502041
3499 4444524553
349E 5320
34A0 49 0601 FCC /IN HEX/
34A1 4E20484558
34A6 00 0602 FCB 0
34A7 04C0 0603 FDB $4C0
34A9 3E 0604 FCC />/
34AA 00 0605 FCB 0
34AB 0000 0606 FDB 0
0607
34AD 0543 0608 MSGD FDB $543
34AF 43 0609 FCC /CHANGE ADDRESSES /
34B0 4B414E4745
34B5 2041444452
34BA 4553534553
34BF 20
34C0 3F 0610 FCC /? (Y OR N)/
34C1 202859204F
34C6 52204E29
34CA 00 0611 FCB 0
34CB 0000 0612 FDB 0
0613
0614
34CD 04A7 0615 MSGF FDB $4A7
34CF 50 0616 FCC /PROGRAM IN PROGRESS/
34D0 524F475241
34D5 4D20494E20
34DA 50524F4752
34DF 455353
34E2 00 0617 FCB 0
34E3 0000 0618 FDB 0
0619
34E5 04A7 0620 MSGG FDB $4A7
34E7 56 0621 FCC /VERIFY IN PROGRESS/
34E8 4552494659
34ED 20494E2050
34F2 524F475245
34F7 5353
34F9 00 0622 FCB 0
34FA 0000 0623 FDB 0
0624
34FC 044A 0625 MSGH FDB $44A
34FE 52 0626 FCC /ROM ERROR/
34FF 4F4D204552
3504 524F52
3507 00 0627 FCB 0
3508 0000 0628 FDB 0
350A 04A6 0629 MSGI FDB $4A6
350C 52 0630 FCC /ROM ADDRESS /
350D 4F4D204144
3512 4452455353
3517 2020
3519 00 0631 FCB 0
351A 0000 0632 FDB 0
351C 04C6 0633 MSGJ FDB $4C6
351E 46 0634 FCC /FAIL DATA /
351F 41494C2044
3524 4154412020
3529 00 0635 FCB 0
352A 0000 0636 FDB 0
352C 04E6 0637 MSGK FDB $4E6
352E 45 0638 FCC /EXPECTED DATA /
352F 5850454354
3534 4544204441
3539 54412020

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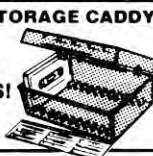
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```

353D 00      0639      FCB  0
353E 0000    0640      FDB  0
3540 0506    0641 MSGL  FDB  $506
3542 43      0642      FCC  /CONTINUE VERIFY ? /
3543 4F4E5449AE
3548 5545205645
354D 5249465920
3552 3F20
3554 28      0643      FCC  /(Y OR N)/
3555 59204F5220
355A 4E29
355C 00      0644      FCB  0
355D 0000    0645      FDB  0
355F 0400    0646 MSGM  FDB  $400
3561 49      0647      FCC  /INPUT HEX DATA/
3562 4E50555420
3567 4845582044
356C 415441
356F 00      0648      FCB  0
3570 0000    0649      FDB  0
3572 044A    0650 MSGN  FDB  $44A
3574 4C      0651      FCC  /LEARNING/
3575 4541524E49
357A 4E47
357C 00      0652      FCB  0
357D 0000    0653      FDB  0
357F 044C    0654 MSGO  FDB  $44C
3581 45      0655      FCC  /ERROR/
3582 52524F52
3586 00      0656      FCB  0
3587 0484    0657      FDB  $484
3589 53      0658      FCC  /START ADDRESS IS /
358A 5441525420
358F 4144445245
3594 5353204953
3599 20
359A 48      0659      FCC  /HIGHER/
359B 4947484552
35A0 00      0660      FCB  0
35A1 04C7    0661      FDB  $4C7
35A3 54      0662      FCC  /THAN STOP ADDRESS/
35A4 48414E2053
35A9 544F502041
35AE 4444524553
35B3 53
35B4 00      0663      FCB  0
35B5 0000    0664      FDB  0
           0665
35B7      0666 LAST  EQU  *
           0667
3000      0668      END  START
           NO ERROR(S) DETECTED
    
```

SYMBOL TABLE:

.A1 302F	.A10 3285	.A11 3296	.A12 32C4
.A13 32FA	.A14 3340	.A15 3363	.A16 339F
.A17 33AE	.A18 33CC	.A2 3065	.A3 3076
.A4 30A4	.A5 30F8	.A7 3162	.A8 3224
.A9 3262	.B1 3041	.B10 328F	.B11 32A0
.B13 330A	.B14 334E	.B15 336D	.B16 33A0
.B17 33B7	.B2 3066	.B3 3082	.B5 3102
.B6 311D	.B7 3184	.B8 3226	.B9 326E
.C13 351B	.C15 337F	.C17 33C0	.C3 3084
.C6 3135	.C7 3193	.C8 324B	.D13 32FF
.D17 33C7	.E8 3251	ADDR 32A1	ASCII 3276
BLANK 3042	BLNK 0012	BUFFER 001A	CADR 0002
CBUF 0008	CHECK 31C9	CHEK 31CB	CHNG 331D
CHROUT 0002	CLS A920	CMT 33D2	CNTRL 33A5
CONT 323F	CTRL FF43	CURSQR 0088	DATA FF42
DISPL1 3290	DISPL2 3293	DLY 33C8	DNFLG 0018
ERR 000A	ERRDSP 31E7	ERROR 31D2	EXDTA 000E
FLADR 000B	FLDAT 000D	GETHEX 3359	HEXCHK 3380
HOME 3314	INIT 31C0	INPUT 30B2	KINPUT 326F
LAST 35B7	LEARN 3094	LOOP 301A	LP 30C4

```

STMGS 32A4      TEMP  000F      TEST  3107      UPFLG  0017
VER1  3073      VER2  306A      VERB  304C      VERIFY  3048
VPPEN 0013      VPPEN  FF46      NARG  0000
LSBN  FF40      MENU  300D      MFLG  0019      MOVE  3194
MSBN  FF41      MSGA  33E2      MSGB  3450      MSGC  34BC
MSGD  34AD      MSGF  34CD      MSGG  34E5      MSGH  34FC
MSGI  350A      MSGJ  351C      MSGK  352C      MSLG  3540
MSGM  355F      MSGN  3572      MSGO  357F      MSGPT  0010
OUTPUT 325F     PLEN  FF45      POLCAT A000     PROG  3148
READ  31AC      ROMEN  FF44      RST  FF47      SPADR  0004
SPMSG  32DA      STACK  0015      STADR  0000     START  3000
    
```

Program Listing 2

```

4000      0001
           0002      NAM  AIDS LISTING 2
           0003      ORG  $4000
           0004
           0005 * BY WILLIAM R. MAHONEY
           0006
           0007 * ROUTINES TO AID IN TROUBLESHOOTING THE CoCo EPROM
           0008 * PROGRAMMER. EACH ROUTINE IS A CONTINUOUS LOOP, AND CAN BE
           0009 * USED TO CHECK ONE OR MORE FUNCTIONS WITH A SCOPE.
           0010
           0011
           0012 * THIS ROUTINE WILL CHECK IC'S A3, B2, B3 (SECTIONS C-D),
           0013 * A2, AND A1. LINE 18 WRITES TO THE PPI CONTROL REGISTER
           0014 * WHILE LINE 19 WRITES TO A PORT. $FF40=PORT A,
           0015 * $FF41=PORT B, AND $FF42=PORT C.
           0016
           0017 START  LDA  #$80      PROGRAMS PPI FOR 3
           0018      STA  $FF43      OUTPUT PORTS
           0019 .A1  STA  $FF40      WRITES TO PORT A
           0020      BRA  .A1      CONTINUOUS LOOP ON WRITE.
           0021
           0022
           0023 * THIS ROUTINE CHECKS THE SAME COMPONENTS AS ABOVE, BUT
           0024 * DOES A CONTINUOUS READ OF THE PPI PORT C
           0025 * LINE 29 PROGRAMS THE PPI PORTS A AND B AS OUTPUTS AND
           0026 * PORT C AS AN INPUT
           0027
           0028 LDA  #$89      PROGRAM PPI FOR PORTS A AND B OUT-
           0029 STA  $FF43      PUT AND PORT C FOR INPUT
           0030 .A2  LDA  $FF42      READS PORT C
           0031      BRA  .A2      CONTINUOUS READ
           0032
           0033
           0034 * THIS ROUTINE CHECKS IC'S A3, B2, B3, E3, C5, Q1, Q2
           0035 * AND ASSOCIATED CIRCUITRY. IN EACH CASE, THE DATA SENT
           0036 * FROM ACCUMULATOR A DOESN'T MATTER AS ONLY THE ADDRESS IS
           0037 * SIGNIFICANT. EACH FLIP-FLOP CAN BE SELECTED BY CHANGING
           0038 * THE ADDRESS WRITTEN TO IN LINE 42.
           0039 * ROMEN*=$FF44, PLEN*=$FF45, VPPEN*=$FF46, AND RST*=$FF47
           0040
           0041
           0042 .A3  STA  $FF44      SET ROMEN FLIP-FLOP
           0043      NOP
           0044      STA  $FF47      RESET PROGRAMMER
           0045      BRA  .A3      CONTINUOUS LOOP ON SET AND RESET
           0046
           0047      END  START
           NO ERROR(S) DETECTED
    
```

SYMBOL TABLE:

.A1 4005	.A2 400F	.A3 4014	NARG 0000
----------	----------	----------	-----------

"ZIPPY"

"ECONOMICAL" 5MEG. SPEED UP for the TRS-80 Model III.

\$ 69.00

EASY INSTALLATION and RELIABLE OPERATION

Plug "ZIPPY" Into your Z-80 Socket and Connect 2 Wires

"UPGRADE"

your TRS-80 Model III to a "DISK DRIVE SYSTEM"

\$ 399.00

Everything you need

- Disk Drive
- Controller Board - 5" & 8"
- Mtg. Brackets
- Power Supply & Cables

!! DISK DRIVES !!

REMEX PREMIUM QUALITY DISK DRIVES
.... AT STANDARD QUALITY PRICES

40-Track, Single Sided, D.D.,	5 ms. step	\$ 185.00	bare
40-Track, Double Sided, D.D.,	5 ms. step	\$ 248.00	bare
		Case & Supply \$49.00	

"COLOR"

TRS-80 Models I & III

- 16 Brilliant Colors
 - 192 x 256 Hi-Rez. Graphics
 - 2 Joystick Ports
 - Color Basic (Permits color commands from Basic)
- ... COMPLETE KIT... includes --
- Board & Manual
 - Parts Kit
 - Power Supply
 - Cables
 - Video Modulator
 - Enclosure

\$ 149.00

"DOUBLER"

for

TRS-80 Mod. I

- MDX - Expansion
 - R.S. - Interfaces
 - LNW - Interfaces
- \$ 99.00**

"MICRO-DESIGN"

"Sales & Service"

	Board & Manual	Parts Kit
MDX-2	\$ 74.95	\$ 189.00
MDX-3	\$ 74.95	\$ 169.00
MDX-4	\$ 29.95	\$ 40.00
MDX-5	\$ 49.95	\$ 79.00
MDX-6	\$ 49.95	\$ 69.00

Enclosure for MDX-2 \$45.00

Character Generator

Mod-I **\$ 18.00**
True Lower Case Decenders

PROGRESSIVE

ELECTRONICS

537 East Main st.
Lancaster, Ohio 43130

Phone: 614-687-1019 ✓ 143
Hours 9 to 5... *VISA* *M.C.*

TRADEMARKS:
TRS-80 - LNW

IJG DEALERS HAVE TRS-

Computer Books and Software for the TRS-80s, are at your IJG Dealer Today.

Books

TRS-80 Disk & Other Mysteries.

The "How To" book of data recovery by H. C. Pennington. 128 pages, \$22.50

Microsoft BASIC Decoded & Other Mysteries.

The complete guide to Level II operating systems & BASIC by James Favour. 312 pages, \$29.95

BASIC Faster & Better & Other Mysteries.

Microsoft BASIC programming tricks & techniques by Lewis Rosenfelder. Software available on disk. Radio Shack Cat. No. 62-1002. 290 pages, \$29.95

The Custom TRS-80 & Other Mysteries.

A guide to customizing TRS-80 hardware and software by Dennis Bathory Kitz. Schematics and listings. 336 pages, \$29.95



TRSDOS 2.3 Decoded & Other Mysteries.

The TRSDOS operating system explained by James Favour. Disassembly of code with commentary. 300 pages, \$29.95

BASIC Disk I/O Faster & Better & Other Mysteries.

Programming techniques and helpful subroutines, by Lewis Rosenfelder, for BASIC programs which store or retrieve data from disk. (Available in June) \$29.95



How To Do It On The TRS-80.

The applications guide to the TRS-80 Models I, II, III & Color Computer by William Barden, Jr. 300 pages, \$29.95 (Available in Spring '83)

Machine Language Disk I/O & Other Mysteries.

The guide to machine language disk software for TRS-80 Models I & III by Michael Wagner. 288 pages, \$29.95

Electric Pencil Operators Manual.

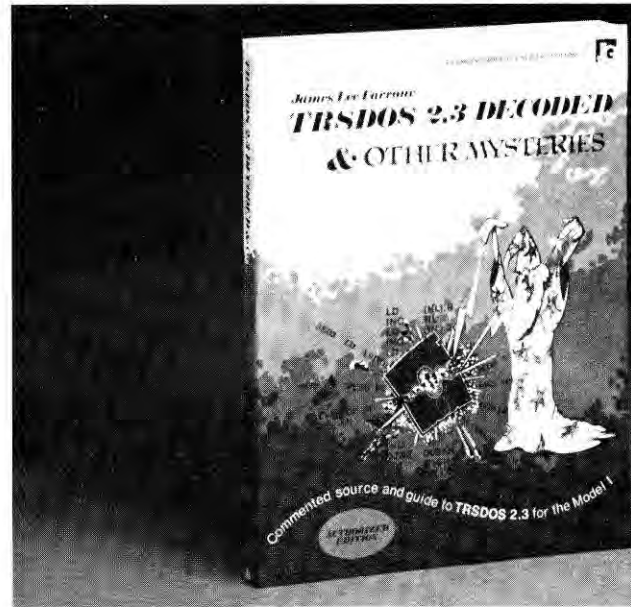
By Michael Shrayer and H. C. Pennington. 123 pages, 24.95

The TRS-80 Beginners Guide To Games & Graphics.

Simple programs teach basic concepts of graphics and game design, by Tom Dempsey. (Available in July) \$24.95

The Captain 80 Book of BASIC Adventures.

Eighteen program listings plus Adventure program generator, by Bob Liddil. 252 pages, \$19.95



NEW BOOK!

Software



Electric Pencil 2.0z Word Processing System.

The easy to learn, easy to use word processing system by Michael Shrayer. Includes operators manual. Disk \$89.95, Cassette or Stringy Floppy \$79.95

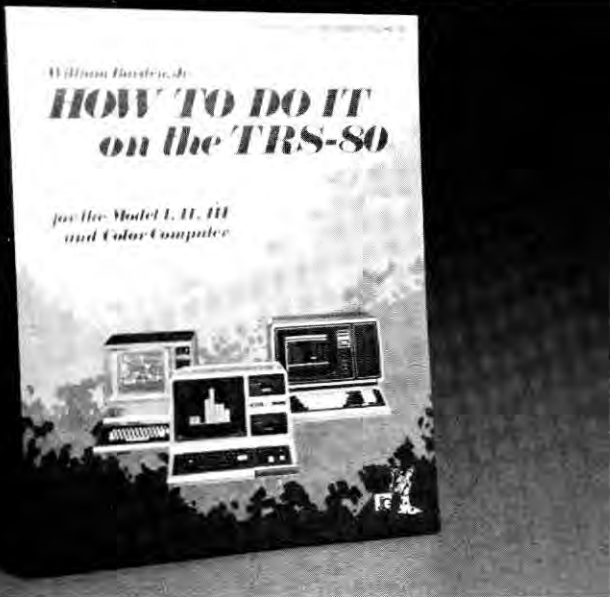


BLUE Pencil — 50,000 Word Expandable Dictionary. Companion to the Electric Pencil 2.0z word processing system. Disk \$89.95

RED Pencil — Automatic Spelling Correction. For use with the Electric Pencil 2.0z word processing system. Must be accompanied by Blue Pencil to operate. Disk \$89.95

BFBDEM — BASIC Faster & Better Library disk by Lewis Rosenfelder. 32 demonstration programs, BASIC overlays, video handlers, sorts and more for the Model I & III. Radio Shack Cat. No. 260-2021. Disk only \$19.95

80[®] BOOKS & SOFTWARE.



NEW BOOK!

BFBLIB — BASIC Faster & Better Demonstration disk by Lewis Rosenfelder. 121 functions, subroutines and user routines for the Model I & III. Disk Only \$19.95

Utilities

TRANSLATE Convert any character to any character or string. Create your own shorthand. Print special characters. Disk \$49.95

DISKMAP Produces two different reports; a listing of disk space allocation by granule, and a listing of all granules allocated to each data file. Disk \$29.95

Games

CYBERCHESS Chess Improvement System. Not a game, but a powerful and effective method for improving one's skill in chess. Choose from 55 amateur or 55 professional disk packets with 4 different games on each. System Disk \$29.95 (Includes four games). Each amateur or professional disk \$19.95 each.

FLAG RACE Race your car through a maze and try to reach all the flags before being caught and killed by drone cars. Can you do it?

For Models I & III. Disk \$24.95

SPACE ROBBERS

Inter-galactic thieves are after your supplies and you must stop them before they take it all. For Models I & III. Disk \$24.95

INTERCEPTOR

The aliens are attacking you in wave after wave, can you survive and get back to the mother ship to refuel? For Models I & III. Disk \$24.95

ALIENS

Invaders attempt to land and you must stop them. But watch out, you're dead if they land on you. For Models I & III. Disk \$24.95

APPLE PANIC Crazy apples chase you over many ladder connected brick levels. Your only hope is to dig holes in the floor and beat them down when they get stuck. Disk \$24.95, Cassette \$19.95

THE BLACK HOLE Your mission is to seek-out and destroy the Dorian leader. But, can you survive the perils of the Black Hole? Disk \$24.95, Cassette \$19.95

TIME RUNNER Newly discovered land is yours for the taking. All you have to do is take it . . . before the defender droids catch you that is. Disk \$24.95, Cassette \$19.95



FUNSOFT Games distributes through IJG for Models I & III.

BABLE TERROR Bables are roaming the maze like complex everywhere but you can only see a few yards ahead, can the Bables be cleared out before they clear out you? Disk \$24.95, Cassette \$19.95

MAD MINES Mad Mines are being placed into the space around your planet. As their mad pace speeds up, the situation becomes more difficult. Can they all be destroyed? Disk \$24.95, Cassette \$19.95

IJG products are available at computer stores, B. Dalton Booksellers, Radio Shack Computer stores, and independent dealers around the world.

If IJG products are not available from your local dealer, order direct from IJG. Include \$4.00 for shipping and handling per item. Foreign residents add \$11.00 plus purchase price per item. U.S. funds only please.

IJG, Inc.
1953 West 11th Street
Upland, California 91786
Phone: 714/946-5805

446
**If it's from IJG
IT'S JUST GREAT!**

Buyer's Guide to Disks and Drives

FLOPPY DISK DRIVES

Company	Model	For TRS-80 Model	Disk Size	Disk Capacity (Kilobytes)
Interface Inc.	100-1	I, III	5 1/4 "	160
Matchless Systems	600	I, III	5 1/4 "	250
	627	Same	Same	Same
	650	II, 12, 16	8 "	600
	654	Same	Same	Same
Microcomputer Technology	350 TF 11	I	5 1/4 "	174
	1470 140-1	III	Same	175
	1471 140-2	Same	Same	Same
	1473 140-3 & 140-4	Same	Same	Same
Percom Data Corp. Inc.	TFD40-1	I	5 1/4 "	184
	TFD40-2	Same	Same	Same
	TFD340-N1	III	Same	Same
	TFD340-N2	Same	Same	Same
	ADD340-N1	Same	Same	Same
	ADD340-X1	Same	Same	Same
	ADD340-X2	Same	Same	Same
PMC Inc.	SFD-51A	I, III	5 1/4 "	250
Radio Shack/Tandy Corp.	261161	I	5 1/4 "	350
	264160	II	8" (76-track)	486
	261164	III	5 1/4 " DS, DD	175
	263023	CC	5 1/4 " (35-track)	156
VR Data Corp.	100-1	III	5 1/4 "	175

NA—Not Available
SS—Single-Sided

DS—Double-Sided
SD—Single-Density

For years now you have been saving your pennies in a coffee can, sacrificing the good things in life, and you're finally ready to visit the local computer store to buy a hard or floppy disk drive. To your dismay, you discover a variety of disk drives for your computer.

Before you tear at your micro in despair, take a look at this buyer's guide. We've taken the frustration out of selecting a disk drive for you. We've included information on both hard disk drives and floppy drives (for those of you who have only a half-full can of pennies). We've also listed information on floppy disks.

Floppy Disk Drives

We haven't forgotten you Model I owners or those of you considering another floppy disk drive for your system. Unless otherwise noted in the chart, all the floppy disk drives listed are 40-track, single-sided, double-density drives. This is the most common add-on

unit on the market today, and the one that most of you purchase.

We omitted original equipment manufacturers (OEMs) from this listing since they provide drives and parts for virtually hundreds of different

hard and floppy disk drive system.

When you look over the floppy guide, you'll notice that there is a wide range in the disk capacity for these drives (160-600 kilobytes). So if you need a specific capacity for your up-

Continues on p. 238

Interface Inc.
7630 Alabama Ave.
Canoga Park, CA 91304
213-341-7914

Matchless Systems
18444 S. Broadway
Gardena, CA 90248
213-327-1010

Microcomputer Technology Inc.
1530 S. Sinclair St.
Anaheim, CA 92806
714-978-9833

Percom Data Corp., Inc.
11220 Pagemill Road
Dallas, TX 75243
214-340-7081

FLOPPY DISK DRIVE MANUFACTURERS

Personal Microcomputer Inc.
475 Ellis St.
Mountain View, CA 94043
415-962-0220

Radio Shack/Tandy Corp.
One Tandy Center
Fort Worth, TX 76102
817-390-3011

VR Data
777 Henderson Blvd. N-6
Folcraft, PA 19032
800-345-8102

Avg. Access Time (ms)	Track → Track Access Time (ms)	Data Transfer Rate (K bits/s)	Warranty	Price
75	5	250	90 days P/L	\$235
75	5	NA	90 days P/L	\$399.95 (1 drive)
Same	Same	Same	Same	\$686 (2 drives)
NA	3	500	Same	\$745 (1 drive)
Same	Same	Same	Same	\$1260 (2 drives)
NA	6	NA	90 days P/L	\$299
Same	Same	Same	Same	\$499 (1 drive)
Same	Same	Same	Same	\$239 (2 drives)
Same	Same	Same	Same	\$299 (3 or 4 drives)
NA	5	250	90 days P/L	\$399 (1 drive)
Same	Same	Same	Same	\$789 (2 drives)
Same	Same	Same	Same	\$579 (1 internal drive)
Same	Same	Same	Same	\$959 (2 internal drives)
Same	Same	Same	Same	\$399 (1 add-on drive)
Same	Same	Same	Same	\$419 (1 add-on external)
Same	Same	Same	Same	\$829 (2 add-on externals)
100	5	250	9 months P/L	\$355
NA	5	500	90 days P/L	\$499 (2nd drive)
Same	Same	Same	Same	\$1150 (incl. cabinet)
Same	Same	Same	Same	\$449 (3rd drive)
Same	Same	Same	Same	\$399 (2nd drive)
90	5	250	120 days P/L	\$864

DD—Double-Density
P/L—Parts and Labor

Y—Yes
N—No

F—Fixed
R—Removable

HARD DISK DRIVES

Company		For Use With Model	Data Capacity (Megabytes)	Disk Size	Operating System
A. M. Electronics Inc.	RD-5067	III	6.7 F (unformatted)	5¼"	DOSPLUS 4.0
	RD-5133	Same	13.3 F (unformatted)	Same	Same
A. R. Business Systems	ARM 525	I, II, III 12, 16	5 F	5¼"	I/III: LDOS II, 12, 16: HSDS
	NA	Same	5 F	Same	Same
	Same	Same	10 F	Same	Same
	Same	Same	15 F	Same	Same
	Same	Same	20 F	Same	Same
	Dual Unit	Same	10 F	Same	Same
	Same	Same	20 F	Same	Same
	Same	Same	30 F	Same	Same
B. T. Enterprises	200505	I, II, III 12, 16	5 F	5¼"	I/III: DOSPLUS II, 12, 16: DOSPLUS (or) TRSDOS
	200510	Same	10 F	Same	Same
	200515	Same	15 F	Same	Same
Cameo Electronics Inc.	Subsystem 3	II	5 F, 5 R	8"	II: CP/M (or) TRSDOS (\$400 extra)
	1010	Same	10 R	Same	Same
	1040	Same	40 F	Same	Same
	1050	Same	40 F, 10 R	Same	Same
	1020	Same	10 F, 10 R	Same	Same
Compukit	NA	I/III	5 F	5¼"	I/III: DOSPLUS
	Same	Same	10 F	Same	Same
	Same	Same	15 F	Same	Same
Corvus Systems Inc.	Model 6	I, II, III	6.7 F (unformatted)	5¼"	I/III: NEWDOS80 II: BIOS Driver
	Model II	Same	14.0 F (unformatted)	Same	Same
	Model 20	Same	21.0 F (unformatted)	Same	Same
I. Q. Systems	Graymatter 5	II	5 F	5¼"	CP/M
	Graymatter 10	Same	10 F	Same	Same
	Graymatter 20	Same	20 F	Same	Same
J & M Systems	JHD-III 5	III	5 F	5¼"	LDOS (\$89 extra)
	JHD-III 10	Same	10 F	Same	Same
Maezon	V5000	III	5 F	5¼"	LDOS
	V10000	Same	10 F	Same	Same
	V15000	Same	15 F	Same	Same
Microcomputer Technology	E5	III	5 F	5¼"	DOSPLUS 4.0
	E11	Same	11 F	Same	Same

NA—Not Available
SS—Single-Sided

DS—Double-Sided
SD—Single-Density

Avg. Access/Retr. Time (ms)	Track-Track Access Time (ms)	Transfer Rate (K bits/s)	Mean Time Between Failure (Power-on Hours)	Daisy Chain	Warranty	Extended Warranty	Price
75	3	625	10,000	Y—4 drives	90 days P/L	N	\$1995
Same	Same	Same	Same	Same	Same	Same	\$2295
70	NA	500	10,000	N	6 months P/L	Y	\$1995
Same	Same	Same	Same	Y—8 drives (or) up to 330 megabytes	Same	Same	\$2495
Same	Same	Same	Same	Same	Same	Same	\$2695
Same	Same	Same	Same	Same	Same	Same	\$3150
Same	Same	Same	Same	Same	Same	Same	\$3350
Same	Same	Same	Same	Same	Same	Same	\$3695
Same	Same	Same	Same	Same	Same	Same	\$4095
Same	Same	Same	Same	Same	Same	Same	\$4995
Same	Same	Same	Same	Same	Same	Same	\$5395
85	3	500	8,000	Y—4 drives	1 yr. P/L	Y	\$2400
Same	Same	Same	Same	Same	Same	Same	\$2550
Same	Same	Same	Same	Same	Same	Same	\$2700
NA	NA	250	6,000	Y—4 drives	1 yr.—drives, 180 days—controller	Y	\$5995
60	Same	Same	Same	Same	Same	Same	\$5995
Same	Same	Same	Same	Same	Same	Same	\$6995
Same	Same	Same	Same	Same	Same	Same	\$9995
Same	15	698.8	Same	Same	Same	Same	\$8995
65	1	500	11,000	Y—4 drives	1 yr.—drives, 120 days P/L	Y	\$1295
Same	Same	Same	Same	Same	Same	Same	\$1495
Same	Same	Same	Same	Same	Same	Same	\$1695
125	625	960	NA	Y—4 drives	6 months P/L	Y	\$2495
72	8.33	687	Same	Same	Same	Same	\$3495
Same	Same	Same	Same	Same	Same	Same	\$4495
85	3	500	11,000	N	1 yr. P/L	Y	\$2195
Same	Same	Same	Same	Same	Same	Same	\$2695
Same	Same	Same	Same	Same	Same	Same	\$3895
NA	3	500	NA	Y—4 drives	1 yr. P/L	Y	\$1795
Same	Same	Same	Same	Same	Same	Same	\$1995
179	3	500	NA	Y—2 drives	1 yr. P/L	Y	\$1995
Same	Same	Same	Same	Same	Same	Same	\$2295
70	Same	625	Same	Same	Same	Same	\$2595
153	3	500	10,000	Y—4 drives	90 days P/L, 1 yr.—circuit	Y	\$1799
Same	Same	Same	Same	Same	Same	Same	\$2499

DD—Double-Density
P/L—Parts and Labor

Y—Yes
N—No

F—Fixed
R—Removable

grade, chances are you'll find it here.

Everything else is pretty much standard among these upgrades with access time about 75 ms, track-to-track access time at 5 ms, and data transfer rate around 250 Kbits/s.

Each upgrade comes with a 90-day warranty that includes parts and labor and, in a few instances, shipping costs. Several offer extended warranties, but, because they vary so much in cost and in coverage, the specifics are not included.

The price of floppy disk drives is a primary concern for many users. Regardless of your requirements, you'll find something here to ease the burden

on your coffee can. If you're penny-conscious and can do without the frills, several companies, such as Interface and Microcomputer Technology, offer basic one-drive upgrade kits at reasonable prices. If you can be more flexible in your spending, you'll find everything you need from drive cabinets to multi-drives.

Hard Disk Drives

Well, here they are: the 15 companies that make hard disk drives for TRS-80 computers.

As with the floppy disk guide, OEMs are not included.

Most hard drives come with nonremovable disks and memory capacities ranging from 5 to 40 megabytes. Cameo and Santa Clara Systems, however, sell drives with removable hard disks that store 5-15 megabytes of data. These drives support several operating systems, from LDOS to DOSPLUS and from OASIS to XENIX. A few models come with CP/M, and others with a BIOS driver. Before you make a purchase, however, make sure your DOS is compatible with the drive you select.

The average access/retrieval time (the length of time it takes the read/write head to find a file on the disk) for most

HARD DISK DRIVES (continued)

Company	Model	For Use With Model	Data Capacity (Megabytes)	Disk Size	Operating System
Percom Data Corp.	PHDRS5	III	5 F	5 1/4"	LDOS (or) DOSPLUS
	PHDRS10	Same	10 F	Same	Same
	PHDRS15	Same	15 F	Same	Same
	PHDRS20	Same	20 F	Same	Same
Radio Shack (Tandy Corp.)	26-1130	I/III	5 F	5 1/4"	LDOS
	26-4150	II, 12, 16	8 F	8"	TRSDOS 1.6 (or) XENIX
	26-4152	Same	12 F	Same	Same
Santa Clara Systems	SCS 5	I, II, III	5 F	5 1/4"	TRSDOS (or) OASIS (or) DOSPLUS
	SCS 10	Same	10 F	Same	Same
	SCS 515	Same	15 F	Same	Same
	SCS 510F	Same	Dual Drive 10 F	Same	Same
	SCS 515F	Same	Dual Drive 15 F	Same	Same
	SCS 5F	Same	Dual Drive 5 F	Same	Same
	SCS 5R	Same	5 R	Same	Same
	SCS 5/5R	Same	5 F, 5 R	Same	Same
	SCS 10/R	Same	10 R	Same	Same
	SCS 15/R	Same	15 R	Same	Same
Thought Works Inc.	TR005	III	5 F	5 1/4"	LDOS
	TR010	Same	10 F	Same	Same
	TR016	Same	16 F	Same	Same
	TR020	Same	20 F	Same	Same
VR Data	NA	I/III	5 F	5 1/4"	DOSPLUS
	Same	Same	10 F	Same	Same
	Same	Same	15 F	Same	Same
	Same	Same	2 x 5 F	Same	Same

NA—Not Available
SS—Single-Sided

DS—Double-Sided
SD—Single-Density

A.M. Electronics Inc.
3446 Washtenaw Ave.
Ann Arbor, MI 48104
313-973-2075

Compukit
16206 D Hickory Knoll
Houston, TX 77059
800-231-6671

Microcomputer Technology
1530 S. Sinclair St.
Anaheim, CA 92806
714-978-9833

HARD DISK DRIVE MANUFACTURERS

A.R. Business Systems
1128 E. Alostia Ave.
Glendora, CA 91740
213-963-7213

Corvus Systems Inc.
2029 O'Toole Ave.
San Jose, CA 95131
408-946-7700

Maezon
1437 N. 27th Ave.
Phoenix, AZ 85009
602-272-2815

Santa Clara Systems
560 Division St.
Campbell, CA 95008
408-374-6972

B.T. Enterprises
108 Carlough Road
Bohemia, NY 11716
516-567-8155

I.Q. Systems
2931 La Jolla St.
Anaheim, CA 92806
714-630-6834

Percom Data Corp.
11220 Pagemill Road
Dallas, TX 75243
214-340-7081

Thought Works Inc.
3532 W. Thomas Road Suite 2
Phoenix, AZ 85019
602-269-6841

Cameo Electronics Inc.
1626 Clementine St.
Anaheim, CA 92802
714-535-1682

J & M Systems
137 Utah N.E.
Albuquerque, NM 87108
505-265-5072

Radio Shack/Tandy Corp.
One Tandy Center
Fort Worth, TX 76102
817-390-3011

VR Data
777 Henderson Blvd. N-6
Folcraft, PA 19032
800-345-8102

	Avg. Access/Retr. Time (ms)	Track→Track Access Time (ms)	Transfer Rate (K bits/s)	Mean Time Between Failure (Power-on Hours)	Daisy Chain	Warranty	Extended Warranty	Price
85	3	500	NA	Y—up to 20 megabytes		90 days P/L	Y	\$1595
Same	Same	Same	Same	Same		Same	Same	\$1995
Same	Same	Same	Same	Same		Same	Same	\$2495
Same	Same	Same	Same	Same		Same	Same	\$2995
75	3	500	NA	Y—2 drives		90 days P/L	Y	\$2495
Same	19	400	Same	Same		Same	Same	\$2495
Same	3	500	Same	Same		Same	Same	\$3495
70	2	500	10,000	Y—4 drives		90 days P/L	Y	\$2340
Same	Same	Same	Same	Same		Same	Same	\$2840
Same	Same	Same	Same	Same		Same	Same	\$3140
Same	Same	Same	Same	Same		Same	Same	\$4756
Same	Same	Same	Same	Same		Same	Same	\$5056
Same	Same	Same	Same	Same		Same	Same	\$4474
Same	Same	Same	Same	Same		Same	Same	\$2895
Same	Same	Same	Same	Same		Same	Same	\$4474
Same	Same	Same	Same	Same		Same	Same	\$4756
Same	Same	Same	Same	Same		Same	Same	\$5056
72	2	500	8,000	Y—4 drives		90 days P/L	N	\$2495
Same	Same	Same	Same	Same		Same	Same	\$2995
Same	Same	Same	Same	Same		Same	Same	\$3795
90	18	Same	Same	Same		Same	Same	\$4495
153	3	NA	NA	N		120 days P/L	Y	\$1995
Same	Same	Same	Same	Same		Same	Same	\$2495
Same	Same	Same	Same	Same		Same	Same	\$2995
Same	Same	Same	Same	Same		Same	Same	\$3295

DD—Double-Density
P/L—Parts and Labor

Y—Yes
N—No

F—Fixed
R—Removable

hard disks was about 70–80 milliseconds, with a few taking longer at 150 to 190 ms.

A quick look at the track-to-track access time shows that most models are capable of accessing a track in 3 to 5 ms.

The average latency (the time it takes the disk to rotate once, until the desired sector reaches the head again) is 8.33 ms for all drives.

The data transfer rate (the rate at which data is loaded on or off the disk) is a more or less standard 500 Kbits/s, though there are a couple of pleasant surprises. The Corvus drives are well above this standard; the Corvus Model 6, for example, has a data transfer rate of 960 Kbits/s.

The reliability of these hard disks is indicated by the mean time between failure (MTBF). This figure is the average time between disk drive breakdowns. Ten thousand hours MTBF seems to be the most common estimate. This translates into more than a year of 24-hour-a-day operation.

Hard disk drive prices range from

\$1295 for Compu-kit's 5-megabyte fixed drive to \$995 for Cameo's Model 1050 with 40 megabytes of fixed memory and 10 megabytes of removable memory.

What about warranties? A hard disk doesn't help you when it's broken, except to serve as an expensive paperweight.

Every company listed in the guide has a limited warranty, usually ranging from 90 days to one year on parts and labor. Several offer an extended warranty. Extended coverage can be as low as \$30 a year or as high as \$35 a month. Examine the small print on the contracts very carefully. You may discover that you have to pay all shipping charges, or that only the circuitry is covered, not the drive or DOS.

If you take the time to decide how much memory you need and how much money you can spend, this buyer's guide will help you limit your choices.

Disks

A computer is virtually useless with-

out a cassette or disk to hold information. As an addendum to this buyer's guide, we decided to list the most common floppy disks available.

This guide includes a description of the disk and the manufacturer's suggested retail price for a box of 10 disks. Although several manufacturers make special or optional disks, we list only the standard disks.

Verbatim, Dysan, and 3M all make the complete line of 5¼-inch and 8-inch disks. Because of space limitations, we could not list every disk made; Verbatim alone, for instance, makes about 40 different disks.

When using this buyer's guide, please remember that the entries represent current information which may be obsolete within three months. In fact, several companies we contacted had discontinued a product line mentioned in guides a month previous. ■

DISKS					
Disk Brand	Model	Disk Type	Price/10	Warranty	Information
BASF	Qualimetric Flexidisk	5¼" SS, DD	\$39.50	Lifetime	800-343-4600
	Same	8" SS, SD	\$39.50	Same	Same
	NA	5¼" DS, DD	\$55	Same	Same
	Same	8" SS, DD	\$47.50	Same	Same
	Same	8" DS, SD	\$52	Same	Same
Compu-sette	NA	5¼" SS, SD	\$26.95	5 yr.	206-675-6143
	Same	5¼" SS, DD	\$28.95	Same	Same
	Same	5¼" DS, DD	\$32.95	Same	Same
	Soft Sector'd	5¼"	\$39.95	Same	Same
Dysan	#104-1	5¼" SS, SD	\$47	Lifetime	408-988-3472
	#104-1D	5¼" SS, DD	\$50	Same	Same
	#104-2D	5¼" DS, DD	\$60	Same	Same
	#204-1D (96-TPI)	5¼" SS, DD (Quad-density)	\$58.50	Same	Same
	#204-2D (96-TPI)	5¼" DS, DD (Quad-density)	\$68.50	Same	Same
*NOTE: Dysan carries the complete line of 8" disks, which range in price from \$48.50 for single density, to \$72 for a box of 10 hard sector'd DS/DD disks.					
Elephant	*NOTE: Declined to provide information concerning their suggested retail pricing of their 5¼" and 8" floppy disks. For information, please contact: 800-538-1793.				
Maxell	NA	5¼" SS, DD	\$29.90	5 yr.	800-235-4137
	Same	8" SS, DD	\$39.90	Same	Same
	Same	8" DS, DD	\$83.90	Same	Same
NA—Not Available SS—Single-Sided		DS—Double-Sided SD—Single-Density	DD—Double-Density P/L—Parts and Labor	Y—Yes N—No	F—Fixed R—Removable

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Televideo 925	\$779.00
Televideo 950	\$979.00
Sanyo CRX-1100	CALL

COMPUTERS

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Novation Smart Cat 1200 baud	\$495.00
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Hayes Smartmodem 1200 baud	\$569.00
Hayes Chronograph	\$229.00
Signalman Mark I	\$89.00
Signalman—IBM	\$189.00

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Verex 5 1/4"	\$23.95
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Verbatim 8"	\$36.95
Verbatim Head Cleaning Diskette	\$9.95
Maxell MD1 5 1/4"	\$29.95
Maxell MD2 5 1/4"	\$44.95
Maxell FD1 8"	\$37.95
Maxell FD2 8"	\$44.95
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Pkaso NE-12 Card	\$159.00
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Microsoft 64K Ram Card	\$399.00
Microsoft 192K Ram Card	\$699.00
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NEC 3550 for the IBM PC	\$1995.00
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NEC 7720 KSR	\$2675.00
NEC 7730 Parallel	\$2250.00
Epson MX 80	CALL
Epson MX 80 FT	CALL
Epson MX 100 FT	CALL
Epson FX Series	CALL
Epson RX Series	CALL
IDS Microprism	CALL
IDS Prism 80	CALL
IDS Prism 132	CALL
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Memorex	NA	5 1/4" SS, DD	\$27.90	NA	800-235-4137
	Same	5 1/4" DS, DD	\$36.90	Same	Same
	Same	8" SS, SD	\$36.90	Same	Same
	Same	8" SS, DD	\$44.90	Same	Same
	Same	8" DS, DD	\$54.90	Same	Same
Omni	NA	5 1/4" SS, SD	\$19.90	5 yr.	617-799-0197
	Dual Headed	5 1/4" DS, DD	\$37.50	Same	Same
	Same	5 1/4" DS, DD (Reversible)	\$39.50	Same	Same
	NA	8" SS, SD	\$24.90	Same	Same
	Same	8" DS, SD	\$34.90	Same	Same
	Dual Headed	8" DS, DD	\$37.50	Same	Same
Radio Shack	#26-406	5 1/4" SS, DD	\$39.95	NA	817-390-3011
	#26-4906	8" SS, DD	\$59.95	Same	Same
	#26-4960	8" DS, DD	\$69.95	Same	Same
TDK	M1DS	5 1/4" SS, DD	\$55	Lifetime	212-682-7600
	M2DS	5 1/4" DS, DD	\$78.50	Same	Same
	M2DX-S	5 1/4" DS, DD (96-TPI)	\$89	Same	Same
	F1-S	8" SS, SD	\$72	Same	Same
	F2D-S	8" DS, DD	\$89	Same	Same
3M	RH	5 1/4" SS, DD	\$42	Lifetime	612-733-1110
	Same	5 1/4" DS, DD	\$60	Same	Same
	Same	5 1/4" SS, DD (96-TPI)	\$58	Same	Same
	Same	5 1/4" DS, DD (96-TPI)	\$78	Same	Same
	NA	8" SS, SD	\$44.50	Same	Same
	W/WP	8" SS, DD	\$55.50	Same	Same
	NA	8" DS, DD	\$71	Same	Same
	1024/F	8" DS, DD	\$71	Same	Same
*NOTE: 3M also carries a complete line of disks with varying options other than those shown above. For further information, call them at the number shown.					
Verbatim	Datalife #MD52501	5 1/4" SS, DD	\$47.50	5 yr.	800-538-1793
	Same #5501	5 1/4" DS, DD	\$65.50	Same	Same
	Same #57701	5 1/4" SS (Quad-density)	\$62.50	Same	Same
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	Same #XL624-01	5 1/4" DS, DD (Hi-density)	\$121	Same	Same
	Verex	8" SS, SD→DS, DD (entire line)	\$44-65	1 yr.	Same
	Datalife	8" SS, SD→DS, DD (entire line)	\$56.50-89	5 yr.	Same
Optima	8" SS, SD→DS, DD (entire line)	\$96-120	17 yr.	Same	
Wabash	NA	5 1/4" SS, SD	\$19.90	5 yr.	800-235-4137
	Same	5 1/4" SS, DD	\$23.90	Same	Same
	Same	8" SS, SD	\$28.90	Same	Same
	Same	8" SS, DD	\$39.90	Same	Same
	Same	8" DS, DD	\$54.90	Same	Same
NA—Not Available SS—Single-Sided		DS—Double-Sided SD—Single-Density	DD—Double-Density P/L—Parts and Labor	Y—Yes N—No	F—Fixed R—Removable



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Programming the Model 16

by Dan Keen and Dave Dischert

Since the arrival of the new 16-bit processors, it is increasingly difficult to define the line separating microcomputers from minicomputers.

TRS-80 owners who have dabbled in Z80 Assembly language might be curious about the differences in writing programs for the new Model 16 with its powerful Motorola MC68000 microprocessor.

The MC68000 is not directly compatible with any other microprocessor, including the 8-bit MC6800 chip. Motorola decided to create instructions that make the most efficient use of the MC68000 chip rather than emphasize compatibility.

Eight data registers, named A0 through A7, and eight address registers, D0 through D7, give this chip real flexibility. Each register is 32 bits long, so that a programmer can store memory address locations without having to put registers in pairs, as is necessary when programming the Z80.

The familiar PC register is again called the program counter register here and it, too, consists of 32 bits.

A 16-bit status register resembles the Z80 flag register. An overflow bit, carry bit, and Z-flag bit are part of this register as well. Their functions are identical to these Z80 flags, so many programming concepts for other microprocessors are applicable here.

Instructions

Many opcodes comprise the 68000 instruction set. But, as in the case of the Z80, many are simply variations of each other and can be grouped together to perform similar functions.

When writing Assembly-language programs for the Z80, it is usually necessary to pair registers in order to store a memory address up to 65,535 (64K).

The MC68000 has registers that can

The 16-bit MC68000 microprocessor is fast, flexible, and not too hard to understand.

be accessed as 32-bit units. This lets it directly access any memory location up to 16 megabytes. Consequently, the MC68000 is capable of executing instructions with great speed.

Registers that are 32 bits wide and hold 4 bytes of information are called long words. Instruction codes can be kept simple by using 4-byte registers. One instruction does the work that takes several instructions with an 8-bit processor.

Another advantage to using 32-bit registers is that it ensures future editions of the MC68000 chip. Radio Shack was wise in using this microprocessor in the Model 16. Motorola designed this chip to be manufactured as a 32-bit processor when the technology permits.

So, while some microcomputer manufacturers use 16-bit chips at their maximum capability, Radio Shack is looking down the road.

It takes at least four separate lines of instruction code to make the Z80 microprocessor move a byte of information from one memory location to another. First, the destination address is read into a register pair. Then the source address is similarly loaded into another pair. The byte of data is then placed into a register and the contents dumped back out into the destination address. The source listing might appear as:

```
LD DE,destination address
LD HL,source address
```

```
LD A,(HL)
LD (DE),A
```

Using the Model 16 assembler, the MC68000 instruction would be:

```
MOVW @A0,#NUMBER
```

The label number is defined and equated to a value elsewhere in the program. The instruction above takes the number stored in the address NUMBER, and places it in the memory address indicated by register A0.

Not all instructions are that powerful, but the MOV or move command represents many codes that perform several tasks simultaneously.

When addressing registers in the 68000, you must specify the length of the operand associated with the mnemonic. In the above move instruction, the letter W is tacked onto the end of the mnemonic MOV. The sizes and their representation of these lengths are B for byte, W for a word, and L for long word. The instruction ADDW means the add instruction acts on 2 bytes. Most instructions consist of two bytes rather than a single byte, as with 8-bit processors.

Addressing Modes

When programming the Z80, you address registers either directly or indirectly. Direct addressing applies when the operand is in the register, and indirect when the register holds the reference address that holds the operand.

Radio Shack's Editor/Assembler for the Z80 allows you to place parentheses around a register to indicate that it is to be indirectly accessed. In the instruction:

```
LD (HL),A
```

the register pair HL is indirectly addressed. The parentheses tell the computer that the value stored in A is not to

```

START      LDA      .A0,SVC BLOCK
           LDW      .A1,#BUFFER LENGTH
           LDW      .A2,#TERMINATOR
           LDW      .A3,MESSAGE1
           MOVW     @A0,#VDLINE SVC NUMBER
           STW      .A1,6@A0
           STW      .A2,8@A0
           STL      .A3,10@A0
           BRK      #0
JPDOS      LDA      .A0,SVC BLOCK
           MOVW     @A0,#JPDOS SVC NUMBER
           BRK      #0
MESSAGE1   TEXT     '80 MICROCOMPUTING MAGAZINE'
ST         EQUW     13
SVC BLOCK  RDATA B  32,0
           NUMBER
           EQUW     9
JPDOS SVC  NUMBER
           EQUW     264
BUFFER LENGTH
           EQUW     255
TERMINATOR EQUW     13
           END      START

```

Fig. 1. Model 16 Assembly Program Listing

be placed directly into HL, but rather in the memory location indicated by HL.

Similarly, on the MC68000, a period placed before a register specifies a direct operation and the @ sign indicates that the operand is in the location pointed to by the address register. In the MOV instruction just discussed, you can see that @A0 is indicating that the contents of that register were the address we were to use.

.A1 represents a direct action on register A1.
@A0 represents an indirect action on register A0.

When writing programs for 8-bit microprocessors, the programmer must not be concerned about whether the byte placement of an instruction is even or odd since all registers are only 1 byte long. This is an added parameter that

must be dealt with when programming the MC68000. Most instructions are 2 bytes long, and a word or long-word operand must fall on an even byte address.

It may seem unusual at first, but it is unnecessary to use an origin pseudo-op or directives, when writing a 68000 program on the Model 16. By not specifying an origin, the assembler automatically places the program in the next available RAM area after TRSDOS and any utility programs are loaded.

The editor/assembler program that Radio Shack provides with the Model 16 is more difficult to work with than their Z80 package. You must spend some time getting acquainted with this editor/assembler before doing any serious programming.

Supervisor Calls

Like the other TRS-80 computers, the Model 16 disk operating system contains many user routines. These supervisor calls can be jumped to from machine-language programs. These calls facilitate communication between the keyboard, video display, line printer, and disk drives.

Before carrying out many Z80 instructions, you must set up certain registers. Prior to using an LDIR mnemonic, load the source address into register pair HL, the destination address into DE, and the number of bytes to copy into BC.

Similarly, before executing a supervisor call, a buffer area in RAM must be established and certain values placed at key positions within it. The instruction BRK #0 calls the routine.

Figure 1 shows a listing created with the Assembler 16. This short program shows two supervisor routines being accessed, displaying text on the screen and returning to the TRSDOS ready mode.

Writing Assembly-language programs for the 68000 is no harder than writing for the Z80; it is merely different, because some new rules apply due to the longer byte length of registers and instructions.

A computer's ability to execute instructions increases more rapidly if it uses a 16-bit processor instead of an 8-bit processor.

A 32-bit, single-chip microprocessor is expected in 1985. By that time, technology will have reached the point where man can package over one million transistors in a single integrated circuit. ■

Dan Keen and Dave Dischert can be reached c/o Soft Horizons, RD1 Box 432, Cape May Court House, NJ 08210.



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Many people think programs should be flowcharted before writing the code and that flowcharting after the fact is a waste of time. Have you spent hours checking the jumps in purchased software so you can make a generalized patch

or custom code a new section? If the answer is yes, then you know that flowcharting a program is not a bad idea. The flowchart display doesn't solve all your programming problems, but is a great tool to have around.

Kilobaud Microcomputing in April 1981 ran an article on a flowchart generator by Peter A. Stark. This interested me, so I translated the program for my TRS-80.

Since the original article had extraordinary remark statements, I tried to keep the

same line numbers. I dropped his remark statements in my translation, though I had to use the two arrays in storing the to and from pointers (original array) S(i) and added SL (i) for the lower half. This was necessary since the full eight-digit floating-point number used originally didn't always give the correct answer during my test phase. This problem was pointed out in the original article and the modifications were shown.

Table 1 contains the new or revised line numbers and comments to go from Percom Super Basic to Radio Shack Disk Basic.

Many TRS-80 programmers like to stack as many statements as possible on one line. This causes problems in the printing even if you only print the keywords. A condensed line sometimes is too large for the available printing area and if left unfixed throws off all the printing.

The following lines handle this situation: Lines 2041-2043 check the length of the condensed line and truncate where necessary. Place a plus sign at the end to highlight if the truncation is performed.

Lines 2210-2230 of the original program use the function POS that indicated the head position of the printer display. I replaced this function with hard code to increase the display to more than 80 characters per line for users with this equipment.

For print characters used to show directions, I replaced the symbol with CHR\$() commands as follows:

CHR\$(96) down arrow
CHR\$(95) left arrow
CHR\$(94) up arrow
CHR\$(126) right arrow

After debugging and fixing my keying errors, I had to test the program on something

```

100 REM ** PARTIAL PROGRAM TO TEST FLOW CHART PROGRAM **
110 CLEAR:CLOSE:CLEAR8800:DEFINTI-N:DIMGL$(100),CC(39):DIMCA$(6)
:T$="###,###,###.##-":U$="####.##-"
111 FORI=1TO39:READCC(I):NEXTI
112 DATA -88900,-1100,-200,-5000,-2500,-1700,0,0
113 DATA 15280,1223,700,2462,5200,2800,300,300,300,2100,2100
114 DATA 3150,1200,570,800,120,750,4000,700,4000,4000,800
115 DATA 1200,2800,1800,14481,7770,400,800,0,0
120 OPEN"R",1,"TRY1"
130 FORI=1TO6:S=1+INT((I+1)/2):R1=I+2*(2-S):FIELD1,127*(R1-1)+1A
S F3$,20AS CT$:GET1,S:CA$(I)=CT$:NEXTI
140 FIELD1,4AS D8$,30AS C2$,10AS F1$,4AS D5$,2AS MF$,83AS F2$,6A
S FA$,8AS AP$,2AS LR$,10AS FD$,2AS K5$,2AS NP$,2AS NR$,2AS NS$:G
ET1,1:KUS=LEFT$(K5$,1):XU#=0:XY#=0
150 DT$=STR$(CVS(D8$)):IFLEN(DT$)=7THENDT$=RIGHT$(DT$,6)
160 DT$=LEFT$(DT$,2)+"/"+MID$(DT$,3,2)+"/"+RIGHT$(DT$,2)
170 CLS:INPUT"PRINT INCOME STATEMENT (Y/N)";Y$
180 IFY$="Y"GOTO210
190 IFY$<"N"GOTO170
200 LOAD"XYZ",R
210 INPUT"PERIOD-ENDING DATE (MM/DD/YY)";DP$
211 INPUT"NUMBER OF MONTHS INTO THE YEAR";IM
212 OPEN"O",3,"LISTCH:1"
220 IFLEN(DP$)<>8GOTO210
230 OPEN"R",2,"DATA88:1"
240 FORI=1TO100
250 S=INT((I+3)/4):R1=I-4*INT((I-1)/4)
260 FIELD2,63*(R1-1)AS Y$,63AS A$:GET2,S:GL$(I)=A$:PRINT@192,"AC
CT: ";I;USING"####";CVI(LEFT$(A$,2));
270 NEXTI
280 N=0:L=50:BM#=0:BC#=0:BY#=0:BP#=0:BR#=0:BL#=0:B2#=0:IC=0:CK#=
":NS=CVI(NS):SN#=0:SY#=0:CC$=""
290 FORI=1TO100
300 I1=I:IFCVI(LEFT$(GL$(I),2))<3000GOTO320
310 I=100
320 NEXTI
330 IFCVI(LEFT$(GL$(I1),2))>3000GOTO350
340 PRINT"NO ACCOUNTS ":FORJ=1TO2000:NEXTJ:GOTO180
350 SN#=0:SY#=0:FORI=1TO100
360 I2=I:E$=GL$(I):IF MID$(E$,52,1)<>"3" GOTO 380
370 SN#=SN#+CVD(MID$(E$,44,8)):SY#=SY#+CVD(MID$(E$,26,8))
380 NEXTI

```

Program Listing 1. Flowchart test listing

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*Michael Tannenbaum, the "80 Accountant"

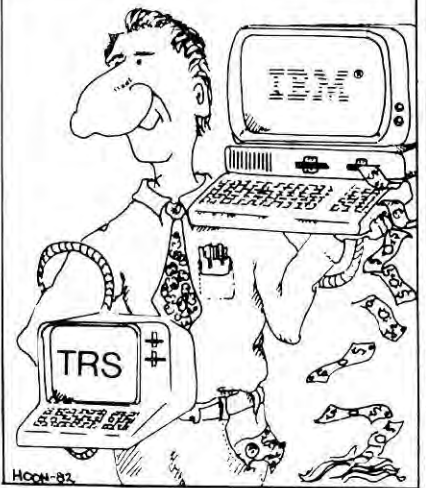
Program Listing 2. Flowchart

```

1 CLEAR 3000
2 K9=35:DIM K$(K9),L$(10),R(20),H$(20),S(500),SL(500),S1(500)
3 LY=1:KS=LY*10:LL=255:S6=0:S5=0
5 IF LY=1 GOTO 10
6 PRINT"Line printer set at 120 CPL";:GOSUB3400:IFX%=1GOTO10 ELS
EEND
10 CLS:PRINT"          FLOGEN - BASIC FLOWCHART PROGRAM"
20 PRINT"  MICROCOMPUTING April 1981 BY P A Stark"
30 PRINT"          Modified for TRS-80 by P R Ohs":PRINT
60 PRINT"Remember program must have been saved with 'A' option":
PRINT"
70 PRINT" ":INPUT"Enter file name of source program to be charte
d";N$
80 INPUT"What drive is it stored on( 0-3)";D$
85 IF VAL(D$)<0 OR VAL(D$)>3 GOTO 80
90 N$=N$+" "+D$
93 PRINT"The file name is ";N$;" is this correct (Y/N)";:GOSUB34
00
95 IF X%<>1 GOTO 70
170 FOR K=1TOK9:READ K$(K):NEXT K
171 DATA REM,GOTO,THEN,GOSUB,STOP,END
172 DATA FOR,NEXT,IF,RETURN,READ
173 DATA INPUT,LINEINPUT,PRINT,LPRINT,OPEN
174 DATA CLOSE,RESTORE,ON,DIM,DATA
175 DATA STOP,CLS,POKE,PEEK,CLEAR
176 DATA DEFFND,DEFSTR,DEFINT,DEFSNG,DEF
177 DATA FIELD,GET,LOAD,***
180 LPRINTTAB(15);"FLOW DIAGRAM FOR: ";N$
200 ON ERROR GOTO 3500:OPEN "I",1,N$
210 IF JP=1 THEN 760
212 LINEINPUT#1,A$
220 IF EOF (1) THEN JP=1
221 K1=INSTR(1,A$," ")
222 IF K1=5 THEN 229
224 FOR I=K1TO4:A$="0"+A$:NEXT I
229 PRINT A$
230 L=LEN(A$)
250 S$=LEFT$(A$,6)
270 IF MID$(A$,6,3)="REM" THEN 210
290 FOR I=7TO L
300 B$=MID$(A$,I,1)
310 IF B$<>" " THEN S$=S$+B$
320 NEXT I
350 L=LEN(S$)
360 IF L<10 THEN 210
370 FOR I=6 TO L
380 B$=MID$(S$,I,4)
390 IF B$=":REM" THEN 210
400 IF B$="GOTO" THEN 470
410 IF B$="THEN" THEN 470
420 GOTO 440
440 NEXT I
450 GOTO 210
470 B=4
510 C=VAL(LEFT$(S$,4))
520 P=I+B
530 T$=MID$(S$,P,1)
540 GOSUB 3040
550 IF T=0 THEN I=I+B: GOTO 440
570 D=VAL(T$)
580 FOR J=P+1 TO P+3
590 T$=MID$(S$,J,1)
600 GOSUB 3040
610 IF T=0 THEN 650
620 D=D*10 + VAL(T$)
630 NEXT J
650 S6=S6+1
660 IF C<D THEN SL(S6)=D
661 IF C>D THEN S(S6)=C:S1(S6)=1
670 IF C=D THEN SL(S6)=C
671 IF C>D THEN S(S6)=D:S1(S6)=2
690 IF MID$(S$,J,1)=", " THEN P=J+1 : GOTO 530
710 GOTO 440
760 M=S6
770 M=INT(M/2)
780 IF M=0 THEN 960
790 K=S6-M
800 J=1
810 I=J
820 L1=I+M
830 IF(S(I)+SL(I)/1000)<(S(L1)+SL(L1)/1000) THEN 920

```

Listing 2 continues



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Listing 2 continued

```

840 A=S(I):AL=SL(I)
850 S(I)=S(L1):SL(I)=SL(L1)
860 S(L1)=A:SL(L1)=AL
870 A=S1(I)
880 S1(I)=S1(L1)
890 S1(L1)=A
900 I=I-M
910 IF I>=1 THEN 820
920 J=J+1
930 IF J>K THEN 770
940 GOTO 810
960 JP=0:CLOSE:OPEN "I",1,N$
970 IF JP=1 THEN 2440
972 LINEINPUT#1,S$
980 IF EOF(1) THEN JP=1
982 K1=INSTR(1,S$," ")
984 IF K1=5 THEN 990
986 FOR I=K1TO4:S$="0"+S$:NEXT I
990 C$=LEFT$(S$,5)
1000 B=6
1010 R4=0 : R5=0
1020 GOSUB 2570
1050 L3=0
1060 GOSUB 3110
1080 IF K$="STOP" THEN K$="***STOP***"
1090 IF K$="END" THEN K$="***END***"
1100 IF K$="GOSUB" THEN K$="GOSUB-->"
1110 IF K$<>"REM" THEN C$=C$+K$+" "+V$
1140 B=B+1
1150 A$=MID$(S$,B,1)
1160 IF A$="" THEN 1320
1170 IF A$<>":" THEN 1140
1180 B=B+1
1190 A$=MID$(S$,B,1)
1200 IF A$="" THEN 1180
1210 IF A$="" THEN 1320
1220 GOSUB 2570
1230 GOSUB 3110
1240 IF K$="STOP" THEN K$="***STOP***"
1250 IF K$="END" THEN K$="***END***"
1260 IF K$="GOSUB" THEN K$="GOSUB-->"
1270 IF K$<>"REM" THEN C$=C$+K$+" "+V$
1280 GOTO 1140
1320 FOR K=1 TO KS
1330 IF R(K)=.5 THEN R(K)=0
1340 IF R(K)=.4 THEN R(K)=0
1350 IF R(K)=1 THEN R(K)=.5
1360 IF R(K)=.9 THEN R(K)=.4
1370 NEXT K
1390 L6=VAL(LEFT$(S$,4))
1400 FOR K=1 TO KS
1410 IF ABS(R(K))<>L6 THEN 1510
1430 IF R(K)>0 THEN 1490
1450 IF R5<K THEN R5=K
1460 R(K)=.9
1470 GOTO 1510
1490 IF R4<K THEN R4=K
1500 R(K)=1
1510 NEXT K
1540 IF S5=S6 THEN 1600
1550 T=INT(S(S5))
1560 IF T>=L6 THEN 1600
1570 IF T<>0 THEN LPRINT"ERROR - MISSING LINE NUMBER";T
1580 S5=S5+1
1590 GOTO 1540
1600 IF INT(S(S5))<>L6 THEN 1940
1620 D9=SL(S5)
1630 S(S5)=0:SL(S5)=0
1650 FOR K=1 TO KS
1660 IF ABS(INT(R(K)))=D9 THEN 1700
1670 NEXT K
1680 GOTO 1730
1700 IF S1(S5)=1 THEN IF R(K)>0 THEN 1830
1710 IF S1(S5)=2 THEN IF R(K)<0 THEN 1870
1730 FOR K=KS TO 1 STEP-1
1740 IF R(K)=0 THEN 1780
1750 NEXT K
1760 GOTO 1890
1780 IF S1(S5)=1 THEN 1820
1790 IF S1(S5)=2 THEN 1860
1800 LPRINT"ERROR ON ";S$:STOP
1820 R(K)=D9
1830 IF R5<K THEN R5=K
1840 GOTO 1890

```

Listing 2 continues



"THERE IS ONLY ONE WAY TO DESCRIBE THE PERFORMANCE OF POSTMAN MASS MAILING SYSTEM, - 'FLAWLESS.'"

Info World, by Tim Daneliuk, Vol. IV, No. 37, ©1982



InfoWorld Software Report Card

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Ease of Use	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Error Handling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Business programs have come of age on the TRS-80* Mod I and III and the speed and flexibility of the POSTMAN MASS MAILING SYSTEM, makes it the best buy on the market today. In these rough economic times, every business program purchase must be selected very carefully and be evaluated and compared against all other competitors. POSTMAN MASS MAILING SYSTEM stands up to this scrutiny.

POSTMAN MASS MAILING SYSTEM has the capability of managing 22,000** names on floppy disk drives and up to 292,000** names on a hard disk system. No longer do you have to search from diskette to diskette to find the file you need. POSTMAN MASS MAILING SYSTEM utilizes all of the disk drives you have on line, and presents all at once, one large file totally accessible; as if you only had one large disk drive. In his review, Tim Daneliuk describes this unlimited storage capability aptly by saying: "POSTMAN 'spans' multiple disk drives" despite the unpretentious 5¼-inch mini-floppy disk. This exceptional feature gives you the ability to start with a two-disk-drive system and add more disk drives as your business grows, without any difficulty.

Professional people in the industry have remarked how POSTMAN MASS MAILING SYSTEM, written entirely in Machine language and menu driven for simplicity, fulfills a variety of small business needs.

PURGE - Consider for instance, how it can purge duplicate labels, preventing you from mailing multiple information to the same person.

SORT - It has the ability to sort on any or all of the ten data files of the program quickly.

ERROR HANDLING - All erroneous data is trapped. It never fails because of incorrect operator entry.

Commonly Asked Questions About POSTMAN MASS MAILING SYSTEM

Q. How many names can I get on my standard 2 drive TRS-80 Mod III?

A. On the average 1900, depending on your operating system. LDOS is the least - Multi-DOS has over 2,000.

Q. How many disk drives can I run at the same time with your program?

A. At this time only 8 disk drives - 4 floppy disks and 4 hard disks.

Q. What is the capacity of a disk drive?

A. There are many different sizes of disk drives. See the chart below.

MOD I SINGLE DENSITY	
135 Track Data Disk	642 ea.
40 Track Data Disk	742 ea.
80 Track Data Disk	1542 ea.

MOD I OR III DOUBLE DENSITY	
140 Track Data Disk	1346 ea.
80 Track Data Disk	2700 ea.
80 Track Dual Head	5500+ ea.
†† 5 Meg Hard Drive	38,000+ ea.
†† 7.5 Meg Hard Drive	68,000+ ea.

† Denotes the size on a standard system from Radio Shack. †† Requires LDOS or DOSPLUS Operating Systems and hard disk version of Postman.

Q. Am I limited to only one disk drive or can I add more drives?

A. You can combine any of the above disk drives, up to a maximum of 4 dual headed 80 track drives, plus 4-7.5 meg

hard drives, for a total capacity of 292,000* names. The system to date has been field tested, and is in everyday use at over 100,000 name capacity.

Q. Outstanding having all those names, but how does it effect the speed of the system?

A. As anyone could expect, as a system gets larger it reacts slower. Below is a sample of the different systems.

SYSTEM CAPACITY	SORT TIME -	INSERT TIME
	ONE FIELD	ALL 10 FILEDS
1,342	12 Seconds	1 Second
5,500	18 Seconds	1 Second
11,000	24 Seconds	2 Seconds
38,000	5 Minutes	2 Seconds
78,000	8 Minutes	2 Seconds
200,000	30 Minutes (estimated)	4 Seconds

The above tests were done with a Mod III and DOSPLUS 4.0 Operating System. The speed you receive will depend on many factors. It should be noted that as you insert a name, it is put in sorted order on the disk. You never need to re-sort, unless you wish to change the order.

Q. Do you plan on adding anything new to your program soon?

A. Yes! and all registered owners of Postman Mass Mailing System can upgrade to the latest version for a nominal fee.

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```

1860 R(K) = -D9+.5
1870 IF R4<K THEN R4=K
1890 IF S5=S6 THEN 1940
1900 IF INT(S(S5+1))=L6 THEN S5=S5+1 : GOTO 1540
1940 FOR K= 1 TO KS
1950 H$(K)="-"
1960 IF K>L3 THEN H$(K)=" "
1970 NEXT K
1990 FOR K= 10 TO 1 STEP-1
2000 IF L$(K)="" THEN LPRINT H$(K);H$(K);
2010 IF L$(K)<>" " THEN LPRINTCHR$(96);H$(K);
2020 NEXT K
2040 LC=LEN(C$)
2041 IF LC<34 THEN 2043
2042 C$=LEFT$(C$,33)+" "
2043 LPRINT C$;
2070 FOR K=1TOKS
2080 H$(K)=""
2090 IF K<=R4 THEN 2150
2110 IF K>R5 THEN 2190
2130 H$(K)=CHR$(126)
2140 GOTO 2190
2150 IF K>R5 THEN 2180
2160 H$(K)="-"
2170 GOTO 2190
2180 H$(K)=CHR$(95)
2190 NEXT K
2210 P3=LEN(C$)+25
2215 IF P3<>INT(P3/2)*2 THEN 2230
2220 LPRINT " ";:P3=P3+1
2230 FOR K=P3 TO 59 STEP 2
2240 LPRINT H$(1);" ";
2250 NEXT K
2270 FOR K=1 TO KS
2280 LPRINT H$(K);
2290 IF R(K)>1 THEN LPRINT CHR$(96);
2300 IF R(K)=1 THEN LPRINT CHR$(95);
2310 IF R(K)=.9 THEN LPRINT CHR$(94);
2320 IF R(K)=.5 THEN LPRINT " ";
2330 IF R(K)=.4 THEN LPRINT " ";
2340 IF R(K)=0 THEN LPRINT " ";
2350 IF R(K)>=0 THEN 2390
2360 IF R(K)=INT(R(K)) THEN LPRINT CHR$(94); :GOTO 2390
2370 LPRINT CHR$(95);
2380 R(K)=R(K)-.5
2390 NEXT K
2400 LPRINT " "
2420 GOTO 970
2440 CLOSE
2460 FOR K=1TO KS
2470 IF L$(K)<>" " THEN LPRINT"ERROR - MISSING NEXT ";L$(K)
2480 NEXT K
2490 FOR K=1TO KS
2500 IF R(K)>1 THEN 2530
2510 IF R(K)<0 THEN 2530
2520 GOTO 2540
2530 LPRINT"ERROR - MISSING LINE NO. ";INT(R(K))
2540 NEXT K
2550 END
2570 FOR K=1TO K9
2580 L=LEN(K$(K))
2590 IF MID$(S$,B,L)=K$(K) THEN 2750
2600 NEXT K
2620 FOR K=B TO LL
2630 T$=MID$(S$,K,1)
2640 IF T$="" THEN 2730
2650 IF T$=":" THEN 2730
2660 IF T$=";" THEN 2700
2670 NEXT K
2680 LPRINT"ERROR - UNDECEIPHERABLE STATEMENT" :STOP
2700 T$=MID$(S$,B,K-B+1): K=B0
2710 GOTO 2750
2730 K=K9
2740 GOTO 2750
2750 K$=T$
2760 IF K<>0 THEN K$=K$(K)
2770 V$=""
2790 IF K$="FOR" THEN 2830
2800 IF K$="NEXT" THEN 2950
2810 RETURN
2830 FOR K=B+3 TO LL
2840 IF MID$(S$,K,1)="" THEN 2880
2850 NEXT K
2860 LPRINT"ERROR IN LINE ";S$ :STOP
    
```

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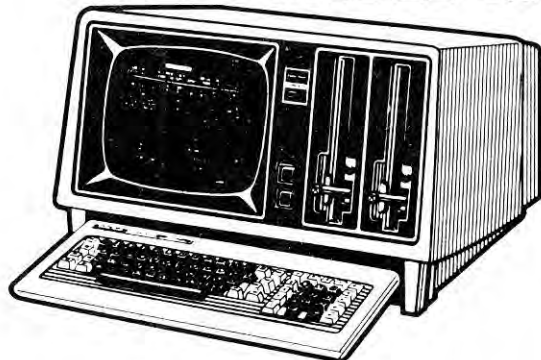
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Institute of Child Development
University of Minnesota

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Listing 2 continued

```

2880 A$=MID$(S$,B+3,K-B-3)
2900 FOR K=1 TO LEN(A$)
2910 IF MID$(A$,K,1)<>" " THEN V$=V$+MID$(A$,K,1)
2920 NEXT K
2930 RETURN
2950 FOR K=B+4 TO LL
2960 IF MID$(S$,K,1)=" " THEN 3010
2970 IF MID$(S$,K,1)=":" THEN 3010
2980 NEXT K
2990 PRINT"ERROR IN LINE ";S$ :STOP
3010 A$=MID$(S$,B+4,K-B-4)
3020 GOTO 2900
3040 REM
3050 T=0
3060 IF T$<"0" THEN RETURN
3070 IF T$>"9" THEN RETURN
3080 T=1
3090 RETURN
3110 IF K$="NEXT" THEN 3240
3120 IF K$<>"FOR" THEN RETURN
3150 FOR K=KS TO 1 STEP-1
3160 IF L$(K)=" " THEN 3200
3170 NEXT K
3180 LPRINT"ERROR - TOO MANY NESTED LOOPS IN ";S$:STOP
3200 L$(K)=V$
3210 IF L3<K THEN L3=K
3220 RETURN
3240 FOR K= 1 TO KS
3250 IF L$(K)=V$ THEN 3290
3260 NEXT K
3270 LPRINT"ERROR - NEXT WITHOUT FOR?"
3280 RETURN
3290 IF L3<K THEN L3=K
3300 L$(K)=" "
3310 RETURN
3400 A$=INKEY$:IFA$=""GOTO3400
3410 IF ASC(A$)>96 A$=CHR$(ASC(A$)-32)
3420 PRINTA$:X$=INSTR("YN",A$):RETURN
3500 PRINT@660,"File not found":FORLL=1TO900:NEXTL:RESUME70
    
```

Model II/16 Conversion

CONVERSION BY TOM YAGER

DELETE THE FOLLOWING LINES:

180

ADD THE FOLLOWING LINES:

75 IF INSTR(N\$,".")<>0 THEN 93

EDIT THE FOLLOWING LINES:

```

70 PRINT:INPUT"Enter file name of source program to be charted";N$
176 DATA DEFFN,DEFSTR,DEFINT,DEFSNG,DEF
200 ON ERROR GOTO 3500:OPEN "I",1,N$:LPRINTTAB(15);"FLOW DIAGRAM FOR: ";N$
2490 FOR K=1TO KS
2840 IF MID$(S$,K,1)=" " THEN 2880
3410 IF ASC(A$)>96 THEN A$=CHR$(ASC(A$)-32)
    
```

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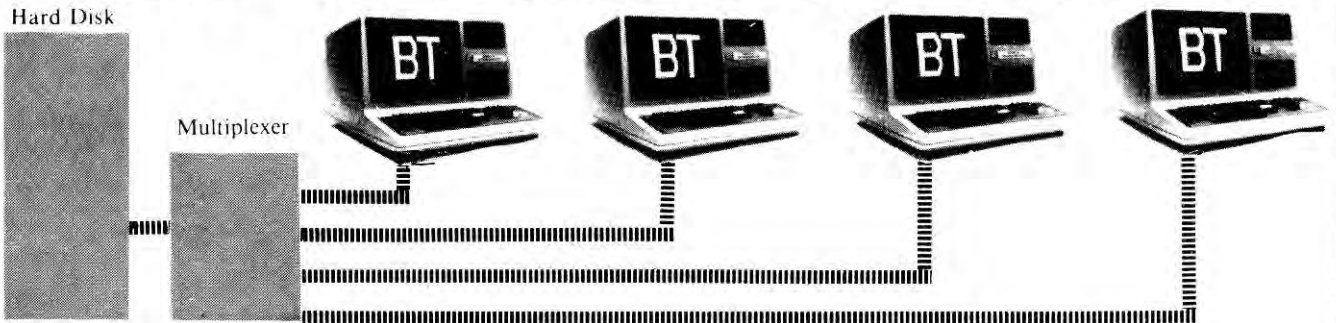
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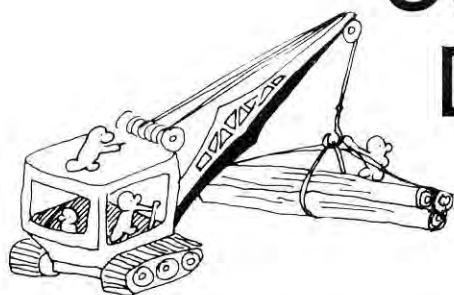
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Using Data Files—Part I



by Jesse W. Baker

Data files consist of characters stored on magnetic disks independent of other programs. You can learn to handle them efficiently.

TRS-80s use two types of disk file structures to store information and/or data: sequential-access and random- or direct-access. This article discusses how to create and use the sequential file structure.

Two disk sizes are available: a 5¼-inch mini-disk and an eight-inch disk. Both sizes have limited data stor-

age capacity, and must be used with file structures that ensure the most efficient use of available space. This is determined by the type of operating system on the computer.

The storage capacity on the 5¼-inch disk under TRSDOS is approximately 184,000 bytes of data on 40 tracks in the double-density format.

The eight-inch disk capacity is approximately 500,000 bytes. A double-density disk has 77 tracks with 26 sectors per track. Each sector holds 256 bytes.

A single-density disk has the same format but holds only one-half the number of bytes per track. Other operating systems may have greater storage capacities.

A disk lasts for approximately 3.5 million passes per track or until you put your grubby fingers on the recording surface, whichever comes first.

Sequential files can be visualized as long contiguous ribbons of information, with data recorded one piece after another. In fact, you are reading this article as a sequential file.

Sequential files use disk space more efficiently than random- or direct-access files. But, there are a number of problems associated with this type of file structure. Since they are designed to store information that will not change very often, it is difficult to make changes to the file contents.

These files are quite slow, because if you want to read a piece of data toward the end of a file, you must search through all the data from the beginning of the file until you find what you're looking for.

It is also difficult to add data to a sequential file because when you open the file as OUTPUT, you destroy its contents. You can prevent this by using a routine that copies the existing file over to another file.

It is interesting to note that some

Close	Used to free the file buffer for other uses and to secure the file. Used by both sequential and random-access files.
Delimiter	A character used by the computer to mark the end of one data item and the start of another.
EOF	End Of File. This allows you to test for the end of file. If you try to read past the end of file you get an error.
Field	An item of information within a record. Example: An individual's name.
File	A group of related records. Example: A mailing list.
I	Tells the computer that the sequential file contents will be read (input) from the disk to the memory.
INPUT #	Reads data from a sequential file.
LINE INPUT #	Reads a line of text from a disk file, one line at a time. Will usually recognize only a carriage return as a delimiter.
O	Tells the computer that the data in memory is sent to the file.
Open	A statement that gives you access to a sequential file. Used by random-access files also.
PRINT #	Writes information to a sequential file.
Record	A complete group of related data. Example: A person's name and address.

Table 1. Glossary of Terms

The Key Box
Model I, II, and III
32K RAM
Disk Basic
One Disk Drive

Model I/III operating systems now allow you to open a file without destroying its contents. TRSDOS 1.3 lets you use the Open "E" option to add to the end of the file.

To create a sequential data file you must follow the word sequence exactly, otherwise you will have problems. A typical statement could be:

OPEN "O", 1, "SAMPLE/FIL"

The Open statement tells the computer which file to use. If the file does not yet exist, it creates one.

The "O" part sets the access mode for the file. "O" (output) takes information from the computer's memory and places it on the disk.

"I" (input) takes information from the disk file and places it into the computer's memory. Please note that you cannot have a sequential file open for output and input at the same time.

The number 1 in the statement assigns a buffer to the file. The buffer is a section of memory that acts as temporary storage for the file contents, 256 bytes at a time. It is used for both output and input. You cannot have the same buffer open for more than one file at a time. Assign another buffer if you have more than one file open at a time. You can have up to 15 buffers open at the same time.

The name of this file is SAMPLE/FIL, but a name can be either alphabetic or a string variable. Using a string variable lets you use the same open statement for many different files.

If you use a specific name for your file, you must enclose the name in double-quotes, as in: OPEN "O", 1, "SAMPLE/FIL".

If you use a variable as the file name, it isn't necessary to use the double quotes, as in: A\$="SAMPLE/FIL" OPEN "O", 1, A\$.

The next line of significance, the print statement, prints data to the file through the buffer specified in the open statement.

Each item in the print list should be followed by a semicolon. This packs the data tightly into the record, where a comma places it far apart, wasting valuable disk space.

The semicolon is called a delimiter. It tells the computer that the items in the list are to be treated as a series or a string of bits or characters. This marker is not a part or member of such a series or string.

The semicolon makes sure that the data is placed properly in the file. Because the sequential file stores data in a long stream, the semicolon forces the item list to be printed in sequence with no extra spaces between each item. For example, if we say: PRINT #1, "A";"B";"C", the computer places A,B,C in the file so it would look like Fig. 1.

Notice that there are no spaces between the characters and that the last character is followed by a period. The period delimiter is placed there by the system to signify the end of the data. If you use just a comma as in PRINT #1, "A","B","C", you get the record shown in Fig. 2.

Notice the amount of wasted space; this example uses 35 bytes instead of four.

A comma can also be a delimiter. The

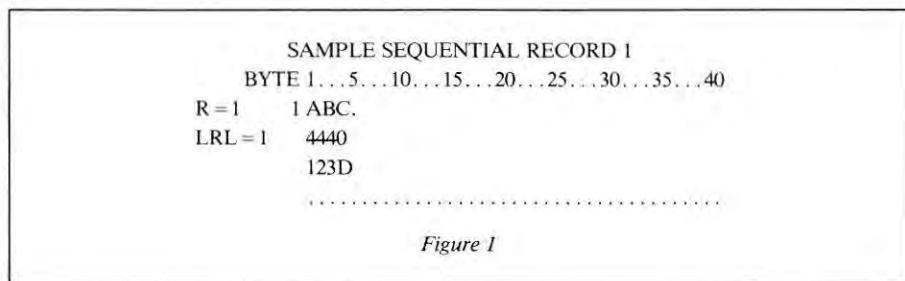


Figure 1

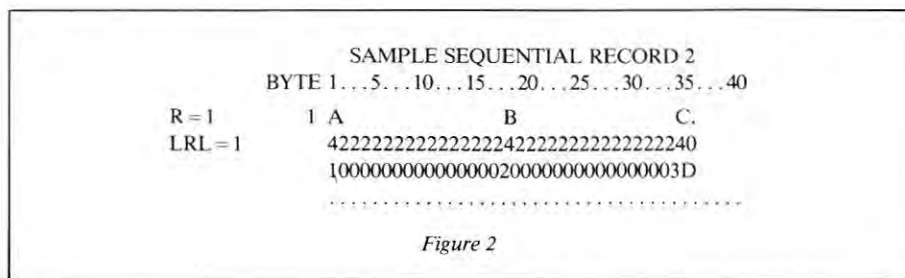


Figure 2

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■ Extend a line or insert new lines:

Extending a line is as simple as two keystrokes, instantly the cursor jumps to the end of the program line and the editor is placed in the insert mode.

■ Delete, copy or move statements:

All you have to do is mark the line or block of lines and then tell the editor where to move or copy them.

■ Global Search and/or change any specified string:

Have you ever needed to change a lot of PRINT statements to LPRINTs?

■ Macro key facility:

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explicit comma is useful for separating a number of data strings in a sequential file, such as: PRINT #1, J\$;“,”;R\$.

Quotes around the comma force a comma delimiter between the data strings and allows the information to be retrieved correctly. For instance,

say that: J\$ = “JOHN” and R\$ = “ROGER”.

Using the above statement, you print the strings to the file and the disk file looks like Fig. 3.

If you asked the computer to INPUT J\$, it would know where the string end-

ed and return JOHN to you, because the comma you forced in between the two names tells it where one ended and the other began. That saved some space; in fact it worked as well as the semicolon.

If you write a string data item with a comma in it as a valid character, such as J\$ = “ROGER,JOHN”, you’ll need to surround the data item with explicit quotes in the print statement and then print it to the file like this: PRINT #1, CHR\$(34);J\$;CHR\$(34), where CHR\$(34) is the hexadecimal code for quotes. The quotes tell the computer to accept all the characters up to the next set of quotes as valid data.

Your file record would then look like Fig. 4.

There is one other type of delimiter often overlooked, but it is as valid as semicolons, commas, or quotes. This is the humble CHR\$(13) or the carriage return that we create every time we press the enter key. The statement PRINT #1, A\$;B\$;C\$ can also be written as:

```
PRINT #1, A$
PRINT #1, B$
PRINT #1, C$
```

Each string variable is followed by a carriage return or CHR\$(13) and this is treated as a delimiter by TRSDOS. This produces a file record that looks like Fig. 5.

It should be noted that the five sample records shown above are typical of what is found in a data file if you list out the file at the TRSDOS Ready mode by typing LIST file name.

In the file above, R = 1 gives the record number and the LRL = 1 gives the length of the record. Sequential files always have a record length (LRL) of 1.

When you ask for a listing of a file, the computer numbers each record as it is listed, and prints the heading showing the relative position of each byte in the record.

After you have opened or created the file and placed your data in it, you must close the file when you have finished with it. Otherwise you may lose its contents. The close statement looks like this: CLOSE 1.

Close statements tell the computer to shut files through the same buffer used to open them. If you opened a file through buffer 2, you would say: CLOSE 2.

Program Listing 1 creates a sequential file using these lines. The program is self-documenting and does not require any action on your part to make it work. Study this listing carefully and

SAMPLE SEQUENTIAL RECORD 3

```

BYTE 1...5...10...15...20...25...30...35...40
R=1      1 JOHN,ROGER.
LRL=1    44442544480
          AF8EC2F752D
          .....
```

Figure 3

SAMPLE SEQUENTIAL RECORD 4

```

BYTE 1...5...10...15...20...25...30...35...40
R=1      1 "ROGER,JOHN".
LRL=1    2544452444420
          22F752CAF8E2D
          .....
```

Figure 4

```

10 REM NAME OF PROGRAM      DEMOOUT/SEQ
20 REM
30 REM AUTHOR                JESSE W. BAKER
40 REM
50 REM PURPOSE OF PROGRAM   THIS PROGRAM CREATES A SEQUENTIAL
60 REM                     FILE TO DEMONSTRATE SEQUENTIAL
70 REM                     FILE TECHNIQUES.
80 REM
90 REM DATE                  OCTOBER 10, 1982
100 '
110 '      *** OPEN THE FILE FOR OUTPUT ***
120 CLS
130 '
140 OPEN "O", 1, "SAMPLE/FIL"
150 '
160 '      *** READ DATA AND PRINT TO FILE ***
170 '
180 READ A, B, C
190 '
200 '      *** CHECK FOR END OF DATA ***
210 '
220 IF A = -9 THEN 430
230 '
240 '      *** PRINT DATA TO SEQUENTIAL FILE ***
250 '
260 PRINT #1, A; B; C
270 '
280 '      *** RETURN FOR MORE DATA ***
290 '
300 GOTO 180
310 '
320 '      *** DATA FOR READ STATEMENT ***
330 '
340 DATA 10,20,30,40,50,60
350 '
360 '      *** END OF DATA FLAG ***
370 '
380 DATA -9,-9,-9
390 '
400 '      *** CLOSE THE FILE ***
410 '
420 CLOSE 1
430 END
500 SAVE "DEMOOUT/SEQ",A
```

Program Listing 1

follow the logic flow before you attempt to run it.

I suggest you take a disk with TRSDOS on it and type in this program. When you are at the TRSDOS Ready mode, make sure to type in: BASIC -F:2.

All TRS-80 models allow you to have either fixed-length (FLR) or variable-length (VLR) records. The command above lets you access Basic on the Model II with two file buffers open. You can then specify the length of the record in the open statement.

The procedure is different on the Model I or III. At the TRSDOS Ready mode you must type: BASIC. After you press enter, TRSDOS loads Basic and prompts: HOW MANY FILES? If you enter a number, you allow for that number of fixed-length (FLR) files. If you want to have variable-length (VLR) files, add the suffix V (for variable) to the number: 2V, for example.

When you open the file for the first time in your program, you can set the record length. But, if you attempt to run any program that accesses a data file without specifying how many files you want open, a BN ERROR message appears for attempting to access a file without preparing the system when Basic was started up.

Program Listing 2 opens and reads the data you put into the file called SAMPLE/FIL. Look at the open statement: OPEN "I" 1, "SAMPLE/FIL". It opens the file and specifies that the file be for input only; that is, the data is taken from the disk and placed into memory.

As in the previous example, you can use the same buffer because the file you want to read has been closed.

Since there is data in this file and you want to read all of it, you must now set up a check condition. This condition checks for the end of the file, EOF. You don't want the computer to attempt to read past the EOF because if it does, you get an error message: EOF ERROR in line nnn. Your check line, then, should look like this: IF EOF(1) THEN 340. Use a conditional branching statement to set up the check condition. This is followed by the expression EOF(1) which tells the computer that if the end of file is reached through Buffer 1 while it is reading the contents of the file, then it must go to line 340 and do what it says there.

Line 340 tells the computer to close the file through Buffer 1, and then to end the program.

Follow this with the statement that goes after the information in the file;

since this is an input file, your line looks like this: INPUT #1, A,B,C.

The line tells the computer that you want to enter data stored under A, B, and C into the memory via Buffer 1.

You need not use the same variable names for input as you did for output. The assignment of variable names is up to you, although I do suggest you keep your names consistent if only to prevent confusion.

Another way to recall the data in a file is through the use of the statement: LINEINPUT # buffer number, variable name.

All TRS-80s can use this statement, which translates into "read a line of text from disk." This is useful when you want to read an ASCII-format Basic program file, or when you want to read in a string of data without following the restrictions regarding leading characters or delimiters. LINEINPUT # reads everything from the first character up to

a carriage return character (CHR\$(13)) not preceded by a line feed character, the end-of-file, or the 255th data character.

Any other delimiters encountered are included in the string. You can use this to read each line of a program that is stored in a sequential file. This works very well if you need a program to compare the contents of one file with another.

Line 260 tells the computer to print the contents of the file on the screen. This is followed by the start of a simple loop, using the unconditional branching statement, GOTO. This loop continues until all the data is read. Of course, this file must also be closed.

Program Listing 3 shows a program that lets you add additional data to an existing file. This is done by transferring the old data to a temporary file, adding the new data, and then writing the whole thing back into the original file.

SAMPLE SEQUENTIAL RECORD 5

BYTE 1...5...10...15...20...25...30...35...40

```
R=1      1  A.B.C.
LRL=1    404040
         1D2D3D
         .....
```

Figure 5

```
10 REM NAME OF PROGRAM      DEMOIN/SEQ
20 REM
30 REM AUTHOR                JESSE W. BAKER
40 REM
50 REM PURPOSE OF PROGRAM   THIS PROGRAM READS A SEQUENTIAL
60 REM                      FILE TO DEMONSTRATE SEQUENTIAL
70 REM                      FILE TECHNIQUES.
80 REM
90 REM DATE                  OCTOBER 10, 1982
100
110 CLS
120 '      *** OPEN THE FILE FOR INPUT ***
130 '
140 OPEN "I", 1, "SAMPLE/FIL"
150 '
160 '      *** CHECK FOR END OF FILE ***
170 '
180 IF EOF(1) THEN 340
190 '
200 '      *** READ DATA FROM FILE ***
210 '
220 INPUT #1, A,B,C
230 '
240 '      *** PRINT DATA FILE ON SCREEN ***
250 '
260 PRINT A,B,C
270 '
280 '      *** RETURN FOR MORE DATA ***
290 '
300 GOTO 180
310 '
320 '      *** CLOSE FILE AND END PROGRAM ***
330 '
340 CLOSE 1
350 END
360 SAVE "DEMOIN/SEQ",A
```

Program Listing 2

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You must do this with sequential files because if you open a file for output, the contents are lost.

These three programs should get you started in the right direction with se-

quential files. I suggest that you use these to create some programs for your own use.

Let me know if this article helped you in any way. Please enclose a self-ad-

ressed, stamped envelope for a reply, if desired. ■

Jesse W. Baker can be reached at P.O. Box 561, Old Town, ME 04468.

```

10 REM NAME OF PROGRAM      ADDDATA/SEQ
20 REM
30 REM AUTHOR                JESSE W. BAKER
40 REM
50 REM PURPOSE OF PROGRAM   THIS PROGRAM ALLOWS YOU TO ADD DATA
60 REM                       TO AN EXISTING SEQUENTIAL DATA FILE.
70 REM
80 REM DATE                  OCTOBER 10, 1982
90 REM
100 CLS
110 '
120 '      *** GET FILE NAME ***
130 '
140 INPUT"ENTER THE NAME OF THE FILE YOU WISH TO ADD DATA TO";A$
150 OPEN "I", 1, A$
160 OPEN "O", 2, "TEMPFIL"
170 '
180 '      *** FILE COPY ROUTINE ***
190 '
200 GOSUB 560
210 '
220 '      *** DATA ENTRY ROUTINE ***
230 '
240 INPUT"ENTER NUMBER OF ITEMS YOU WISH TO ENTER";N
250 PRINT
260 FOR X = 1 TO N
270 :   PRINT"ITEM # ";X;" ==>";INPUT A
280 :   PRINT #2,A
290 NEXT X
300 '
310 '      *** CLOSE FILES ***
320 '
330 CLOSE 1,2
340 '
350 '      *** REOPEN FILES ***
360 '
370 OPEN "I", 1, "TEMPFIL"
380 OPEN "O", 2, A$
390 '
400 '      *** FILE COPY ROUTINE ***
410 '
420 GOSUB 560
430 '
440 '      *** CLOSE FILES AGAIN ***
450 '
460 CLOSE 1,2
470 PRINT"FILE COPY COMPLETE"
480 '
490 '      *** END PROGRAM ***
500 '
510 END
520 '
530 '      *** FILE COPY SUBROUTINE ***
540 '      *** COPY FILE 1 TO FILE 2 ***
550 '
560 IF EOF(1) THEN RETURN
570 INPUT #1, A
580 PRINT #2, A;
590 GOTO 560
600 SAVE"ADDDATA/SEQ",A

```

Program Listing 3

\$54.95 for COMPLETE SET

A hhhh, instant relief! At last there is a permanent cure for contact oxidation on Model I edge connectors. Many TRS-80 users are familiar with the symptoms: untimely resets, spontaneous reboots, or the inability to get the computer started at all without a frustrating session with a pink eraser.

The Gold Plug 80 is a well made device consisting of an edge-card plug with gold plated contacts, available with either 34 or 40 contacts. The rear of the plug has ter-

minal tabs which fit exactly over the existing foil fingers on the TRS-80's connectors. After installation, the original plugs have been extended about a half inch, meaning that the plastic door covers no longer fit. This did not trouble me, but you should take it into consideration. E.A.P.'s advertising leaflet, by the way, cautions you about the doors, which is refreshing. They also have the excellent policy of permitting you to return any plugs ordered for a refund if after seeing them you are un-

willing to undertake the installation.

An excellent set of instructions accompany the plugs, and they are shipped promptly. I ordered mine by mail on a Monday and received my set of plugs by first class mail on Tuesday of the next week.

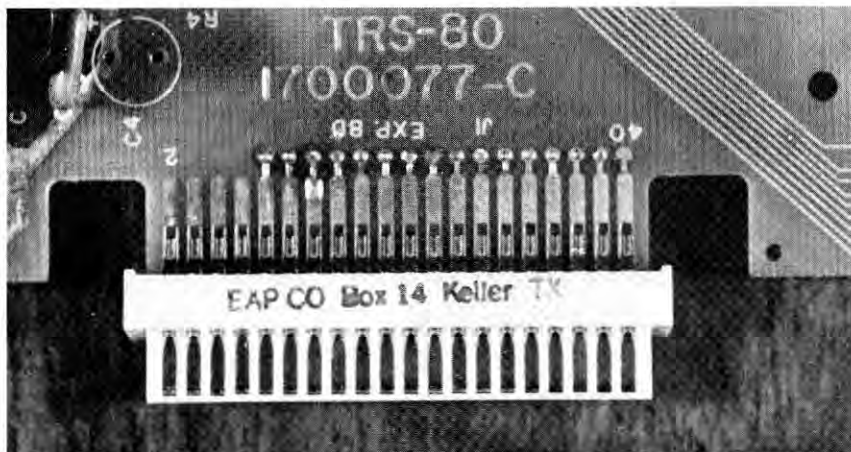
Installation

Installation requires a soldering iron (I use a 40-watt Weller), Rosin-core solder, a Phillips screwdriver, and your last Pink Pearl. The keyboard and Expansion Interface have to be disassembled to get at the connectors, which are then cleaned—the eraser's last fling. The Gold Plug 80 is fitted over the existing plug with the contacts centered, and then soldered to the board. I have some soldering experience, but it proved to be an easy, safe job. The contact is heated, a very small amount of solder applied, and then you go on to the next contact. It took about an hour to do all six plugs.

If you are a little nervous about this kind of work, note that all the contacts on the underside of the RS-232 output connector are grounded—that is, they are all connected. Start there; you can do no harm and the practice will be helpful.

The Gold Plug 80 set I bought included all six plugs. The plugs are available individually for \$9.95, or you can get a pair for the keyboard to Expansion Interface cable for \$18.95.

As I said earlier, I did resolder every connector on the machine, and I haven't had a single unwanted reset since. ■



The Gold Plug 80

GOLD PLUG 80-E.A.P. COMPANY 216
P.O. Box 14 Keller, TX 76248 (817) 498-4242



"No, we're all okay, but our computer's gone."

It could have been a lot worse.

Luckily, all that was missing was the computer and some spreadsheet software. And that should be covered by insurance.

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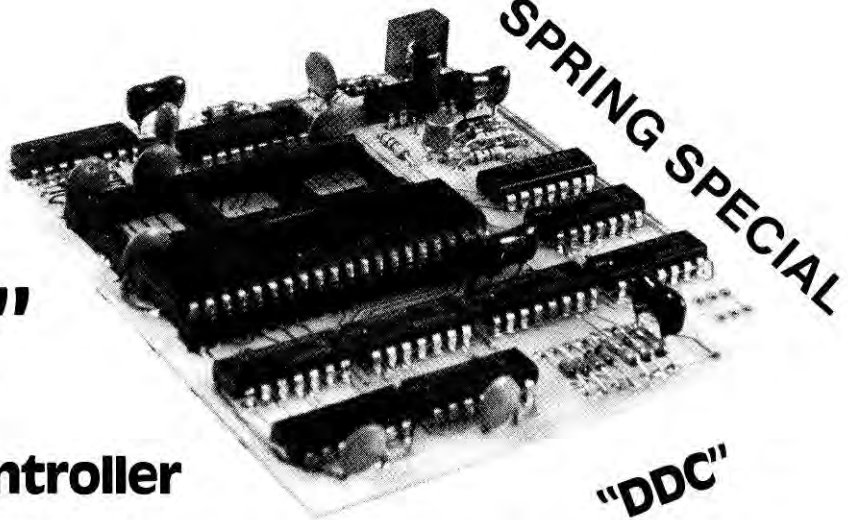
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80 MICRO

Aerocomp's Proven Best-By Test! The "DDC"



Double Density Controller

★ Technical Superiority

At last! A double density controller for Model I with HIGHER PROBABILITY OF DATA RECOVERY THAN WITH ANY OTHER DOUBLE DENSITY CONTROLLER ON THE MARKET TODAY! The "DDC" from Aerocomp. No need to worry about the problems that keep cropping up on existing products. AEROCOMP'S new analog design phase lock loop data separator has a wider capture window than the digital types currently on the market. This allows high resolution data centering. The finest resolution available with digital circuitry is 125 ns (nano seconds). The "DDC" analog circuit allows infinitely variable tuning. Attack and settling times are optimum for 5-1/4 inch diskettes. The units presently on the market use a write precompensation circuit that is very "sloppy". Board to board tolerance is extremely wide - in the order of ± 100 ns. The "DDC" is accurate to within ± 20 ns. The bottomline is state of the art reliability!

★ Test Proven

Tests were conducted on AEROCOMP'S "DDC", Percom's "Doublers A" and "Doublers II" and LNW's "LNDOUBLER" using a Radio Shack TR580 Model I, Level 2, 48 K with TR580 Expansion Interface and a Percom TFD100 disk drive (Siemens Model 82). Diskette was Memorex 3401. The test diskette chosen was a well used piece of media to determine performance under adverse conditions. The various double density adapters were installed sequentially in the expansion interface.

The test consisted of formatting 40 tracks on the diskette and writing a 6DB6 data pattern on all tracks. The 6DB6 pattern was chosen because it is recommended as a "worst case" test by manufacturers of drives and diskettes. An attempt was then made to read each sector on the disk once - no retries. Operating system was Newdos/80, Version 1.0, with Double Zap, Version 2.0. Unreadable sectors were totalled and recorded. The test was run ten times with each double density controller and the data averaged. Test results are shown in the table.

★ Features

TRS80 Model I owners who are ready for reliable double density operation will get (1) 80% more storage per diskette, (2) single and double density data separation with far fewer disk I/O errors, (3) single density compatibility and (4) simple plug-in installation. Compatible with all existing double density software.

★ Value **\$139.95**
for the Best DD Controller on the market.

★ TEST RESULTS ★

MFR & PRODUCT	SECTORS LOCKED OUT (AVG)
AEROCOMP "DDC"	0
PERCOM "DOUBLER II"	18
PERCOM "DOUBLER A"	250
LNW "LNDOUBLER"	202

Note: test results available upon written request. All tests conducted prior to 8-25-81

Aerocomp's 14 day money back guarantee applies to hardware only. Specials will be prorated. Shipping \$2.00 in Cont. US. See opposite page for details.

SPRING SPECIAL
"DDC" and LDOS **\$189.95**

\$169.95 for "DDC" with DOSPLUS 3.30

Data Separators

The advances that make the "DDC" great are incorporated in the new AEROCOMP Single Density Data Separator ("SDS") and Double Density Data Separator ("DDS").

★ Has your original manufacturer left you holding the bag?

If you already own a Percom "Doublers A", "Doublers II" or LNW "LNDOUBLER" or Superbrain, the AEROCOMP "DDS" will make it right. Look at the test results:

MFR. & PRODUCT	SECTORS LOCKED OUT	
	WITHOUT "DDS"	WITH "DDS"
PERCOM "DOUBLER II"	18	1
PERCOM "DOUBLER A"	250	0
LNW "LNDOUBLER"	202	0

Note: Same test procedures as "DDC".
* Trademark of Percom Data Co.
** Trademark of LNW
*** Trademark of Tandy Corporation

★ "DDS" **\$49.95**
(Use 1791 chip from your DD Controller)

★ "DDS" with disk controller chip included **\$79.95**

★ Disk controller chip **\$34.95**

(Shipping \$2.00 Cont. US - see opposite page for details)

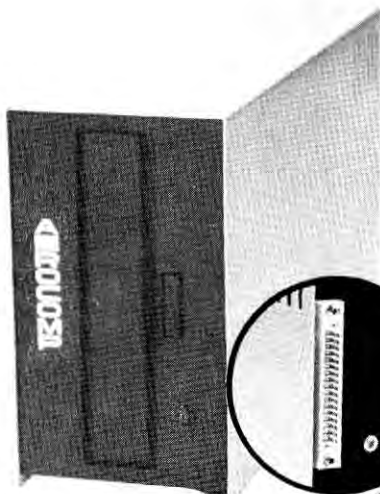
Do you need a Single Density Data Separator?

The internal data separator in the WD1771 chip (R/S Expansion Interface) is NOT recommended by WD for reliable data transfer. Do you have any of these problems: Lost data, tracks locked out, CRC errors, disk retry? YOU NEED ONE!

★ "SDS" **\$29.95**
(For Mod. I; shipping \$2.00)

Plugs directly into your existing Double Density Controller.

See opposite page ▶▶▶▶▶



DISK DRIVES

40 & 80 TRACK

SINGLE & DOUBLE SIDED

as low as **\$169**

NEW!

PACESETTERS

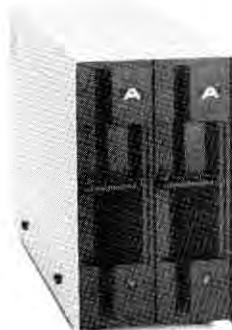
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AEROCOMP!

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- ★ Single or double density
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- ★ Two 80 track Dual Head \$579

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TRS80 Mod. I & III, IBM PC & TI 99/4A. Power supply & enclosure. MPI or Tandon. 5.25 in.

- ★ 40 track single side \$199
- ★ 40 track SS "Flippy" \$219
- ★ 40 track Dual Head \$279
- ★ 80 track SS \$299
- ★ 80 track SS "Flippy" \$319
- ★ 80 track Dual Head \$379
- ★ APPLE compatible w/cable (Shugart) ... \$279
- ★ APPLE compatible disk controller. \$89

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Internal drives for TRS80 Mod. III, IBM PC, TI 99/4A, 5.25 in. (controller required)

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- ★ 80 track SS \$269
- ★ 80 track Dual Head \$339 (add \$20 for "Flippy" modification)
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- ★ 8 inch Dual Head Thinline \$499

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Convert your cassette Mod. III to disk. Complete internal drive kits with 40 track SS drives, disk controller, power supply, mounting towers, hardware & cables.

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MODEL I STARTER PACKAGE

One 40 track SS drive, 2-drive cable, TRSDOS 2.3 disk & manual, freight & insurance.

\$249

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- ★ DOSPLUS 3.5 \$129
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TRS80 Color Computer Drives

First Drive \$399
Includes controller, cable (2-D) and Book

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Model II Real-World Input/Output

by J.J. Barbarello

This Model II capacitance meter lets your computer communicate with the outside world. It's inexpensive and simple to build, too.

Most people think of the TRS-80 Model II solely as a business machine. Trading up from a Model I implies that you give up all thought of interfacing with the outside world. But you'll see this is far from the case.

It's true that the Model II doesn't have the Model I's now-famous audio cables that allow you to connect it to almost anything. But it does have something just as good (or better).

The Model II's I/O (input/output) facility is its line printer port. You might consider the parallel printer port as just a way to get a printout, but to the Model II it's just another I/O port.

This article describes the construction of a computerized Capacitance Measuring Interface (CMI), a device that assures the appropriate I/O electrical signals come from and go to the computer.

The CMI measures capacitors as low as one picofarad or as high as 20 microfarads. Add to that the computer's capability to store results, use measured values in computer-aided design, and perform go-no go testing and you have capabilities that cost thousands of dollars on today's market.

For those of you with an interest in electronics as well as computers, a capacitance meter is an invaluable piece of test gear. You probably don't own one, however, because you wouldn't use it

enough to justify its cost. Like me, you probably select a marked capacitor and hope that its true value isn't too far off.

The Capacitance Measuring Interface changes all that. When you complete this project, you'll have an important, useful test instrument as well as an understanding of how to interface your Model II to the outside world.

Measuring Capacitance

The standard capacitance measuring scheme determines the time needed for an unknown capacitor to charge to a predetermined level. This time is then converted into a capacitance value.

The CMI uses the same principle. If you connect a 555 Timer IC as shown in Fig. 1 and trigger it with a negative-going pulse, pin 3 immediately rises to the supply voltage ($V+$). It stays at $V+$

for a time equal to $1.0986 \times (C_X) \times R$ seconds. This time is independent of supply voltage and, if R is constant, is always the same for a given capacitor. We then determine C_X by accurately measuring the length of the positive pulse present at pin 3 (since $C_X = \text{duration of pulse} / (1.0986 \times R)$).

The CMI Circuit

Referring to the CMI schematic in Fig. 2, notice that IC1 is a 555 Timer IC connected like the one in Fig. 1. The duration of IC1's output pulse depends on C_X and the value of the timing resistor $R3$ or $R4$ (selected by rotary switch $S1a$). IC2 remains unaffected by the positive transition of IC1's output. But when the pulse from IC1 ends, this negative transition is transmitted through $C1$ and triggers IC2. As a result, IC2 produces a fixed-duration, positive-going pulse to $J2$.

In review, IC1's output pulse starts when a positive-going trigger is provided to $Q1$ (since the trigger is inverted by $Q1$ and turns on IC1). Also, you can tell when IC1's output has ended by the presence of a positive pulse at $J2$. All you need do now is have the computer provide the trigger pulse and count until it senses a pulse at $J2$.

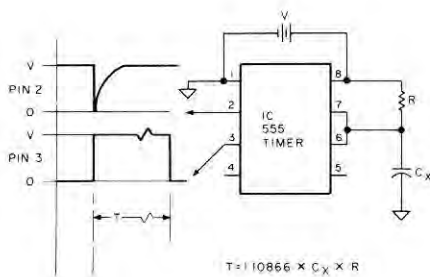


Figure 1

The Key Box

**Model II
32K RAM
Basic, Assembly Language
Editor/Assembler or Debug**



THOR POINT OF SALE SYSTEMS

One or more THOR POS registers can be configured to work with a single Model I/III computer or our THOR Local Area Network described below.

HARDWARE:

- Up to 64 user configureable keys.
- Adjustable tilt video monitor displaying 16 lines of 32 characters.
- 20 character per line alphanumeric printer (40 optional).
- Adjustable 8 digit numeric LED display.
- Cash drawer with manual (key) and automatic opening.
- RS-232 interface to Model I/III or other types of computers.
- Optional bar/OCR code scanning, scales and other peripherals.

SOFTWARE:

- Register functions under control of a master computer such as a TRS-80 Model I/III or a THOR Local Area Network.
- Automatic price lookup with product descriptions for over 65,000 items when using a Winchester disk such as the THOR model described below.
- Optional inventory control with automatic depletion at the time of sales and generation of below minimum stocking lists.
- Optional automatic entry of sales into a general ledger system.
- Common manager reports for sales, voids, discounts, etc.

The THOR POS hardware and standard software from \$1799.



THOR WINCHESTER DISK DRIVES

- Disk capacity of up to 40 megabytes or more for your Model I/III computer. Available in fixed and/or removable drive versions.
- External mounting in a two-drive case as shown or internal mounting.
- Each THOR System comes with a two drive controller and interface to your Model I/III.
- Software available includes an optional operating system (LDOS or NEWDOS-80) and diagnostics.
- The THOR Local Area Network can be field installed. (See below).

THOR Winchester Disk Drive System from \$1299

THOR LOCAL AREA NETWORK (LAN)

A new concept is emerging. An LAN now makes it possible for the smallest business or school to have multi-processing with shared access of common files on a Winchester disk.

The THOR LAN extends this concept. The THOR LAN allows the use of various microcomputers which you already own so that your present investment is not made obsolete. Hardware/software interfaces are available for TRS-80, Apple and Atari. IBM and Commodore are coming soon. The THOR LAN can support up to 254 users with over 4,000 feet of cabling. Ten conductor ribbon cable allows easy addition of new computers. Speeds of up to one megabit per second are possible. File protection is available with multiple users having the option to access any authorized information.

LAN capabilities can be added to the THOR Winchester Disk System described above for just a small additional cost.

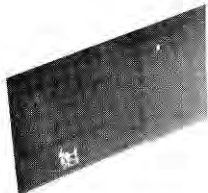
THOR LAN Hardware/Software from \$2699

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Now you can maintain rosters, grades, attendance and miscellaneous records for your classes (up to 99 students per class). Our test module allows you to create any number of multiple choice, true/false, essay or fill-in-the-blank questions in any combination. Finally our test administration module allows you to print out or directly administer a random set of test questions via the computer. Automatic scoring, statistics about your students and other features make this the most comprehensive software available at this price \$199

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If you are interested in this or a related business contact WMS for more information.

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A comprehensive low cost system for the one doctor or small clinic. Includes records, histories, invoices, word processing and more functions too numerous to reference. Call for a detailed brochure.

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If you have a specialized vertical market requirement and are willing to be a development/test site, WMS will contract to pay you a royalty for every additional sale of the resultant software.

Contact our technical staff for more information concerning what a THOR LAN system with specialized peripherals and software can do for you.

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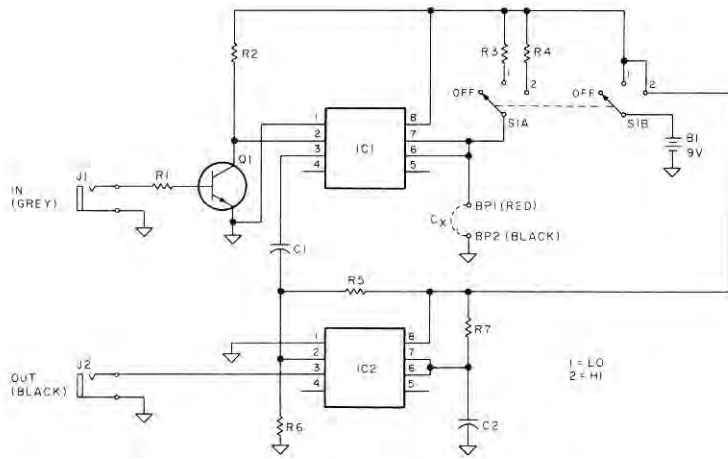


Figure 2

Power for the circuit is provided by a 9-volt battery. S1b acts as a power-on switch, providing power to the circuit when S1 is in position 1 or 2 and disconnecting the battery when S1 is in the OFF position.

The Computer's Part

Do you remember those wonderful commands In and Out from the Model I? They're alive and well as part of the Model II's Z80 instruction set. However, instead of using them on port #255 as we did on the Model I, we use port E0H (244 decimal). Port E0H is the parallel printer channel port to which we can output and (to a limited extent) input data. Use the prime signal to trigger the CMI. Normally the prime signal resets certain printers, but it can trigger any external device.

Input signals such as busy, acknowl-

edge, or fault sense when the CMI com-

pletes its task (see the Model II Technical Reference Manual for a complete description of the printer/floppy disk controller). However, the CMI is arbitrarily designed to trigger the paper empty pin to inform the computer that its task is complete.

So, by connecting J1 of the CMI to the prime pin and J2 to the paper empty pin, you can trigger the CMI and then sense when it has completed its task. All that's left to do is count the time in between and convert that time to a capacitance value. Generating the prime signal, sensing the paper empty signal, and counting and conversion are all controlled by the CMI program.

Two Programs in One

The Basic language CMI Driver pro-

(NOTE: All resistors are 1/4 watt, 10 percent. All capacitors are 10 V or greater disc.)

- R1, R2, R5, R6, R7.... 10k Ohms
- R3..... 10 Megohms
- R4..... 100k Ohms
- C1..... 0.01 μ F
- C2..... 0.1 μ F
- IC1, IC2..... 555 Timer IC
- Q1..... 2N2222A or PN2222 NPN silicon transistor
- J1, J2..... 1/8 inch phono jack
- S1..... 2 pole, 6 position rotary switch
- B1..... 9 V battery clip
- BP1..... Red 5-way binding post
- BP2..... Black 5-way binding post

Miscellaneous: P.C. board, interconnecting cable, control knob, hookup wire, suitable case.
 Note: A complete kit of all items listed above plus the CMI programs and a Computer Aided 555 Timer Design program on disk is available for \$39.95 from the author. Please specify kit #CMI-IID. NJ residents include sales tax.

A version of the CMI is available for Model I/III. Contact the author for further details.

Table 1. List of Materials

Just Married!

THE
MODEL III
 TO
IBM

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 Includes: 80x24 Display
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 sheets suitable for posting with full team and
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 and simple with extensive prompting and
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32K TRS 80 COLOR Version \$24.95.

Adds a second level with dungeons and more Questing.



CATERPILLAR

O.K., the Caterpillar does look a lot like a Centipede. We have spiders, falling fleas, monsters traipsing across the screen, poison mushrooms, and a lot of other familiar stuff. COLOR 80 requires 16k and Joysticks. This is Edson's best game to date. \$19.95 for TRS 80 COLOR.



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The Adventures below are written in BASIC, are full featured, fast action, full plotted adventures that take 30-50 hours to play. (Adventures are interactive fantasies. It's like reading a book except that you are the main character as you give the computer, commands like "Look in the Coffin" and "Light the torch.")

Adventuring requires 16k on Sinclair, TRS-80, and TRS-80 Color. They require 8k on OSI and 13k on VIC-20. Sinclair requires extended BASIC. Now available for TI99. Any Commodore 64.

\$14.95 Tape — \$19.95 Disk.

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(by Rodger Olsen)

This ADVENTURE takes place on the RED PLANET. You'll have to explore a Martian city and deal with possibly hostile aliens to survive this one. A good first adventure.

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This is our most challenging ADVENTURE. It is a treasure hunt in a pyramid full of problems. Exciting and tough!

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Dungeons of Death — Just for the 16k TRS-80 COLOR, this is the first D&D type game good enough to qualify at Aardvark. This is serious D&D that allows 1 to 6 players to go on a Dragon Hunting, Monster Killing, Dungeon Exploring Quest. Played on an on-screen map, you get a choice of race and character (Human, Dwarf, Soldier, Wizard, etc.), a chance to grow from game to game, and a 15 page manual. At the normal price for an Adventure (\$14.95 tape, \$19.95 disk), this is a giveaway.

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Program Listing 1

```

1 REM**          CMI DRIVER PROGRAM
2 REM**          NAME: CMI
3 REM**          LATEST REVISION: #3, 16 Jan 1982
4 REM**
10 CLS: CLEAR 1000: SYSTEM "LOAD MODIICMI": DEFUSR4=&HF050: DEFUSR5=&
HF07C
20 DEFSTR A,N,R:A=CHR$(26)+" "+CHR$(25):N=CHR$(25):R=CHR$(26):AB
=" ":ALN=R+STRING$(80,32)+R
30 PRINT CHR$(154);STRING$(78,150);CHR$(154);:PRINT A;TAB(24);R;
" COMPUTERIZED CAPACITANCE METER ";N;TAB(79);A;
40 FOR I=1 TO 2:PRINT A,TAB(79);A;:NEXT:PRINT R;CHR$(153);N;STR
ING$(78,150);R;CHR$(153);N
50 PRINT@(8,0),ALN:PRINT@(16,0),ALN;:FOR I=9 TO 15:PRINT@(I,0),A
:PRINT@(I,79),A;:NEXT
60 PRINT@(12,35),"METER ON":PRINT@(9,2),"R":PRINT@(10,2),"A":PRI
NT@(11,2),"N":PRINT@(12,2),"G":PRINT@(13,2),"E"
70 PRINT@(2,3),STRING$(74,151):PRINT@(3,7),"Press ";R;" 1 ";N;"
for LO range, ";R;" 2 ";N;" for HI range, or ";R;" F1 ";N;" to t
urn Meter OFF."
80 VR(1)=11.07:VR(2)=.0972:Z(1)=15:Z(2)=1:MULT=47222:GOTO 280
90 REM**          INITIALIZATION COMPLETED - PROGRAM BEGINS
**
100 PRINTCHR$(2):X=USR4(0):PRINTCHR$(1):IF X<0 THEN X=65536+X
110 X=X-Z(RNG%):IF X>0 THEN GOSUB 2200:GOTO 150
120 GOSUB 2200:PRINTCHR$(2):FOR I=1 TO 10:PRINT@(12,30),"<< OUT
OF RANGE >>";
130 FOR J=1 TO 50:NEXT:PRINT@(12,30),SPACE$(20);:FOR J=1 TO 50:N
EXT J,I
140 PRINT@(12,30),CHR$(1);"<< OUT OF RANGE >>";:GOTO 280
150 D#=X/(VR(RNG%)*MULT)+9999999999:CV=X/(VR(RNG%)*MULT):IF RNG%
<>1 THEN 220
160 LO=LEN(STR$(INT(VR(1)*MULT*.1/X)))+1:Y$=MID$(STR$(D#),13,LO)
170 IF LO=7 THEN LO=6
180 R%=10:C=8:GOSUB 2000:C=C+7
190 FOR F=1 TO LO:J=VAL(MID$(Y$,F,1))
200 ON J+1 GOSUB 1000,1100,1200,1300,1400,1500,1600,1700,1800,19
00
210 C=C+7:NEXT F:GOSUB 2100:GOTO 280
220 IF RNG%=2 THEN NV=MID$(STR$(CV),2,5)
230 IF CV<1 THEN NV="0"+LEFT$(NV,4) ELSE NV=LEFT$(NV,4)
240 IF LEN(NV)<4 THEN NV=NV+"0"
250 R%=10:C=20:FOR F=1 TO 4:Z=ASC(MID$(NV,F,1))-47:Z=Z+(Z=-1)*-1
2
260 ON Z GOSUB 1000,1100,1200,1300,1400,1500,1600,1700,1800,1900
,2020
270 C=C+7:NEXT:GOSUB 2100
280 PRINT@(19,35),"RANGE ?...":CHR$(23);:RI=INPUT$(1)
290 IF ASC(RI)=1 THEN PRINT" OFF":X=USR5(0):GOSUB 2200:PRINT@(12
,35),"METER OFF.":PRINT@(20,0);:END
300 RNG%=VAL(RI):IF RNG%<>1 AND RNG%<>2 THEN 280
310 PRINT R;" MEASURING ";N:PRINT@(15,1),RNG%;:IF ROLD%<>RNG% TH
EN X=USR4(0):ROLD%=RNG%
320 GOTO 100
330 REM**
340 REM*****          DISPLAY SUBROUTINES          *****
*****
350 REM**
1000 REM** ZERO
1010 PRINT@(R%,C),CHR$(154);A;A;A;A;CHR$(154):FOR I=1 TO 3:PRINT
@(R%+I,C),A;AB;AB;AB;AB;A:NEXT I:PRINT@(R%+4,C),R;CHR$(153);N;A;
A;A;R;CHR$(153);N:RETURN
1100 REM** ONE
1110 PRINT@(R%,C+1),CHR$(146):FOR I=0 TO 4:PRINT@(R%+I,C+2),A;A:
NEXT:PRINT@(R%+4,C+1),A;A;A;A:RETURN
1200 REM** TWO
1210 PRINT@(R%,C),A;A;A;A;A;A:PRINT@(R%+1,C+5),A:PRINT@(R%+2,C),
A;A;A;A;A;A
1220 PRINT@(R%+3,C),A:PRINT@(R%+4,C),A;A;A;A;A;A:RETURN
1300 REM** THREE
1310 PRINT@(R%,C),A;A;A;A;A;A:PRINT@(R%+1,C+5),A:PRINT@(R%+2,C+1
),A;A;A;A;A:PRINT@(R%+3,C+5),A:PRINT@(R%+4,C),A;A;A;A;A;A:RETURN
1400 REM** FOUR
1410 PRINT@(R%,C),A;A;AB;AB;A;A:PRINT@(R%+1,C),A;A;AB;AB;A;A:PRI
NT@(R%+2,C),A;A;A;A;A:PRINT@(R%+3,C+4),A;A:PRINT@(R%+4,C+4),A;
A:RETURN
1500 REM** FIVE
1510 PRINT@(R%,C),A;A;A;A;A;A:PRINT@(R%+1,C),A:PRINT@(R%+2,C),A;
A;A;A;A:PRINT@(R%+3,C+5),A:PRINT@(R%+4,C),A;A;A;A;A;A:RETURN
1600 REM** SIX
1610 PRINT@(R%,C),A;A:PRINT@(R%+1,C),A;A:PRINT@(R%+2,C),A;A;A;A;
A;A:PRINT@(R%+3,C),A;A;AB;AB;AB;A:PRINT@(R%+4,C),A;A;A;A;A;A:RET
URN
1700 REM** SEVEN
1710 PRINT@(R%,C),A;A;A;A;A;A:FOR I=1TO4:PRINT@(R%+I,C+4),A;A:NE
XT:RETURN
1800 REM** EIGHT
1810 FOR I=0 TO 5 STEP 2:PRINT@(R%+I,C),A;A;A;A;A;A:NEXT:FOR I=1

```

Listing 1 continues

gram (Program Listing 1) performs many of the required functions. The input and output signals, as well as the intermediate count, are performed by a machine-language program. This program, "MODIICMI" loads by line 10 of the Basic program, which also defines its entry point (0F050H). The assembled program (fully commented) is in Program Listing 2. Essentially, the program sends a prime signal to the CMI. It then enters a loop and senses the paper empty pin, increments the count if the PE pin is low, then waits and tries again. When the PE pin is sensed high (line 220) or the maximum count has been reached (line 240), execution jumps out of the loop. At this point, the count is transferred to the Basic variable and a return is performed.

During non-CMI applications, the prime pin is at a logic level 1. During CMI operation, the prime pin stays low

"A capacitance meter is an invaluable piece of test gear."

(except for the trigger pulse). When you finish using the CMI and wish to use the parallel printer channel for the line printer, return the prime pin to the logic 1 level using lines 370 and 380 of the machine-language program. This short routine (defined as USR5 in the Basic program's line 10) is called just before the program ends at line 290.

The majority of the Basic program deals with screen formatting and measured value display. The screen's presentation simulates a meter with a large LCD (Liquid Crystal Display) readout. Line 70 prints a message on the screen prompting you to press 1 for the LO range, 2 for the HI range and F1 to turn the meter off.

Construction

A printed circuit (PC) board is required to maintain the accuracy of the CMI. Fabricate the PC board using the pattern shown in Fig 3a. Then begin mounting the components and jumper J1, paying special attention to the orientation of IC1, IC2 and Q1 (see Fig 3b). Next, mount and connect J1, J2, BP1,

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Listing 1 continued

```

TO 3 STEP 2:PRINT@(R%+I,C),A;AB;AB;AB;AB;A:NEXT:RETURN
1900 REM** NINE
1910 PRINT@(R%,C),A;A;A;A;A:A:PRINT@(R%+1,C),A;AB;AB;AB;A;A:PRIN
TE@(R%+2,C),A;A;A;A;A:A:PRINT@(R%+3,C+4),A;A:PRINT@(R%+4,C+4),A;A
:RETURN
2000 REM** LEADING ZERO
2010 GOSUB 1000:C=C+7
2020 PRINT@(R%+4,C+2),A;A:RETURN
2100 REM** uF
2110 PRINT@(R%+3,C),A;AB;A:PRINT@(R%+4,C),A;CHR$(153);A
2120 PRINT@(R%+1,C+4),A;A;A:PRINT@(R%+2,C+4),A:PRINT@(R%+3,C+4),
A;R;CHR$(153);N:PRINT@(R%+4,C+4),A:RETURN
2200 REM** CLEAR DISPLAY
2210 PRINTCHR$(2)
2220 FOR I=10 TO 15:PRINT@(I,5),STRING$(70,32);:NEXT
2230 PRINTCHR$(1):RETURN
    
```

```

00010 ;*****
00020 ;* SOURCE=MODIICMI/ASM - OBJ=MODIICMI *
00030 ;* Version 1.1 9 Jan 1982 *
00040 ;* c 1982 by J.J. Barbarello *
00050 ;* Capacitance Measuring Interface *
00060 ;* Machine Language Driver. For use *
00070 ;* with CMI Hardware. *
00080 ;*
00090 ;*****
P050 00100 ORG 0F050H
P050 3E81 00110 LD A,129 ;TURN OFF
P052 D3FF 00120 OUT (255),A ; REAL TIME CLOCK.
P054 2295F0 00130 LD (0F095H),HL;Save HL counter
P057 210000 00140 LD HL,0 ;Initialize
P05A 110100 00150 LD DE,1 ; Registers.
P05D 3E00 00160 LD A,0 ;Send A pulse
P05F D3E0 00170 OUT (0E0H),A; To the Line Printer's
P061 3E08 00180 LD A,8 ; "PRIME" Pin (# 26),
P063 D3E0 00190 OUT (0E0H),A; (PRIME Stays at Logic 1).
P065 DBE0 00200 IN LOOP IN (0E0H);Get status of "Printer".
P067 CB77 00210 BIT 6,A ;Check Bit 6 ("Paper Empty")
P069 2009 00220 JR NZ,DONE ;If set, jump to "DONE".
P06B 19 00230 ADD HL,DE ;Increment HL Counter.
P06C 3806 00240 JR C,DONE ;If Count>FFFFH, Return.
P06E 0602 00250 LD B,2 ;Must delay here so count
P070 10PE 00260 WAIT DJNZ WAIT ; is not too high!
P072 18F1 00270 JR LOOP ;Not done yet. Go back.
P074 EB 00280 EX DE,HL ;Save count in DE.
P075 2A95F0 00290 HL,(0F095H);Get addr of variable.
P078 73 00300 LD (HL),E ;Put Count LSB in variable.
P079 23 00310 INC HL ;Get ready for MSB.
P07A 72 00320 LD (HL),D ;Put Count MSB in variable.
P07B C9 00330 RET ;Return to BASIC program.
;
; << RESTORE PROPER "PRIME" LOGIC LEVEL >>
;
P07C 3E00 00370 LD A,0
P07E D3E0 00380 OUT (0E0H),A
P080 C9 00390 RET
0000 00400 END
    
```

Program Listing 2

BP2, S1 and B1 as shown in Fig. 3c.

Place S1 to the off position and snap a 9-volt battery into B1. Mount the completed CMI in any suitable case or use it as is. Finally, mount a suitable control knob on S1, positioning the marker at the off position.

With the CMI complete, you must fabricate a connecting cable. The cable consists of two 1/8-inch phono plugs at one end, a 34-pin female header (made from AP Products', part number 929975) at the other, and a three-conductor cable interconnecting them as shown in Fig. 4. When the connecting cable is made, your CMI is complete.

Using the CMI

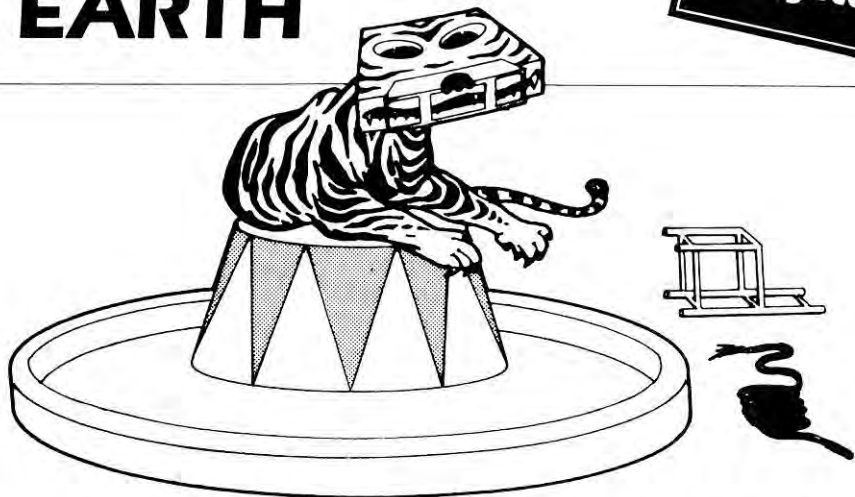
Enter the machine-language program (with an Editor/Assembler or the TRSDOS Debug facility). Save this program under the name "MODIICMI".

Now enter and save the Basic program using the name "CMI". Type RUN"CMI" and press enter. After a short time, the screen clears and the CMI meter appears on the screen.

Now attach the connecting cable to the parallel printer channel and the CMI. Obtain a marked, known-value capacitor of about 0.1 μ F and attach it to the CMI binding posts. Place the range switch to the LO position. At the bottom of the screen you should see the prompt RANGE?... Press the 1 key. Immediately after the prompt, you should see "MEASURING" in reverse video. After some time, the measured value appears in the display above the prompt (EX: 0.094 μ F). Place the range switch to HI and press 2 on the keyboard. Again, "MEASURING" appears. Next, the previous measurement disappears and is replaced by the new

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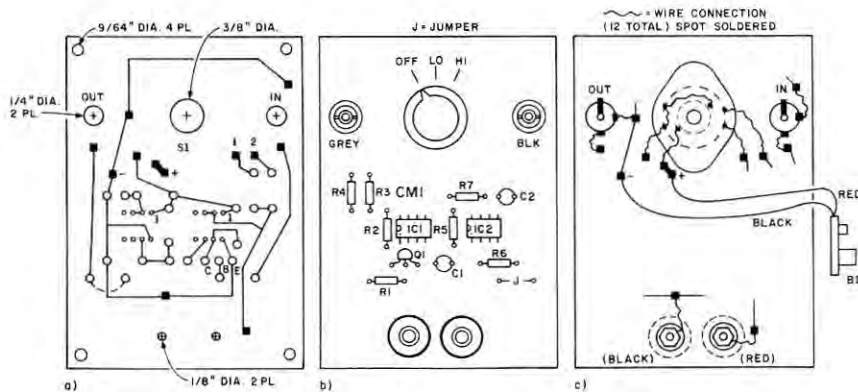


Figure 3

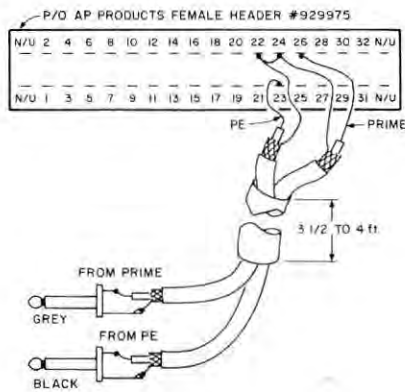


Figure 4

measured value (EX: 0.09 μ F).

At this point, try measuring any other capacitors you wish. You must adhere to two rules, however. First, always press the number corresponding to the range set for the CMI. For instance, pressing 2 when the CMI is set to the LO range results in an erroneous reading. Second, when measuring polarized capacitors (such as electrolytes), always connect the positive (+) lead to the red binding post and the negative (-) lead to the black binding post.

If you attempt to measure a capacitor that is larger or smaller than the selected range, the message <OUT OF

RANGE> blinks in the display area. Simply change ranges and try again. If the <OUT OF RANGE> message appears after trying both ranges, the capacitor is either larger than 20 μ F, or is defective.

When you finish with the meter, place the range switch to the off position and press the keyboard's F1 key in response to the screen's RANGE?... prompt. The display area clears, the message "METER OFF" appears and the program ends.

Calibration

Calibration corrects the CMI circuit's

stray capacitances and deviation from nominal values of R3 and R4. All factors to be calibrated are contained in line 80.

To begin calibration, enter the following: 105 PRINT@(22,0), "FACTOR=";X. Run the program with the CMI on the LO range (#1) and no capacitor connected. Press 1 for "RANGE?... " and the factor indicated (<OUT OF RANGE> appears). This is Z(1). Repeat for the HI range (#2). The factor that appears is Z(2). Now measure R3 (EX: 10.9 megohms). This is VR(1) (EX: 10.9). Repeat, measuring R4 (EX: .0973 megohms) which

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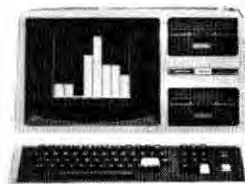
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is VR(2). Modify the present line 80 values of Z(1), Z(2), VR(1), and VR(2). Delete line 105 and save the program.

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After loading "MODIICMI" and performing a DEFUSR4=&HF050: DEFUSR5=&HF07C, your program then executes the X=USR4(0) command. It determines the range (1 or 2) selected and then adjusts the variable X using the formula: X = X - Z(RNG%). (NOTE: The variable RNG% should previously have been assigned the range number selected.) You then calculate X = X/(VR(RNG%)*MULT) to determine the value (in µF). Use the measured value in any subsequent process you wish. When the CMI is no longer necessary, your program should execute an X=USR5(0) to return the prime pin's logic level to "normal." ■

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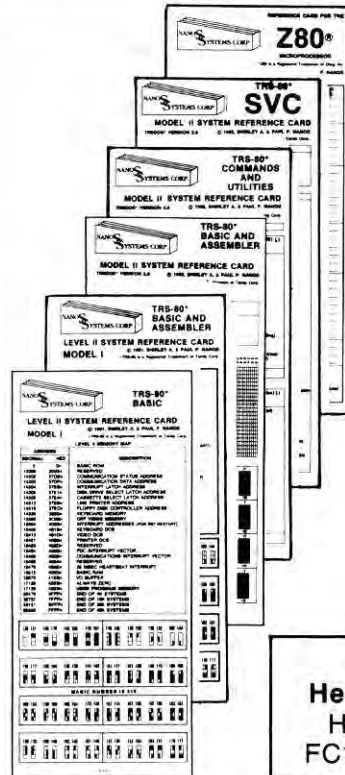
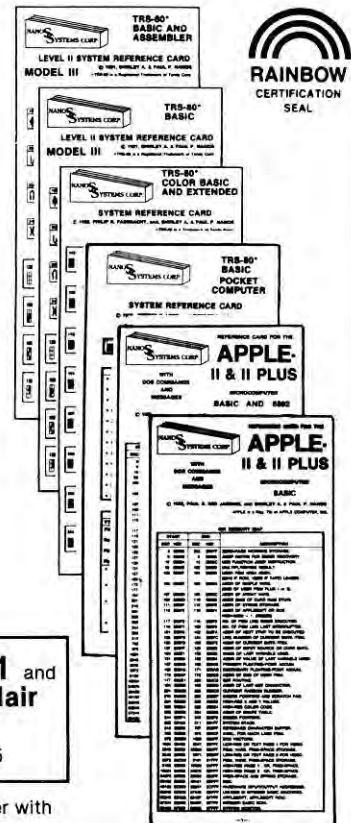
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Reproduce finer shading levels.

The Printer as a Paintbrush— Part II

Mike Keller
13423 Desert Hills NE
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In Part I of this series (May 1983, p. 218) we learned to digitize block letters and line drawings, and reproduced images on two printers with dot-addressable graphics.

Because these images were black and white, our computer just needed to know whether an individual point on the graph was "on" or "off." Dark squares on the original image were represented as dots on the printout, and white squares were not printed at all. Digitizing a photograph, however, is not as cut and dried. A photograph

consists of many levels of shading, from white to grey to black.

Part II will consider the problem of reproducing several shading levels, so you can print a fairly close representation of a photo on your printer. Photo 1 shows a sample of the results you may expect. The printout was digitized from an 8 by 10 photograph. Also included in this part is a short Basic program that generates a miniature TRS-80 screen-print.

System Requirements

Other than a printer with dot-addressable graphics, no special hardware is needed to use the programs shown here. The programs were developed on a TRS-80 Model I with Disk Basic and 48K memory, but should work with 32K as well. As with the listings from last month, each program is shown in two versions: one for the NEC 8023 printer, and one for the Epson MX-80 with Graftrax 80 installed. The routines shown for the NEC should work on the C.I.TOH 8510 or the ADS 8001.

Here's how we will approach digitizing a photo: First, several dot matrix patterns will be developed that produce different levels of shading when printed. Then we will divide the photo into small squares, and build data statements that contain a series of digits. Each digit will represent the shading level which best approximates that of a given square in the original photo. A program will then read the data and send it to the printer as a series of shading levels.

Decisions, Decisions

Several considerations must be balanced against one another when setting up our



Photo 1. Digitized 8 by 10 photograph

The Key Box

Model I
32K RAM
Disk Basic
Printer with dot-addressable graphics

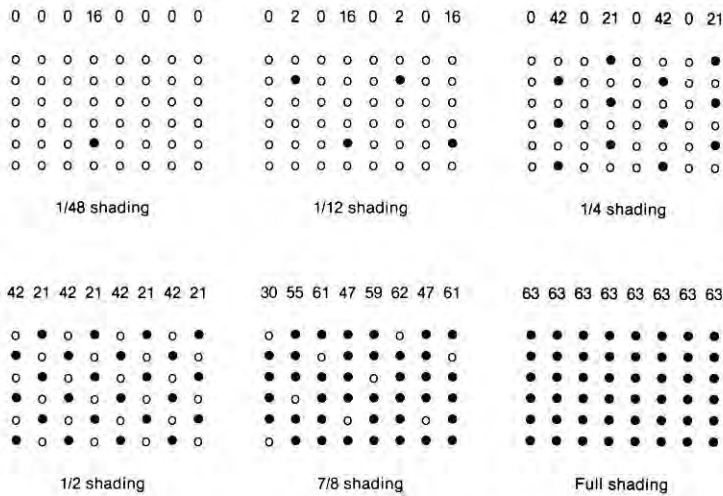


Fig. 1. Shading level dot patterns for the NEC

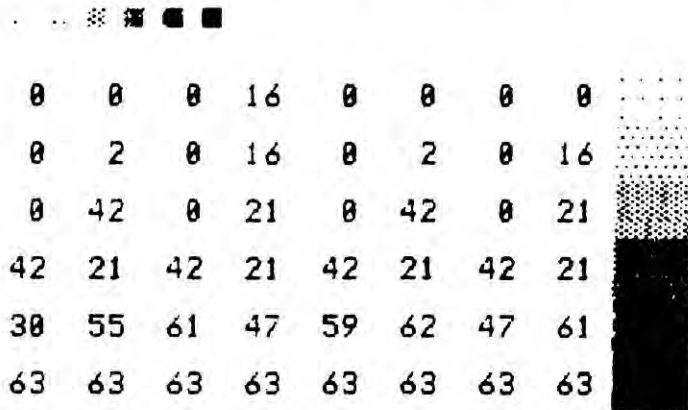


Fig. 2. Sample printout from Listing 1a

programs. They center around two main issues: quality of the finished product versus the amount of time we are willing to spend in the digitizing process. The smaller the squares used to graph the photo, the higher will be the quality of the printout, but there are a couple of things to remember here. First, smaller blocks mean you will have a smaller matrix (fewer dots) to work with in developing the shading levels. Second, smaller blocks mean more blocks. In digitizing an 8 by 10 inch photograph using 1/24 inch squares, you would have to enter (manually) over 46,000 characters into the data statements! Even using some kind of file management to prevent an Out of Memory error, you would probably need a magnifying glass and the patience of Job to complete the project.

At the other extreme, representing an 8 by 10 photo with 1/4 inch squares would require only 1280 digital characters, and the graph would be easy to see and digitize. Unfortunately, the resolution would be so poor that many details of the photo would be missing. Another problem with such low resolution is stair-stepping—the zigzag appearance of any shading boundaries that run diagonally across the photograph.

Compromise

After experimenting with several block

sizes for the graph, I settled on 1/12 inch squares. The individual squares are large enough to keep track of during the manual digitizing, and the resolution is not bad. The use of 1/12 inch blocks also allowed me to design six distinct shading levels. This is enough to show some fairly subtle changes of shading within a photo. Photo 1 represents the results of this compromise. It is a printout of an 8 by 10 photograph digitized with 1/12 inch blocks. The printout was generated from 120 data statements, with each statement containing a 96-character string (11,520 characters in all). If this seems like a lot of work, it was. But the final result was worth the effort!

Shading Levels

Both the NEC and the Epson printers are capable of generating a 1/12 inch matrix of dots. On the NEC, the matrix will be eight dots wide by six dots tall, with the printer set to the Elite print style (96 dots per inch horizontally). On the Epson, we will be using a matrix 10 dots wide by six dots tall, in the 960 graphics mode (120 dots per inch horizontally). Because the horizontal dot spacing is not the same for the two printers, the dot patterns for the six shading levels will have to be unique to each printer.

Developing shading levels is not simply a matter of putting more ink or less ink on the

paper within each block. The dots must be uniformly spaced within the matrix, and the pattern used must be one that does not create a separate noticeable pattern when repeated over a large area. This gets a little tricky. Just when I thought a pattern would work for, say, light grey, it turned out that the pattern produced a distracting series of zigzagging dots when I printed several in a row. Even a pattern that caused no problem there might look like a group of small circles when printed one over the other.

Experimentation

Program Listing 1a (for the NEC printer) and Program Listing 1b (for the MX-80) were

“One problem with low resolution is stair-stepping.”

written to speed up the process of developing and testing dot patterns for various shading levels. Figure 1 shows some sample dot patterns for the 8 by 6 matrix on the NEC printer. The first pattern (1/48) uses only one of the 48 possible dots in the matrix, producing a very light shading. The last pattern (48/48 shading) prints all 48 dots of the matrix, for the darkest shading possible without using a smaller horizontal dot spacing mode. The remaining patterns produce intermediate levels of shading on this printer. The dot patterns for the MX-80 are not shown, but you can draw them yourself from the data statements in Listing 1b. Remember, the top pin of the MX-80 print head is treated as if it were bit 7 of an eight-bit binary number. This is the reverse of the NEC printer, which treats the top pin as bit 0.

In Fig. 1, the decimal values that generate each pattern are shown above the columns of dots. You can experiment with other patterns by changing the data statements in Listing 1, or by adding your own.

When you run the program it will print the individual matrices, and then combine several rows and columns of the patterns, as in Fig. 2. This gives you a chance to check for unwanted patterns that may appear when a matrix is repeated. On the printout, the decimal values for each pattern are printed in a horizontal row to the left of the dots. As an example, the decimal values 0,42,0,21,0,42,0,21 will generate the third matrix from the left at the top of the figure. Of course, these are the same values that were in the data statement, but it's good to have a hard copy that relates the

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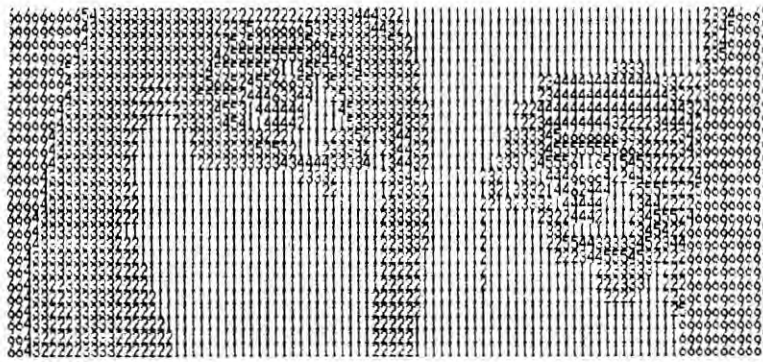


Fig. 3. LLIST data lines

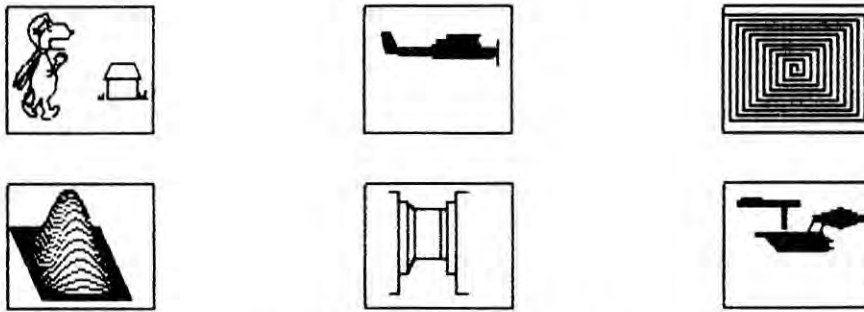


Fig. 4. Sample mini-screen prints

decimal data to its visual pattern.

Even if you are not interested in trying out patterns of your own, I would recommend a little experimentation with different values so you will have a better idea of how this works.

Selecting a Subject

Now that six levels of shading are available on the printer, we can proceed with the project. The first step is to select an appropriate photograph. This should not be done casually, because you are going to spend several hours digitizing, and a poor choice can make the job more difficult. Here are some things to consider:

Avoid color pictures. You will be busy

“Use a photo that has a minimum of fine detail.”

enough determining which levels of grey to use, without the added distraction of differentiating light blue and medium-dark yellow.

Use a photo that has a minimum of fine detail. A landscape scene where each blade of grass is visible may be pretty, but it might be impossible to show such detail in a 1/12 inch block. I encountered this when trying to digitize the subject's hair in my selected photo. The detail in that area was too fine to represent with 1/12 inch squares, so I simply used all dark blocks.

Avoid a photo with lots of subtle changes in shading. If one shade gradually changes to another over a large area of the photo, you will have to show this as a sharper boundary on your printout. An example of this can be seen in Photo 1 where there is a shadow on the subject's right cheek. This particular problem could be solved by developing more shading levels to choose from. In this case, I felt that the benefit would be small compared to the extra work.

A closeup portrait such as the one shown makes a very good subject. Although the eyes are fairly high in detail, they will be large enough on a closeup to be captured in digital form.

Most Important Step

After you have decided on a suitable subject, drop by the local print shop and have several photocopies made. You will be making lots of marks on a working copy, and you will need the original for comparison during the touch-up process.

Now take one of the copies and deter-

```

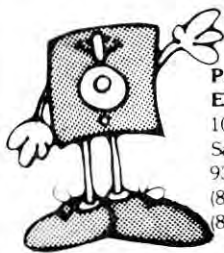
10 'SHADES a ***** FOR NEC 8023 PRINTER *****
20 'AIDS DEVELOPMENT OF SHADING PATTERNS FOR AN 8 x 6 MATRIX
30 '
40 '===== INITIALIZE =====
50 CLEAR 1000: DEFINT A-Z: PR=14312 'PRINTER'S ADDRESS
60 LPRINT CHR$(27)+"T12" 'SET 12/144 (6/72) LINE SPACING
70 LPRINTCHR$(27)+"E" 'SELECT "ELITE" STYLE (96 DOTS/IN)
80 '
90 '===== READ MATRICES TIL OUT OF DATA =====
100 ON ERROR GOTO 140 'ANTICIPATING "OUT OF DATA" ERROR
110 SH=1 'START WITH SHADING COUNTER AT 1
120 FOR B=1 TO 8: READ SH(SH,B): NEXT B
130 SH=SH+1: GOTO 120
140 RESUME 240 'ALL DATA HAS BEEN READ
150 '===== EXPERIMENTAL DATA FOR 8 x 6 MATRIX =====
160 DATA 0,0,0,16,0,0,0,0: '1 OUT OF 48 DOTS
170 DATA 0,2,0,16,0,2,0,16: '4 OUT OF 48 DOTS
180 DATA 0,42,0,21,0,42,0,21: '12 OUT OF 48 DOTS
190 DATA 42,21,42,21,42,21,42,21: '24 OUT OF 48 DOTS
200 DATA 30,55,61,47,59,62,47,61: '42 OUT OF 48 DOTS
210 DATA 63,63,63,63,63,63,63,63: '48 OUT OF 48 DOTS
220 '
230 '===== INDIVIDUAL BLOCK PRINTOUT =====
240 N=SH-1: ON ERROR GOTO 0 'NO MORE ERRORS EXPECTED
250 FOR SH=1 TO N
260 LPRINT " "; 'SEPARATE THE MATRICES
270 LPRINT CHR$(27)+"S0008"; '8 GRAPHICS BYTES TO FOLLOW
280 GOSUB 440 'SEND THE CURRENT MATRIX
290 NEXT SH: LPRINT STRING$(2,10)
300 '===== FULL PRINTOUT FOR COMPARISONS =====
310 INPUT"PRESS <ENTER> FOR FULL PRINTOUT... ";A$
320 FOR SH=1 TO N
330 FOR LN=1 TO 3
340 IF LN <> 2 THEN LPRINTSTRING$(32,32);: GOTO 370
350 LPRINTUSING"### ";SH(SH,1),SH(SH,2),SH(SH,3),SH(SH,4);
360 LPRINTUSING"### ";SH(SH,5),SH(SH,6),SH(SH,7),SH(SH,8);
370 LPRINT CHR$(27)+"S0032"; '32 GRAPHICS BYTES TO FOLLOW
380 FOR Q=1 TO 4: GOSUB 440: NEXT Q
390 LPRINT:NEXT LN
400 NEXT SH
410 LPRINT CHR$(27);"A" 'RESTORE NORMAL LINE SPACING
420 LPRINT STRING$(8,10): END
430 '===== SUBROUTINE TO SEND A MATRIX TO PRINTER =====
440 FOR B=1 TO 8
450 IF PEEK(PR) <> 63 THEN 450 ELSE POKE PR,SH(SH,B)
460 NEXT B: RETURN

```

Program Listing 1a

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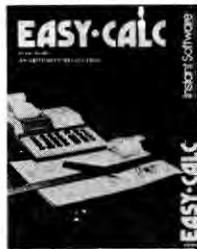
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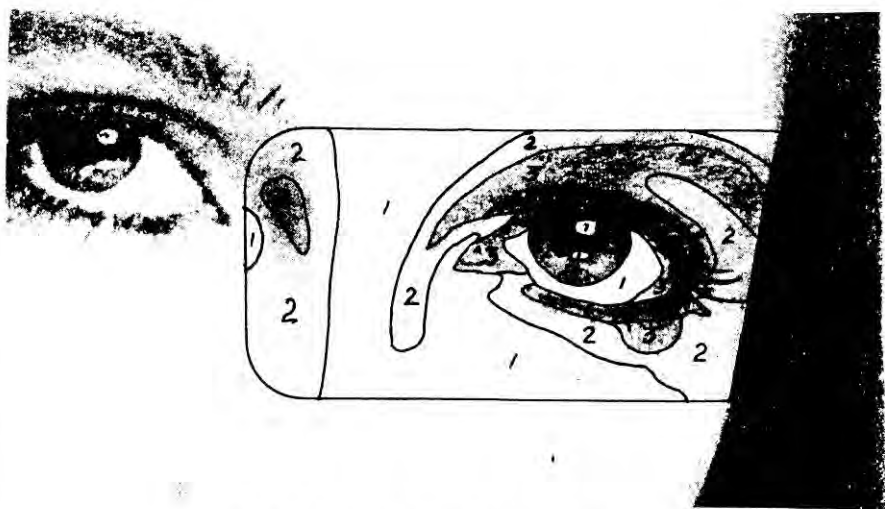


Fig. 5. Section of photo with shading levels marked

mine where your six shading levels would most closely match the shadings in the photograph. Circle these areas as in the rectangular section of Fig. 5 (you should do it for the entire photograph), and write in each area the shade that will be assigned to it. Start with all the areas that will get a

shading level of six, or black. Then mark all the areas that will have the lightest shading. This will give you some perspective for assigning appropriate values to the intermediate areas.

This marking is the single most important phase of the digitizing process, so take your

```

10 'SHADES b          ***** FOR MX-80 PRINTER *****
20 'AIDS DEVELOPMENT OF SHADING PATTERNS FOR AN 10 x 6 MATRIX
30 '
40 '===== INITIALIZE =====
50 CLEAR 1000:
DEFINT A-Z: PR=14312 'PRINTER'S ADDRESS
60 LPRINT CHR$(27)+"A"+CHR$(6) 'SET 6/72 LINE SPACING
70 '
80 '===== READ MATRICES TIL OUT OF DATA =====
90 ON ERROR GOTO 130 'ANTICIPATING "OUT OF DATA" ERROR
100 SH=1 'START WITH SHADE COUNTER AT 1
110 FOR B=1 TO 10: READ SH(SH,B): NEXT B
120 SH=SH+1: GOTO 110
130 RESUME 220 'ALL DATA HAS BEEN READ
140 '===== EXPERIMENTAL DATA FOR 10 x 6 MATRIX =====
150 DATA 0,0,8,0,0,0,0,2,0,0: '2 OUT OF 60 DOTS
160 DATA 0,16,0,4,0,1,0,16,0,4: '5 OUT OF 60 DOTS
170 DATA 4,17,4,17,4,17,4,17,4,17: '15 OUT OF 60 DOTS
180 DATA 42,21,42,21,42,21,42,21,42,21: '30 OUT OF 60 DOTS
190 DATA 63,45,63,54,63,27,63,45,63,54: '50 OUT OF 60 DOTS
200 DATA 63,63,63,63,63,63,63,63,63,63: '60 OUT OF 60 DOTS
210 '===== INDIVIDUAL BLOCK PRINTOUT =====
220 N=SH-1: ON ERROR GOTO 0 'NO MORE ERRORS EXPECTED
230 FOR SH=1 TO N
240 LPRINT" "; 'SEPARATE THE MATRICES
250 LPRINT CHR$(27)+"L"; '960 GRAPHICS MODE
260 POKE PR,10: LPRINT CHR$(255); 'SEND BYTE COUNT OF 10
270 GOSUB 450 'SEND THE CURRENT MATRIX
280 NEXT SH: LPRINT STRING$(2,10)
290 '===== FULL PRINTOUT FOR COMPARISONS =====
300 INPUT"PRESS <ENTER> FOR FULL PRINTOUT... ";A$
310 FOR SH=1 TO N
320 FOR LN=1 TO 3
330 IF LN <> 2 THEN LPRINTSTRING$(40,32);: GOTO 370
340 LPRINTUSING"### ";SH(SH,1),SH(SH,2),SH(SH,3),SH(SH,4);
350 LPRINTUSING"### ";SH(SH,5),SH(SH,6),SH(SH,7),SH(SH,8);
360 LPRINTUSING"### ";SH(SH,9),SH(SH,10);
370 LPRINT CHR$(27)+"L"; '960 GRAPHICS MODE
380 LPRINT CHR$(40)+CHR$(255); 'SEND BYTE COUNT OF 40
390 FOR Q=1 TO 4: GOSUB 450: NEXT Q
400 LPRINT:NEXT LN
410 NEXT SH
420 LPRINT CHR$(27)+CHR$(64) 'RESET PRINTER
430 LPRINT STRING$(8,10): END
440 '===== SUBROUTINE TO SEND A MATRIX TO PRINTER =====
450 FOR B=1 TO 10
460 IF PEEK(PR) <> 63 THEN 460 ELSE POKE PR,SH(SH,B)
470 NEXT B: RETURN

```

Program Listing 1b

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time and don't leave any areas—however small—unmarked. If you are having difficulty determining which level to assign to an area, the time to decide is now. Waiting

until you are entering digits into data strings is a mistake. Believe me—I've tried it both ways. A little extra care here will pay off in time and effort saved while building

the data statements. The marked copy will probably bear little resemblance to the original photograph by now, but don't get discouraged; the final printout will look a whole lot better.

Graphing

The next step involves printing the graph over the copy you just marked. A fresh ribbon should be used for this, especially if your photo has large areas of dark shading. Program Listing 2 (a or b) prints the graph. Run it with the marked photocopy in the printer (if your MX-80 does not have friction-feed, you can tape the copy to some fanfold and use the fanfold as a carrier). It is important to position the copy correctly in the printer before generating the graph, as you

```

10 'GRAPHER a ***** FOR NEC 8023 PRINTER *****
20 'PRINTS AN 8 x 10 INCH GRAPH OF 1/12th INCH SQUARES FOR
30 'DIGITIZING A PHOTOGRAPH. TOTAL SQUARES = 11,520
40 '
50 CLEAR 200: DEFINT A-Z
60 INPUT"TO PRINT GRAPH, PRESS <ENTER> ";A$
70 LPRINT CHR$(27);"E" 'SELECT ELITE CHARS. (96 DPI)
80 LPRINT CHR$(27);"T12" 'LINE SPACING OF 12/144 INCH
90 BL$=STRING$(7,32)+CHR$(63) 'BACKWARDS "L" (6 x 8 DOTS)
100 FOR ROW=1 TO 121
110 LPRINTCHR$(27);"S0768"; 'SEND BYTE COUNT OF 768 (8*96)
120 FOR BLOK=1 TO 96: LPRINT BL$;: NEXT BLOK: LPRINT
130 PRINT"PRINTING ROW:";ROW
140 NEXT ROW: END

```

Program Listing 2a

```

10 'GRAPHER b ***** FOR MX-80 PRINTER *****
20 'PRINTS AN 8 x 10 INCH GRAPH OF 1/12th INCH SQUARES FOR
30 'DIGITIZING A PHOTOGRAPH. TOTAL SQUARES = 11,520
40 '
50 CLEAR 200: DEFINT A-Z
60 INPUT"TO PRINT GRAPH, PRESS <ENTER> ";A$
70 LPRINT CHR$(27)+"A"+CHR$(6) 'SET 6/72 LINE SPACING
80 BL$=STRING$(9,1)+CHR$(63) 'BACKWARDS "L" (6 x 10 DOTS)
90 FOR ROW=1 TO 121
100 LPRINT CHR$(27)+"L"; '960 GRAPHICS MODE
110 LPRINTCHR$(192)+CHR$(3); 'SEND BYTE COUNT OF 960 (10*96)
120 FOR BLOK=1 TO 96: LPRINT BL$;: NEXT BLOK: LPRINT
130 PRINT"PRINTING ROW:";ROW
140 NEXT ROW: END

```

Program Listing 2b

"There will be cases where . . . you will have to wing it."

will only have one shot at this. Try printing the graph first on a plain sheet of paper to determine the alignment you will need. When the graph has been printed on the marked copy, you will have something like the copy in Fig. 6.

After printing the graph, it's a good idea to number every fifth block across the top and down the left side of the graph, as in Fig. 6. This will help you keep track of your location on the graph as you convert the shading levels into data statements.

Almost There

The final step takes longest, but should go pretty smoothly if you prepared the copy well. Program Listing 3 (a or b) generates the final printout, and lacks only the data strings which define your photo. Key in the version for your printer and save it so it can be used as a shell for any future photos you might want to digitize.

Start the data statements with line 1001, using a line numbering increment of one. With the fingers of one hand on the number keys and the other hand keeping track of the current block on the graph, build each data string. Your markings will make it easy to see which shading level applies to each block, so you will not be slowed down by having to make the shading decisions as you go along. Each data string corresponds to a row of the graph, so start a new line in the program when you reach the end of a row.

There will certainly be cases where a block is half one shade and half another. In those cases, you will have to wing it. A glance at the original photograph will help here, but don't get sidetracked. Deviating from the shadings you decided on earlier

```

10 'DIGIFOTO a ***** FOR NEC 8023 PRINTER *****
20 'RECONSTRUCTS A PHOTOGRAPH FROM DATA STATEMENTS
30 ' M. KELLER ALBUQUERQUE, NM (505) 294-4966
40 '
50 CLEAR 200: DEFINT A-Z: PR=14312 'PRINTER'S ADDRESS
60 DIM SH(6,8) 'ARRAY TO HOLD SHADING LEVELS
70 FOR SH=1 TO 6 'DEFINE SIX 8-BYTE SHADING MATRICES
80 FOR BYTE=1 TO 8: READ SH(SH,BYTE): NEXT BYTE
90 NEXT SH
100 '===== SHADING DATA =====
110 DATA 0,0,0,16,0,0,0,0: '1 OUT OF 48 DOTS
120 DATA 0,2,0,16,0,2,0,16: '4 OUT OF 48 DOTS
130 DATA 0,42,0,21,0,42,0,21: '12 OUT OF 48 DOTS
140 DATA 42,21,42,21,42,21,42,21: '24 OUT OF 48 DOTS
150 DATA 30,55,61,47,59,62,47,61: '42 OUT OF 48 DOTS
160 DATA 63,63,63,63,63,63,63,63: '48 OUT OF 48 DOTS
170 '===== PRINT THE PHOTO =====
180 INPUT"TO RECONSTRUCT THE PHOTOGRAPH, PRESS <ENTER> ";A$
190 LPRINTCHR$(27);"E"; 'SET 96 DOTS PER INCH HORIZONTALLY
200 LPRINTCHR$(27);"T12" 'SELECT 6-DOT LINE SPACING
210 READ TG$: NB=LEN(TG$) 'READ PHOTO'S WIDTH
220 'NEXT LINE BUILDS STRING FOR INITIALIZING GRAPHICS MODE
230 GR$=CHR$(27)+"S"+STRING$(5-LEN(STR$(NB*8)),"0")+RIGHT$(STR$(NB*8),LEN(STR$(NB*8))-1)
240 LN=LN+1: PRINT"PROCESSING LINE:";LN
250 LPRINT GR$; 'INITIALIZE GRAPHICS
260 FOR BLK=1 TO NB: SH=VAL(MID$(TG$,BLK,1))
270 FOR BYTE=1 TO 8
280 IF PEEK(PR) <> 63 THEN 280 ELSE POKE PR,SH(SH,BYTE)
290 NEXT BYTE
300 NEXT BLK: LPRINT
310 READ TG$: IF TG$ <> "DONE" THEN 240
320 LPRINT CHR$(27);"A"; 'RESTORE NORMAL LINE SPACING
330 LPRINT CHR$(27);"N" 'RESTORE NORMAL CHARACTERS
340 END
350 'DATA LINES CAN BE ADDED HERE OR MERGED FROM ANOTHER FILE.
5000 DATA"DONE"

```

Program Listing 3a

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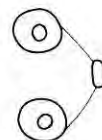
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* 2. DO YOU NEED TO ADD ADDITIONAL FILES OR *
* FIELDS TO THE DATA BASE? *
* 3. CAN YOU MODIFY YOUR DATA BASE ANY TIME? *
* 4. ARE YOU LIMITED TO THE NUMBER OF SCREEN *
* OR PRINTER FORMATS ALLOWED? *
* 5. DO YOU HAVE TO USE MORE THAN ONE DATA *
* BASE BECAUSE THE ONE YOU ARE USING WILL *
* NOT HANDLE DATA BASES WITHIN DATA BASES? *
* 6. DOES YOUR DATA BASE HAVE ALL THE SPEED *
* OF MACHINE LANGUAGE IN BASIC FORMAT? *
* 7. ARE YOUR FIELDS LIMITED IN LENGTH AND *
* NUMBER? CAN YOU ADD MORE LATER? *
* 8. CAN YOU CLAIM THAT YOU WROTE IT WITH *
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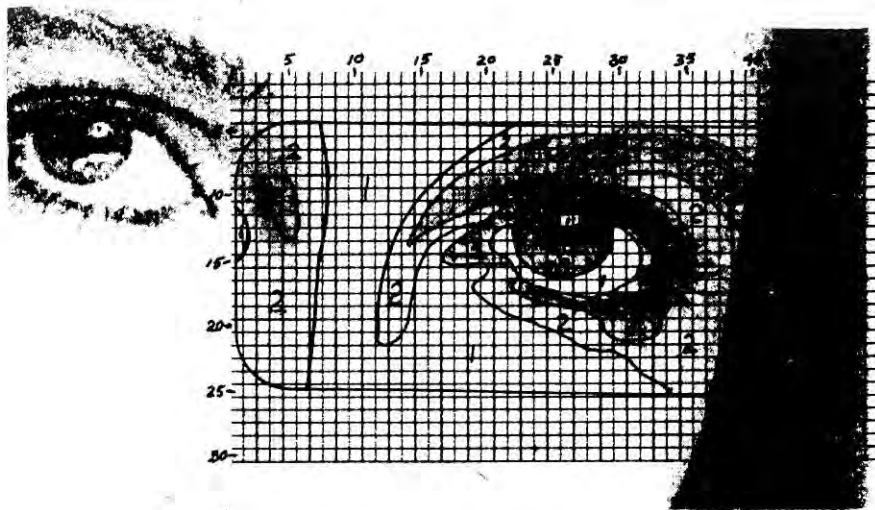


Fig. 6. Graphed copy ready for digitizing

can start a chain reaction of bad choices in the rest of that line.

Take Five

Building the data statements is a tedious process, and I recommend that you take plenty of breaks. It's also a good idea to generate a printout every so often to see how things are going, but don't expect too much. The image will undoubtedly need touching up in a few places. Besides, a portion of the picture won't look as good by itself as it will in the full printout.

If you reach the end of a row, and the data

line you just typed in does not have the same number of characters as the preceding lines, you are better off to completely redo the line. It is almost impossible to backtrack and find the place where you goofed.

If you plan to include a printed border around your final printout, as I did, use a six as the first and last character of each data statement. Also, the first and last data lines should consist of all sixes.

Touching Up

Try not to make any alterations until the

entire photo is digitized. Something that looks wrong when partially completed may fall into place after the next few lines are added. In touching up the data for Photo 1, I used the following method: When the image was complete, I generated a printout on a sheet of tracing paper. Placing this over the original photo showed the blocks that needed changing. Some blocks were too dark on the printout, and some were too light. Those that were too light were the easiest to spot. By listing the data lines in the affected area (as in Fig. 3), I was able to find and correct those characters which were wrong. The printer was set to a small line spacing before listing, so that the erroneous characters would be easier to identify.

Feel free to exercise a little artistic freedom in the touch-up process. If your original photo contains a blemish, or there is an area you would like to enhance, go right ahead. After all, it's your paintbrush.

When you are satisfied with the printout, it is ready to be printed on a good sheet of bond paper. A full printout of an 8 by 10 photograph will take about 30 minutes on the NEC printer, and about 50 minutes on the MX-80. Before wrapping everything up, make sure you save the data statements as you would save a program. They can be merged with the shell program any time you want a printout.

Instant Replay

Here is a summary of the steps used in digitizing the photograph:

- Select an appropriate subject
- Have photocopies made
- Outline and mark the shaded areas
- Superimpose the graph
- Build the data statements
- Touch up the data as necessary
- Generate a final printout
- Save the data lines on disk

Manipulation

Images are often converted into a digital form for scientific and other applications. This is usually to make it possible to manipulate the image in some manner. There are many ways in which an image might be manipulated. For example, if you want a negative of your digitized photograph, change line 70 of Listing 3 to read:

```
FOR SH=6 TO 1 STEP -1:
```

This sets up the shading levels in reverse order, so a data character which calls for shading 1 will show up on the printout as shading 6, and vice versa.

Another type of manipulation would be to eliminate some intermediate shading levels in the printout. This produces an image that is more highly contrasted, showing contours that may not be noticeable with subtle shading boundaries. One way to do this is to add the following line immediately after line 260 (line 300 of the MX-80 version):

```
IF SH/2 = INT(SH/2) THEN SH = SH - 1
```

This eliminates any even-numbered shadings, printing them instead as the next

```

10 'DIGIFOTO b          ***** FOR MX-80 PRINTER *****
20 'RECONSTRUCTS A PHOTOGRAPH FROM DATA STATEMENTS
30 ' M. KELLER          ALBUQUERQUE, NM          (505) 294-4966
40 '
50 CLEAR 200: DEFINT A-Z: PR=14312 'PRINTER'S ADDRESS
60 DIM SH(6,10)        'ARRAY TO HOLD SHADING LEVELS
70 FOR SH=1 TO 6      'DEFINE SIX 10-BYTE SHADING MATRICES
80   FOR BYTE=1 TO 10: READ SH(SH,BYTE): NEXT BYTE
90 NEXT SH
100 '===== SHADING DATA =====
110 DATA 0,0,8,0,0,0,0,0,2,0,0:      '2 OUT OF 60 DOTS
120 DATA 0,16,0,4,0,1,0,16,0,4:      '5 OUT OF 60 DOTS
130 DATA 4,17,4,17,4,17,4,17,4,17:   '15 OUT OF 60 DOTS
140 DATA 42,21,42,21,42,21,42,21,42,21: '30 OUT OF 60 DOTS
150 DATA 63,45,63,54,63,27,63,45,63,54: '50 OUT OF 60 DOTS
160 DATA 63,63,63,63,63,63,63,63,63,63: '60 OUT OF 60 DOTS
170 '===== PRINT THE PHOTO =====
180 INPUT"TO RECONSTRUCT THE PHOTOGRAPH, PRESS <ENTER> ";A$
190 LPRINTCHR$(27)+"A"+CHR$(6)        'SELECT 6-DOT LINE SPACING
200 READ TG$: NB=LEN(TG$)              'READ PHOTO'S WIDTH
210 'NEXT FOUR LINES SET BYTE COUNT CODES FOR MX-80
220 IF NB*10 <= 255 THEN BC=NB*10: BC$=CHR$(255): GOTO 270
230 IF NB*10 > 767 THEN BC=NB*10-768: BC$=CHR$(3): GOTO 270
240 IF NB*10 > 511 THEN BC=NB*10-512: BC$=CHR$(2): GOTO 270
250 BC=NB*10-256: BC$=CHR$(1)
260 '
270 LN=LN+1: PRINT"PROCESSING LINE: ";LN
280 LPRINT CHR$(27)+"L";              '960 GRAPHICS MODE
290 POKE PR,BC: LPRINT BC$;           'SEND BYTE COUNT
300   FOR BLK=1 TO NB: SH=VAL(MID$(TG$,BLK,1))
310     FOR BYTE=1 TO 10
320       IF PEEK(PR) <> 63 THEN 320 ELSE POKE PR,SH(SH,BYTE)
330     NEXT BYTE
340   NEXT BLK: LPRINT
350 READ TG$: IF TG$ <> "DONE" THEN 270
360 LPRINT CHR$(27)+CHR$(64)          'RESET PRINTER
370 END
380 'DATA LINES CAN BE ADDED HERE OR MERGED FROM ANOTHER FILE.
5000 DATA"DONE"

```

Program Listing 3b

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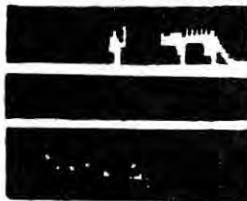
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lower level. Although probably not very useful with the small number of shadings we are printing, this effect is invaluable in other applications. It was used, for example, to bring out details in the digital photographs taken by the Voyager spacecraft. By comparison, those pictures consisted of 64,000 blocks, and each block could have one of 256 shading levels.

You might want to try generating a mirror image of the photo. Changes in the shading data might also produce some interesting effects. Once the photograph information is in a digital form, there is almost no limit to the ways in which it can be processed.

Miniature TRS-80

As promised, I have included as a final ex-

ample of digitizing, a program that prints a miniature (less than 1-inch) copy of the TRS-80 screen. This is done with Program Listing 4 (a or b). It reads the screen pixels (the blocks which can be set or reset), and prints each lighted pixel as a dot on the paper. Since these pixels are arranged on the screen in a 48 by 128 matrix, the dots in the printout are arranged in the same way. At this tiny size it's not possible to duplicate any alphanumeric characters on the screen. You may have a few programs, however, that display some pretty fancy figures using the TRS-80's graphic blocks. These will be reconstructed by the program, surrounded by a rectangular border as in Fig. 4. If you are using an MX-80 printer, you will notice some distortion in the aspect ratio (ratio of height to width).

The program takes a little over three minutes to generate a screen print. A negative image can be produced by changing line 5160 to this:

A(COL,ROW) = POINT(COL,ROW + REF) + 1

Each sample printout shown in Fig. 4 was generated by merging the routine with a main program. You might recognize a few of these designs, since some are from popular programs. At some convenient place in the main program after the screen display was complete, I inserted a GOTO statement to cause a jump to the mini-screen routine.

Mini-screen could be used as a subroutine for multiple screen prints during a single program run, but the Clear and DEFINT statements will have to be removed from line 5050, and the A array will have to be dimensioned in the main program. By setting horizontal tabs from within the program, you can print several images side-by-side. This effect can also be achieved on the NEC printer by changing the left margin.

For those who are curious about how the conversion is done, the key line of the program is line 5070. It is a defined function which converts a vertical pattern of eight screen pixels into a single decimal value. This value is sent to the printer in line 5220 (line 5230 in the MX-80 version), reproducing the vertical pattern with dots. The process is repeated until the end of a screen line is reached. A carriage return is then executed and the next column of eight pixels is done the same way.

Hidden Artists

I hope these articles have given you some food for thought. The projects were fun and challenging for me, and like most undertakings of this type, provided a valuable learning experience. As is always the case with programming, the methods outlined here represent only one approach. With a little imagination, you can unlock even more of the artist built into your smart printer, and maybe a little of the artist in you. ■

Mike Keller enjoys using the computer as a tool in the creative process.

```

5000 'MINI-SCREEN a          ***** FOR NEC 8023 PRINTER *****
5010 'DOES MINIATURE TRS-80 SCREEN-PRINT (GRAPHICS ONLY)
5020 ' M. KELLER           ALBUQUERQUE, NM           (505) 294-4966
5030 '
5040 '===== INITIALIZE =====
5050 CLEAR 1000: DEFINT A-Z: PR=14312: DIM A(128,7)
5060 'FUNCTION TO CONVERT 8 VERTICAL PIXELS TO A DECIMAL VALUE
5070 DEF FN F1(X)=A(COL,0)+A(COL,1)*2+A(COL,2)*4+A(COL,3)*8+A(CO
L,4)*16+A(COL,5)*32+A(COL,6)*64+A(COL,7)*128
5080 '===== PRINT SCREEN GRAPHICS =====
5090 LPRINT CHR$(27);"P";           'PROPORTIONAL SPACING
5100 LPRINT CHR$(27);"T16";         '2/3 LINE SPACING
5110 LPRINTCHR$(27)+"S0132";        'GRAPHICS, 132 BYTES
5120 LPRINTCHR$(128)+STRING$(130,64)+CHR$(192) 'TOP BORDER
5130 FOR REF=0 TO 40 STEP 8         '6 PASSES WILL BE NEEDED
5140   FOR COL=0 TO 127
5150     FOR ROW=0 TO 7
5160       A(COL,ROW) = -(POINT(COL,ROW+REF))
5170     NEXT ROW
5180   NEXT COL
5190   LPRINT CHR$(27)+"S0132";      'GRAPHICS MODE, 132 BYTES
5200   LPRINTCHR$(255);:POKE PR,0   'SEND LEFT BORDER
5210   FOR COL=0 TO 127
5220     IF PEEK(PR) <> 63 THEN 5220 ELSE POKE PR, FN F1(X)
5230   NEXT COL
5240   POKE PR,0:LPRINTCHR$(255)    'SEND RIGHT BORDER
5250 NEXT REF
5260 LPRINTCHR$(27)+"S0132";        'GRAPHICS MODE, 132 BYTES
5270 LPRINTCHR$(3)+STRING$(130,2)+CHR$(3) 'BOTTOM BORDER
5280 LPRINT CHR$(27);"A";           'SET NORMAL LINE SPACING
5290 LPRINT CHR$(27);"N";           'SELECT PICA PRINT STYLE
5300 END

```

Program Listing 4a

```

5000 'MINI-SCREEN b          ***** FOR MX-80 PRINTER *****
5010 'DOES MINIATURE TRS-80 SCREEN-PRINT (GRAPHICS ONLY)
5020 ' M. KELLER           ALBUQUERQUE, NM           (505) 294-4966
5030 '
5040 '===== INITIALIZE =====
5050 CLEAR 1000: DEFINT A-Z: PR=14312: DIM A(128,7)
5060 'FUNCTION TO CONVERT 8 VERTICAL PIXELS TO A DECIMAL VALUE
5070 DEF FN F1(X)=A(COL,7)+A(COL,6)*2+A(COL,5)*4+A(COL,4)*8+A(CO
L,3)*16+A(COL,2)*32+A(COL,1)*64+A(COL,0)*128
5080 '===== PRINT SCREEN GRAPHICS =====
5090 LPRINT CHR$(27);"A"+CHR$(8)    '8/72 LINE SPACING
5100 LPRINTCHR$(27)+"L";            '960 GRAPHICS MODE
5110 LPRINTCHR$(132)+CHR$(255);     'SEND THE BYTE COUNT
5120 LPRINTCHR$(3)+STRING$(130,2)+CHR$(3) 'TOP BORDER
5130 FOR REF=0 TO 40 STEP 8         '6 PASSES WILL BE NEEDED
5140   FOR COL=0 TO 127
5150     FOR ROW=0 TO 7
5160       A(COL,ROW) = -(POINT(COL,ROW+REF))
5170     NEXT ROW
5180   NEXT COL
5190   LPRINT CHR$(27)+"L";          '960 GRAPHICS MODE
5200   LPRINTCHR$(132)+CHR$(255);    'SEND THE BYTE COUNT
5210   LPRINTCHR$(255);:POKE PR,0   'SEND LEFT BORDER
5220   FOR COL=0 TO 127
5230     IF PEEK(PR) <> 63 THEN 5230 ELSE POKE PR, FN F1(X)
5240   NEXT COL
5250   POKE PR,0:LPRINTCHR$(255)    'SEND RIGHT BORDER
5260 NEXT REF
5270 LPRINTCHR$(27)+"L";            '960 GRAPHICS MODE
5280 LPRINT CHR$(132)+CHR$(255);    'SEND BYTE COUNT
5290 LPRINTCHR$(128)+STRING$(130,64)+CHR$(192) 'BOTTOM BORDER
5300 LPRINT CHR$(27)+CHR$(64)      'RESET PRINTER

```

Program Listing 4b

DATA BASE BLUES

 * 1. DOES YOUR DATA BASE MANAGEMENT PROGRAM
 * MEET ALL OF YOUR REQUIREMENTS?
 * 2. DO YOU NEED TO ADD ADDITIONAL FILES OR
 * FIELDS TO THE DATA BASE?
 * 3. CAN YOU MODIFY YOUR DATA BASE ANY TIME?
 * 4. ARE YOU LIMITED TO THE NUMBER OF SCREEN
 * OR PRINTER FORMATS ALLOWED?
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 * NOT HANDLE DATA BASES WITHIN DATA BASES?
 * 6. DOES YOUR DATA BASE HAVE ALL THE SPEED
 * OF MACHINE LANGUAGE IN BASIC FORMAT?
 * 7. ARE YOUR FIELDS LIMITED IN LENGTH AND
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Bustout Bustout Bustout

by Terry Hague

At first glance, Bustout seems like a simple game. You get three bars of green lights, worth 50, 25, and 10 points. The object is to knock out as many lights as possible.

But Bustout is difficult to master. You have only three balls, and the pad-

This Color Computer game gives you three chances to knock out as many lights as possible.

dle is difficult to control. My high score at the expert level is only 2,400.

Bustout is written for the Color Computer. You need joysticks and at least 4K of memory. You also must be able to POKE 65495,0 to play at the expert level. If your computer locks up when you POKE, you can still play, but you'll have to delete lines 10-40. ■

Program Listing

```

10 CLS:PRINT"ENTER (1) BEGINNER":PRINT"          (2) EXPERT"
20 A$=INKEY$:IF A$="" THEN GOTO20
30 IF A$="1"GOTO50
40 POKE 65495,0
50 CLS(0)
60 T=4:A=0
70 FORX=10 TO 53:SET(X,5,1):SET(X,7,1):SET(X,9,1):NEXTX
80 N=JOYSTK(0):IF N<10 THEN N=10
90 IF N>50 THEN N=50
100 IF N=M GOTO 140
110 RESET(M,29):RESET(M+1,29):RESET(M+2,29)
120 M=N
130 SET(M,29,1):SET(M+1,29,1):SET(M+2,29,1)
140 IF A=0 GOTO200
150 IF A<=10 THEN B=B*-1:A=10:SOUND 200,1
160 IF A>=53 THEN B=B*-1:A=53:SOUND 200,1
170 IF C<=5 THEN D=D*-1
180 IF C=5 THEN SOUND 150,1
190 IF A>0 GOTO 220
200 G=PEEK(65280):IF G=126 THEN GOSUB310
210 IF G=254 THEN GOSUB310
220 RESET(A,C)
230 IF A=0 GOTO80
240 A=A+B:C=C+D
250 IF A<10 THEN A=10
260 IF A>53 THEN A=53
270 IF POINT(A,C)=1 THEN GOSUB 470
280 SET(A,C,1)
290 IF C=28 THEN GOSUB340
300 GOTO80
310 A=11:B=1:C=RND(9):C=C+9:D=1
320 PRINT@1,T-2:PRINT@25,S
330 RETURN
340 IF A=M GOTO 400
350 IF A=M+1 GOTO 400
    
```

Listing continues

- A = Horizontal location of ball
- B = Horizontal speed of ball
- C = Vertical location of ball
- D = Vertical speed of ball
- M = Joystick location
- F = Your score
- T = Number of balls
- W = High score

Table 1. List of Variables.

The Key Box

**Color Computer
4K RAM
Color Basic
Joysticks**

Continues on p. 299

Terry Hague lives at Pole 113 Rocky Hill Road, North Scituate, RI 02857.

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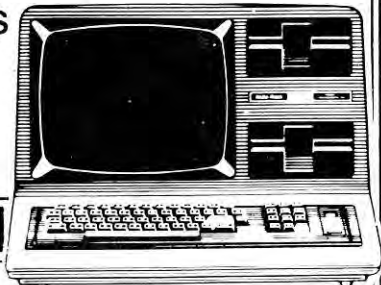
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Listing continued

```

360 IF A=M+2 GOTO 400
370 T=T-1:IF T=1 THEN GOSUB620
380 RESET(A,C)
390 A=0:RETURN
400 IF A=M THEN B=B-1
410 SOUND 100,1
420 IF A=M+2 THEN B=B+1
430 IF B>2 THEN B=2
440 IF B<-2 THEN B=-2
450 D=D*-1
460 RETURN
470 RESET(A,C):RESET(A+1,C)
480 IF C=5 THEN SOUND 25,1
490 IF C=5 THEN S=S+50
500 IF C=7 THEN SOUND 50,1
510 IF C=7 THEN S=S+25
520 IF C=9 THEN SOUND 75,1
530 IF C=9 THEN S=S+10
540 PRINT@25,S
550 D=D*-1:C=C+D
560 FOR X=10 TO 53
570 Y=POINT(X,5):IF Y=1 THEN RETURN
580 Y=POINT(X,7):IF Y=1 THEN RETURN
590 Y=POINT(X,9):IF Y=1 THEN RETURN
600 NEXT
610 GOTO 50
620 CLS
630 PRINT"YOUR SCORE WAS";S
640 IF S>W THEN W=S
650 S=0
660 PRINT"THE HIGH SCORE WAS";W
670 PRINT"DO YOU WISH TO PLAY AGAIN (Y/N) ?"
680 A$=INKEY$:IF A$="" GOTO 680
690 IF A$="N" GOTO720
700 IF A$="Y"GOTO50
710 GOTO680
720 POKE 65494,0
    
```

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Ordering Via Recursive Routines

by John Stover

How many different permutations (orderings) are there for N different items? The answer is easy to find. It is simply $N!$ (N factorial, which is $N * (N-1) * (N-2) * (N-3) \dots 1$). Thus the number of possible orderings for six different items is six factorial, $6 * 5 * 4 * 3 * 2 * 1$, or 720.

But what are those orderings? If you have only a few items, it is easy to write the orderings. For example, the six possible orderings of the first three integers are 123, 213, 132, 231, 312, and 321. It isn't difficult to write the orderings for

Recursive routines can calculate all possible number combinations in a small amount of code.

larger numbers of items, but it is tedious.

I needed a routine to generate all the possible orderings in a gene-sequencing program of any number of items. I decided to use a recursive routine.

A recursive routine is one that calls itself. The simplest example would be: 10 GOSUB 10. Recursive routines are very powerful in certain programming applications. The Program Listing shows how these routines can make a very short program handle a complicated task.

Consider the possible ordering of the first six integers. You could start with the ordering 123456. Next, you would switch one and two to produce 213456. The next ordering would move the three over one space to the left, producing 231456. The next would switch one and two again, and so on. The general idea is to keep the six in the last position until all the possible combinations of five digits have been exhausted. Similarly, we want to keep the five in the fifth place until all possible permutations of four digits have been exhausted, and so on down to the first two digits. This is how the Program Listing works.

The number of digits to be ordered is entered in line 130. The digits are placed in numerical order for the first permutation (lines 160-180) and printed (line 200).

At line 210 the level, L , is set equal to the number of digits. Assuming the level is greater than two (the trivial case) the program transfers to the main routine at line 430. Since you want to maintain the highest-order digit in its place while switching all the others, the program immediately reduces the level by one ($L = L - 1$) and, if you have not yet reached the trivial case of $L = 2$, goes to line 440, which calls the same subroutine again. The same logic continues to apply. You want to maintain the next-

Program Listing

```

10 REM *****
*****
20 REM ROUTINE TO CALCULATE ALL PERMUTATIONS
OF N DIGITS
30 REM *****
*****
40 REM L(I)=THE PLACE IN THE ORDER OF THE DIG
IT I
50 REM O(I)=THE DIGIT IN PLACE NUMBER I
60 REM I(L)=TEMPORARY STORAGE OF THE LEVEL BE
ING CALCULATED
70 REM N=THE NUMBER OF DIGITS
80 REM L=THE LEVEL (NUMBER OF DIGITS) BEING P
ROCESSED CURRENTLY
90 REM NO=THE PERMUTATION NUMBER
100 REM *****
***
110 REM ROUTINE STARTS HERE
120 REM *****
***
130 INPUT "ENTER THE NUMBER OF DIGITS ";N
140 DIM O(N),L(N),I(N)
150 NO=0
160 FOR I=1 TO N
170 O(I)=I:L(I)=I:I(I)=N
180 NEXT
200 GOSUB 600
210 L=N
220 IF L>2 GOSUB 430

```

Listing continues

The Key Box

**Model I, II, II, or Color Computer
4K RAM
All Basics**

Robot Reader

by Charles Gillen

How can you judge the difficulty of a text and know that it's appropriate for your audience? My program, Robot-Reader, scans a 100-word sample of any text and tells you how much education is required to understand it. Robot-Reader runs on a 16K Level II Model I or III.

Background

Even before computers were common, educators devised formulae to judge the difficulty level of a text based on the number of words per sentence, and the frequency of long words. One formula takes the average number of words per sentence plus the percentage of long words (three or more syllables) and multiplies this by a standard factor. This formula (see line 280 of the Program Listing) is fine for lower-school grades, but gives an inflated rating for more difficult texts. It accurately classifies the familiar "See Dick. See Dick run," as suited for first grade, but rates high school material as requiring many years of post-graduate study.

A different formula (line 290) used by

This short Basic program accepts text, analyzes it, and tells you its difficulty level.

the Department of Defense to measure and standardize written English also uses the average number of words per sentence, but stresses the average number of syllables per word. This formula is more reasonable at higher education levels, but yields a negative grade when confronted with "See Dick."

By sampling various texts, I found the two formulae seemed to agree in the area of the sixth grade. Robot-Reader analyzes a text with both formulae and uses the more appropriate formula to make a final recommendation.

The Program

Robot-Reader monitors each letter,

counts syllables, and ticks off each sentence as you type in a sample text. It does this between each keystroke, so if you type faster than 15 words per minute it can't keep up. If your keyboard has a CPU clock speed-up installed, just throw the switch and zip along as usual.

I put program initialization and instructions in lines 350-510 at the bottom of the listing, so I could locate the text input section (lines 20-120) at the top in the interest of faster execution. The input section counts vowels and assumes

Program Listing

```

0 REM "ROBOT-READER" BY CHARLES E. GILLEN 12 FEB 82
10 CLS:GOTO350:REM *** TEXT INPUT ROUTINE FOLLOWS:
20 A=INKEY$:IFA=""THEN20ELSEPRINTA;:B=RIGHT$(B,3)+A
30 IFA="A"ORA="E"ORA="I"ORA="O"ORA="U"ORA="Y"THENS=S+1;V=V+1ELSE
V=0:GOTO50
40 IFV=2THENS=S-1;V=0
50 G=RIGHT$(B,4):IFG="DED"ORG="DED."ORG="TED"ORG="TED."THEN90
60 G=RIGHT$(B,3):IFG="LE"ORG="LE."THEN90
70 IFG="ED"ORG="ED."THENS=S-1:GOTO90
80 G=RIGHT$(B,2):IFG="E"ORG="E."THENS=S-1
90 IFA=DTHENN=N+1:IFS>2THENL=L+1
100 IFA=CTHENW=W+1:IFS>2THENL=L+1
110 IFA=CORA=DTHENT=T+S:S=0
120 IFA=EORW>=QANDA=DTHEN140ELSEA="":GOTO20
130 REM *** ANALYSIS
140 IFN=0THEN490:REM NO SENTENCES TYPED
150 CLS:PRINT:PRINT:PRINT:PRINTTAB(20)"ANALYSIS OF TEXT SAMPLE:
    
```

Listing continues

A-G	are defined as strings
A\$	INKEY\$ input of sample text
B\$	Contains last four letters input
C\$	CHR\$(32), blank space
D\$	CHR\$(45), a period
E\$	CHR\$(13), the enter key
F\$	PRINT USING formatter

Integer and single precision variables:

L	Counts long words
N	Counts sentences
Q	Length of sample: 100 words
R1	Result of low-range formula
R2	Result of high-range formula
S	Counts syllables per word
T	Total syllables in text
V	Counts vowels
W	Counts words

Table 1. Program Variables

The Key Box

**Model I/III, II/12/16
16K RAM I/III, 64K RAM II/12/16
Cassette and Disk Basic**

```

160 PRINT:PRINTTAB(13)USINGF;N;:PRINT"SENTENCE";
170 IFN>1THENPRINT"S";:REM ADD PLURAL
180 PRINT" IN SAMPLE":W=W+1:IFT<WTHENT=W
190 PRINTTAB(13)USINGF;W;:PRINT"TOTAL NUMBER OF WORDS
200 IFW=W/NTHEN220:REM IF ONLY ONE SENTENCE
210 PRINTTAB(13)USINGF;W/N;:PRINT"AVERAGE WORDS PER SENTENCE
220 IFL<1THEN250:REM SKIP NEXT IF NO LONG WORDS
230 PRINTTAB(13)USINGF;L;:PRINT"LONG WORDS ( 3 + SYLLABLES)
240 PRINTTAB(13)USINGF;100*L/W;:PRINT"PERCENT LONG WORDS
250 IFT/W<1.01THEN270:REM SKIP IF ALL WORDS = 1 SYLLABLE
260 PRINTTAB(13)USINGF;T/W;:PRINT"AVERAGE SYLLABLES PER WORD
270 PRINT:PRINT"EDUCATIONAL GRADE LEVEL --> ";
280 R1=(W/N+100*L/W)*.4:REM LOW RANGE FORMULA
290 R2=(.39*(W/N)+(11.8*(T/W))-15.59:REM HI RANGE FORMULA
300 IFR1>6.7ANDR2<R1THENPRINTUSINGF;R2:GOTO320
310 PRINTUSINGF;R1:REM LO RANGE BELOW GRADE 6.7
320 PRINT@974,"< ENTER > TO TEST ANOTHER SAMPLE";
330 IFINKEY$<>ETHEN330ELSERUN:REM LOOK FOR <ENT>
340 REM *** INITIALIZATION
350 DEFSTR A-G:DEFINT L,N,Q,S,T,V,W
360 Q=100:REM MAXIMUM WORDS IN SAMPLE
370 C=CHR$(32):REM BLANK SPACE
380 D=CHR$(46):REM PERIOD
390 E=CHR$(13):REM <ENTER> KEY
400 F="###.# ":REM PRINT FORMATTER
410 REM *** INSTRUCTIONS
420 PRINT"ROBOT-READER CAN JUDGE THE DIFFICULTY OF ANY TEXT.":PR
INT
430 PRINT"THE RATING IS APPROXIMATELY CORRECT TO WITHIN PLUS OR
MINUS":PRINT"ONE SCHOOL YEAR. FOR GREATER ACCURACY AT BOTH ENDS
OF THE":PRINT"EDUCATIONAL LADDER, TWO DIFFERENT FORMULAE CALCULA
TE
440 PRINT"THE RESULT, WITH A CROSSOVER POINT IN THE SIXTH GRADE.
":PRINT"THE HIGH RANGE FORMULA WAS DEvised BY A NAVY PSYCHOLOGIS
T,":PRINT"PETER J. KINKAID, AND IS NOW USED BY THE DEFENSE DEPAR
TMENT
450 PRINT"TO SIMPLIFY COMPLICATED TRAINING MANUALS.":PRINT:PRINT
"THIS PROGRAM PERFORMS THE ANALYSIS WHILE YOU TYPE, SO DON'T GO
":PRINT"SO FAST IT CAN'T KEEP UP. THE RESULT IS GIVEN IMMEDIATELY

460 PRINT"AFTER 100 OR SO WORDS, OR IF YOU <ENTER> AFTER A PERIO
D.

470 PRINT@974,"< ENTER > TO INPUT YOUR SAMPLE";
480 IFINKEY$<>ETHEN480
490 CLS:PRINT"INPUT SAMPLE OF TEXT TO BE GRADED":PRINT
500 PRINT"GO S L O W.":PRINT"USE A PERIOD AND ONE SPACE AFTER E
ACH SENTENCE.":PRINT"DON'T USE ANY OTHER PUNCTUATION.":PRINT"TO
END, TYPE A PERIOD AND < ENTER > .":PRINT:PRINT"--> ";
510 GOTO20
520 REM AS A TEST CASE, THE TEXT ON LINES 420-460 YIELDED A
GRADE LEVEL OF JUST BELOW THE 10TH GRADE.

```

that each vowel represents one syllable. If a double vowel is spotted it is counted only once.

The program remembers the last four letters input. It checks these to see if a word or sentence has just been completed by looking for a space or a period. It also looks for vowel endings that should not be counted as a syllable, such as the *e* in *mile* or the *ed* in *tired*.

Using the Program

Use no punctuation except for a period and a single space at the end of each sentence. Don't expect much accuracy if your sample is very short. Each new text may present some problems: Hyphenated words count as one long word unless you skip the hyphen. Should an independent clause be treated as a new sentence? Should you spell out numbers? If your sample is long enough, the result varies little no matter how you resolve these questions.

Though the program gives an analysis whenever you type a period and hit the enter key, it's best to keep typing until Robot counts 100 words. The program terminates your input the next time you finish a sentence. The analysis is instantaneous giving a final grade and also a word count. I shaped the analysis to avoid telling the obvious—if all your words have only one syllable, or you have typed no long words, the program does not give percentages for them. ■

Ed. Note: To run this program on a Model II, 12, or 16, change PRINT@ 974 in lines 320 and 470 to PRINT@ (19,17).

Charles Gillen lives at 1458 Greenmont Court, Reston, VA 22090.

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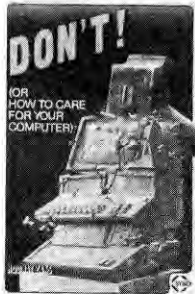
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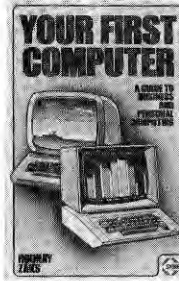
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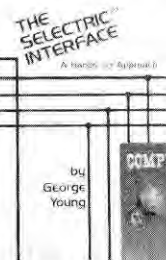
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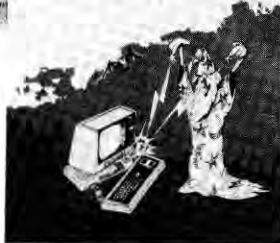
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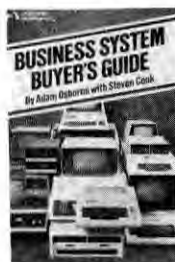
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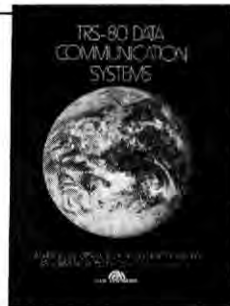
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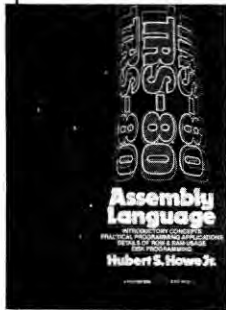
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A New York City hacker has developed Color Computer software to enrich the spirit.

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Eye of the Tiger

Tandy gets it back with the Model 100.



Tandy Corporation made a significant move into the portable microcomputer market by introducing its TRS-80 Model 100 this spring.

According to one industry source, Tandy's invested \$180 million in the venture, more than it's ever sunk into a new project. And from the initial reaction of the TRS-80 community, the money was well-invested.

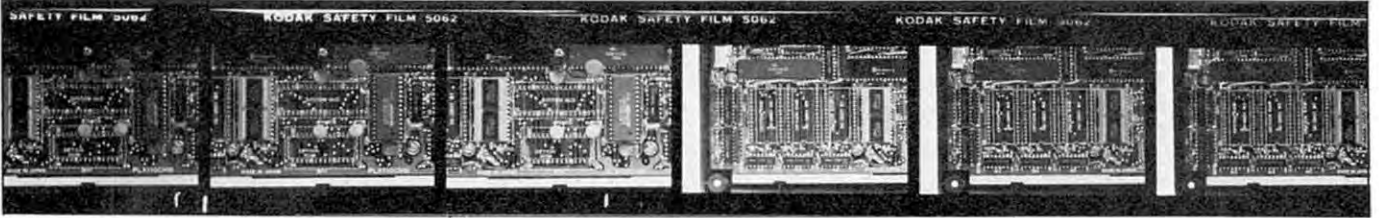
"This will do for the portable market what the Model I did for microcomputers," the source said. "Tandy sold 300,000 Model I's in three years. It will sell that many Model 100s in one year."

The 100 is available in 8K (\$799) or 24K (\$999). Upgrades, up to 32K, cost \$120 for each 8K of CMOS memory.

The portable comes with its own version of Microsoft Basic and four built-in applications programs for word processing, telecommunications, and storing schedules and addresses.

Programmers interviewed by *80 Micro* said the 100's Basic is more powerful than the versions in Tandy's Models I or III. It features:

- A wide-range of input-output statements, allowing a user to access devices like the RS-232C port or eight-line-by-40-character LCD screen;
- Commands to generate music from the 100's five-octave sound generator;
- A Call function allowing Basic to di-



Tandy's Model 100 Micro Executive Work Station may be small outside, but inside it packs quite a wallop.

rectly access machine-language subroutines; and

- Commands allowing program execution to be interrupted when it encounters data from the RS-232 or modem, or senses a function key has been pressed, a time reached, or a certain error has arisen.

The 100 contains a simple word-processing program. A user can insert and delete characters, "cut" and "paste" blocks of text, and search for character strings.

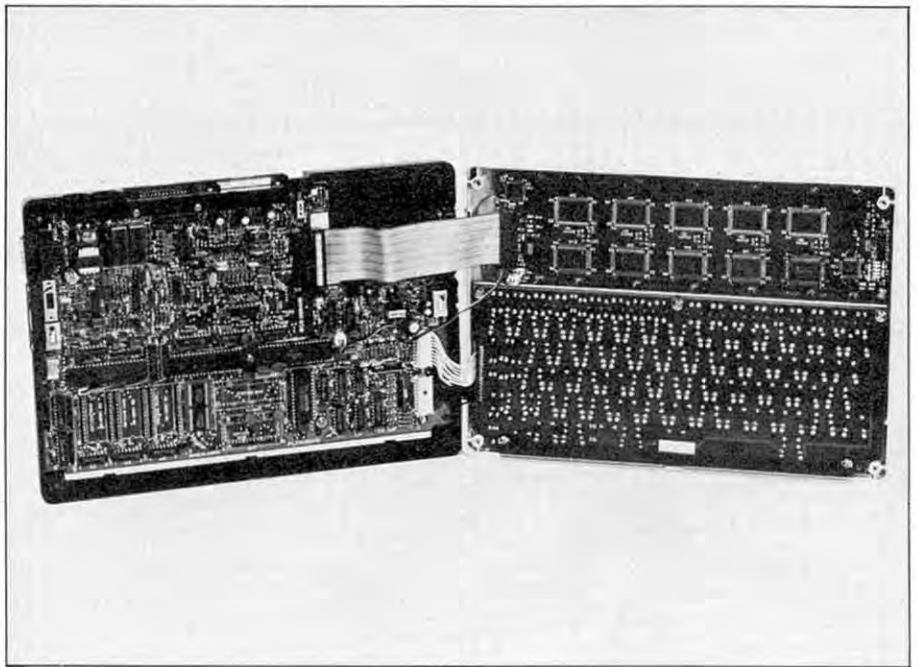
The schedule program acts as a mini-data-base manager. A user can store and search for records. The address program is similar. However, it's linked to the telecommunications program, so if phone numbers are stored with the address, the 100 can dial them automatically.

Telcom also allows the 100 to talk with other computers. It can upload and download files and tap into bulletin boards and data bases. Using Telcom, the 100 can be programmed to automatically log a user onto an information system like The Source or CompuServe.

It is powered by four "AA" batteries and has an optional ac adapter. A built-in nickel-cadmium battery recharges itself when the computer's turned on and keeps the memory alive when the computer's off. In an 8K machine, the Ni-Cad will retain what's in memory for 30 days after last power-on. In a 32K unit, memory stays refreshed eight days.

Other features include full-size keyboard, eight programmable function keys, four command keys, four cursor movement keys, a 10-key numeric keypad, built-in modem, RS-232C interface, and parallel printer port.

Next month, *80 Micro* will run an extensive review of the 100. ■



Initial reaction to the 100 indicate it may soon be the star of the Tandy line.



HARDWARE

Microflops

Pint-sized disk makers look to market for sub-5.25-inch standard.

BY JOHN P. MELLO JR.

80 MICRO NEWS EDITOR

Half a meg on a 3-inch disk? Or will it be on a 3 and a half-inch disk? Or 3 and a quarter? How about 3.9? Those are the questions confronting benchmark makers at the American National Standards Institute. But it appears they're questions that won't be answered this year.

"I think I would be naive to hope that ANSI would finish all the technical work they need to do to make it official this year," observed Charles Payne.

Payne, business planning manager for Verbatim Corporation, chairs the Microfloppy Industry Committee, an informal panel representing 21 firms backing the 3.5-inch, hard-jacket standard for microflops.

One industry newspaper supported Payne's analysis: "Most drive manufacturers we spoke with agreed there would be no movement toward standardization this year... Of course, as the drives and disks come to market, the customers might create a standard by economic persuasion."

If consumers "vote" for a standard with their dollars, some observers believe the firms that get their products into volume production fast and maintain reliability will be very influential on the "economic electorate." One of those firms may be Tabor Corporation, the leading proponent of the 3.25-inch, soft-jacket standard.

Tandon and Shugart (both 3.5-inch supporters) are six months behind us, said Tabor Corporation President Michael Hanley in an exclusive interview with editors at Wayne Green Inc.

However, Tabor is plotting a course into the wind. Of the four lines of microflop products being produced, all

but Tabor's use hard-shelled disks. And with industry heavies like Shugart, Tandon, and Verbatim lining up behind the 3.5-inch standard, the momentum seems to be behind that benchmark.

Even if the marketplace establishes the standard, it still may be a year away—if not longer. Most estimates show relatively small volumes of microflop products being shipped this year. Dataquest predicts 155,000 drives will be sold in 1983, while Matsushita estimates 1 million microdrives will be sold in 1984, 2 million in 1985, and 4 million in 1986.

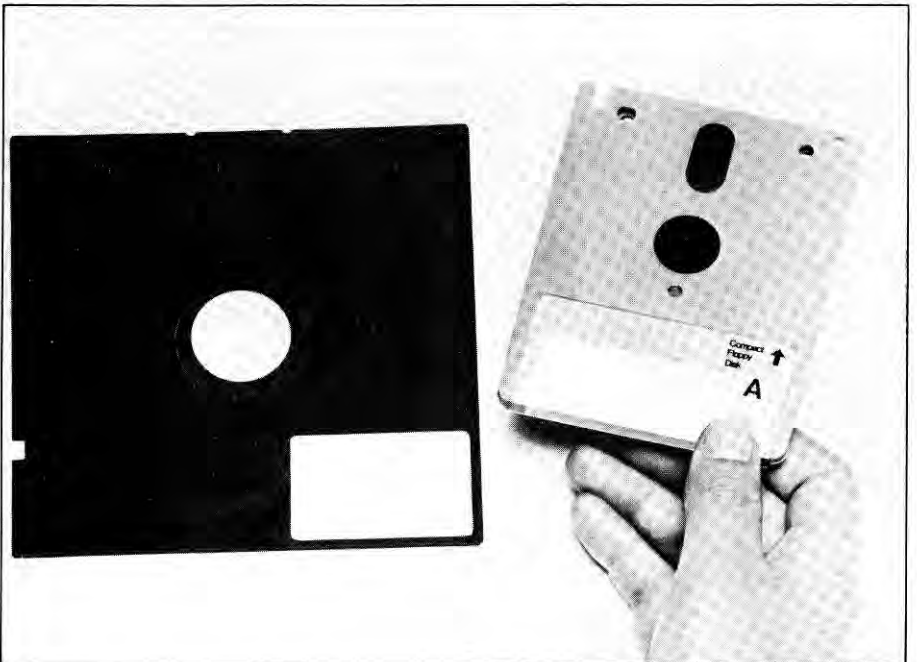
A big reason for the slow development of the market is it's tied to the portable

computer market, which observers say won't take off until next year.

If microflops are primarily used for portables, the 3.5-inch standard—with its hard plastic shell—could gain an upper hand in the market. George Sollman, vice president and general manager of Shugart Associates' sales and marketing division, told one reporter, "People are going to be using these drives in environments where computers are going to be bounced around and you have to take steps to ensure proper protection of the media."

"We were concerned," explained Tom Jarrett, marketing manager for Shugart's microflop venture, "about providing as much protection as possible for the media. That led us down the path to the hard jacket."

"There's obviously some market places where you're going to have a high degree of contamination or susceptibility to contamination," Tabor's Hanley admitted. "In that case, it might be the right thing to do to put the disk in a cartridge rather than in a standard floppy."



Three-inch, hard-shelled microflop compared to 5.25-inch minifloppy.

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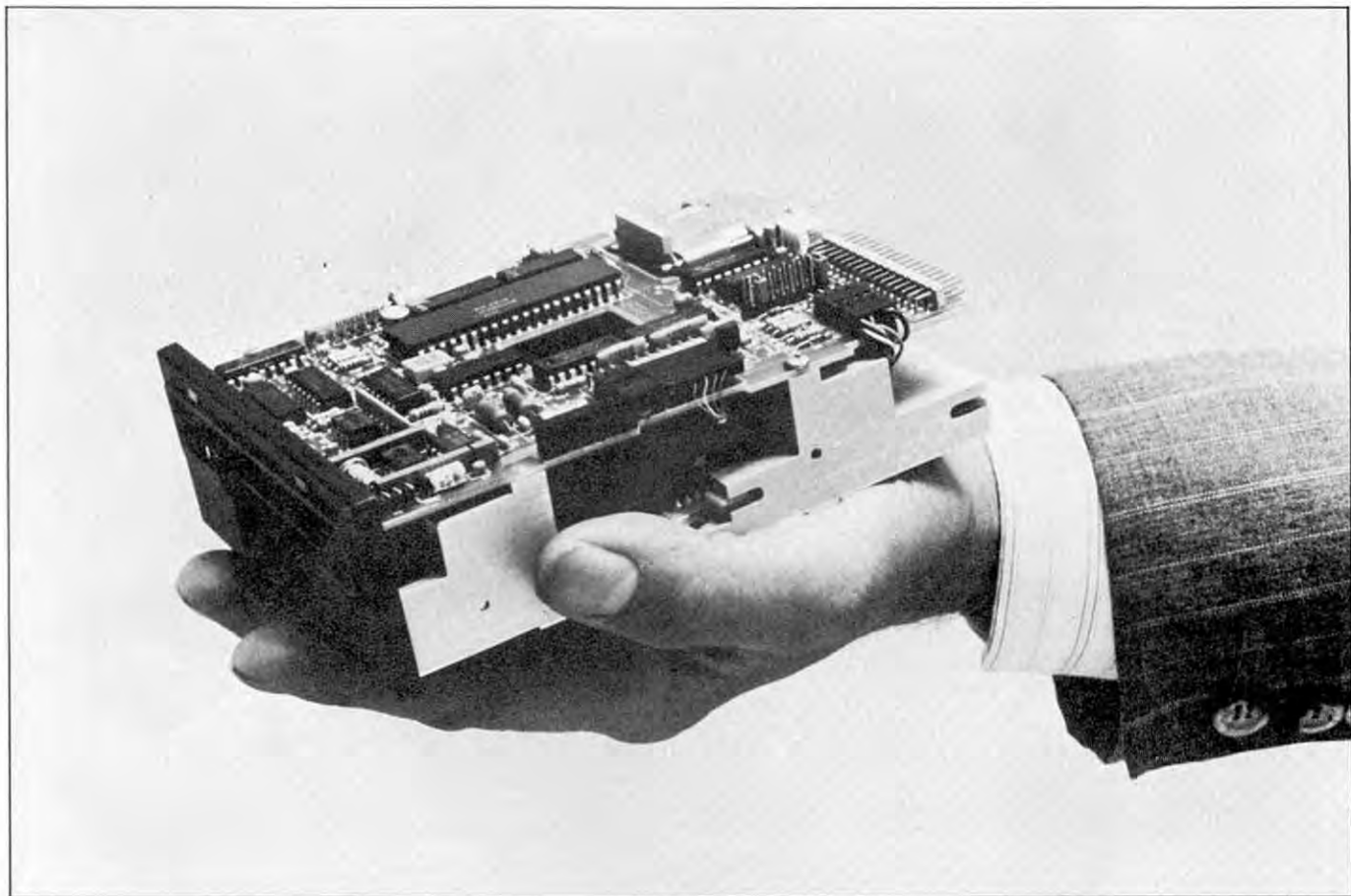
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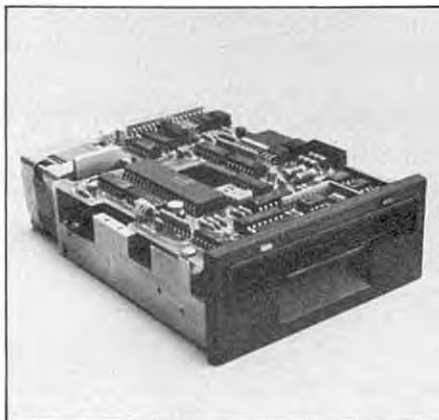
Tabor claims its 3.25-inch disk drive is very reliable.

Microfloppy Committee Chairman Payne said his panel initially favored the soft-jacketed disk. "I have that prejudice," he admitted, "because we [Verbatim] make that kind of product and it would be easier and cheaper for us." But, he said, after surveying Original Equipment Manufacturers and users, the hue and cry was for the hard jacket.

Tabor also talked to manufacturers, according to Hanley. "The manufacturers' major concern," he said, "is they have to buy all new manufacturing equipment to produce the hard shell. It's very expensive. Capital investment is in the range of \$2 million."

He claimed, "From the media manufacturer's point of view—with the exception of Verbatim—everyone seems to want to go along with the three and a quarter. But if the Sony [3.5] cartridge gains acceptance, they're willing to go along to get business. They really don't want to do it."

Hanley argued hard-shelled disks



have disadvantages in the price and reliability departments.

He explained soft-jacket floppies have five parts, while one hard-jacket version has 12 parts, another 16. "They've added parts that can go wrong," he said. "That affects reliability."

He sees the hard-jacket's Achilles heel as the door on the outside of the disk. When inserted in the drive, the door opens. While outside the drive, it

stays closed to block out contaminants. If that mechanism fails, Hanley contended, there's no way to recover the data.

Shugart's Jarret acknowledged, "The fewer moving parts you have in a drive, the more reliable it tends to become." But he added, "We have some pretty stringent requirements for reliability for [the door] mechanism. The design testing we've done shows it's very reliable." Those tests, he said, show the mechanism still working after 30,000 insertions.

Payne of Verbatim added that since the door mechanism is on the shell's outside, it can be easily pried off and the data recovered from the disk.

Reliability is also a problem with the 3-inch standard, according to opponents of that proposed benchmark. Ironically, why it's a problem is because of an informal goal the industry's agreed upon: a megabyte of storage on a double-sided microfloppy.

"It's a well-engineered product," Payne said of the 3-inch disk. "The

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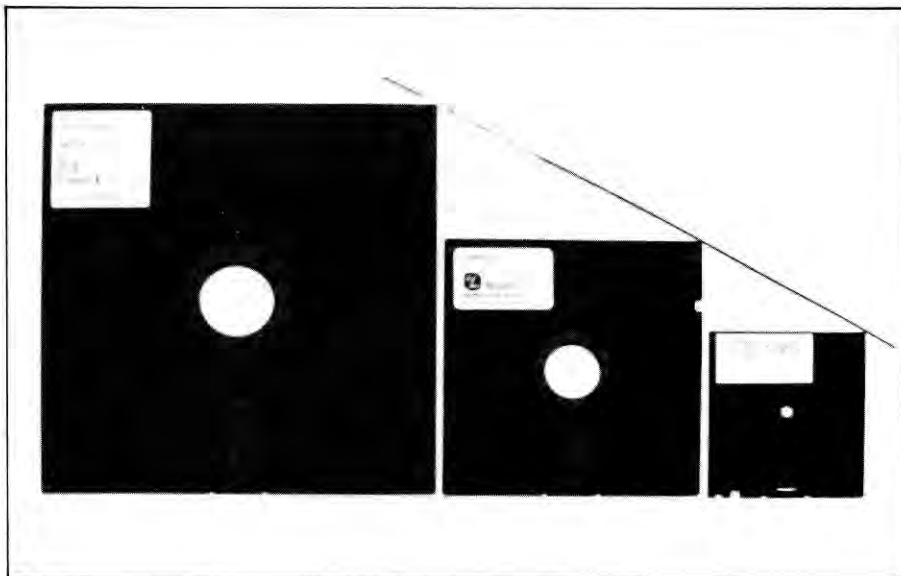
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The Lineup: Tabor's 3.25-inch microfloppy compared to 5.25-inch and 8-inch floppies.



only trouble is when you try to get a higher density."

To pack a meg on a 3.5-inch disk, manufacturers use 135 tracks per inch. The 3.25-inch disk has a tpi of 140. The 3-inch makers—now with single-sided storage of 250K at 100 tpi—will have to hike their tpi to 200 to make the one meg goal. "The technical people on the committee and at ANSI just don't believe they're going to do that," Payne said. "If they do do it, we don't think it will be reliable. It's just pushing the technology real hard."

When asked about Payne's remarks, a spokesman for one distributor of Hitachi's 3-inch drive nonchalantly brushed them aside. "I firmly believe and Hitachi believes," said an Amdek Corporation spokesman, "that for reliability, they're practically the same. They don't make inferior products in Japan."

Shugart's Jarret doesn't doubt a one meg 3-inch disk can be made reliable. But he asks, "Is it a cost-effective technology?"

"We can go to 200 tpi," he said. "People are doing it on five and a quarter products. But they're using servo and data-sampling concepts for fine positioning. All that is very expensive to implement."

"If you go addressing more costly technology to achieve certain performance goals," he noted, "you sometimes price yourself out of the market."

Pricing is another point in the 3.25-inch disk's favor, according to Hanley of Tabor. The hard shell, he said, costs 10 percent to 40 percent more to make than the soft shell. He added: "Our sensitivity is to the user. We're trying to keep it as cheap as possible."

"I think they're right in claiming it can be made less expensively in equivalent volumes," Verbatim's Payne acknowledged, "but I don't think

there's a prayer there's going to be equivalent volumes. The demand for the hard shell is going to be greater."

Whether it be 3, 3.5, 3.25, or 3.9, microfloppy technology will initially cost more than minifloppies, a prospect inducing some chipsters to turn their backs to the new medium. As one computerist on CompuServe remarked about Amdek's 3-inch disk drives: "Is it worth it? No, unless space is a premium factor. Plus the cost of the non-flexible diskettes make it an unattractive offer at this time."

The fourth entry into the microfloppy sweepstakes is big, slow, incompatible with popular interfaces, and has low storage capacity. Why is it in the running? Verbatim's Payne has an answer to that question: "The really nice thing about that drive is it has IBM's name on it."

Payne said IBM planned to release their 3.9-inch drive with its PC. If that schedule had been followed, he continued, IBM could have established the microfloppy standard. But it wasn't. Now they've got this thing, he noted, with low capacity—a quarter meg on a side—is non-compatible, and is large, slow, and generally, out of date.

"I'm really sorry they [IBM] got into it," he added, "because they have enough weight to drag a part of the industry with them and it's going to fragment the market."

The Big Blue's said it released its drive because it wants to be more than a supplier of computer systems. It wants to provide peripherals to the OEM market, too. But some observers ques-

tion that rationale.

They maintain IBM, seeing the Japanese 3.5-inch standard gaining ground, decided to throw a monkey wrench into the scheme of things. Tabor's vice president for marketing, George Rea, told one newspaper: "Everyone has gotten a little upset about the fact that it is Sony leading the way. There has been resistance from U.S. companies—including IBM—to having a Japanese company forcing a standard on the U.S. market."

Asked if IBM could hurt its reputation by marketing its 3.9, Verbatim's Payne responded: "I think they will do less well with it than they would with a three and a half inch product, but what could be a major pain for a disk-drive company like Shugart or Tandon probably would be a minor problem for IBM."

As far as IBM is concerned, it was undaunted by benchmark makers when it came to introducing its new product. Hayes Price, OEM marketing and planning manager, told one reporter: "If there had been a standard set, we still would have announced this product. We have had it under development for some time."

Will the four standards survive? Not likely, said Scott Holt, Seagate sales and marketing vice president. He told one newspaper, "I don't believe the market can support the four there today." However, more than one design may survive the coming shakeout. Observed Tandon's product manager Robert Abraham to one reporter, "There probably will be a couple of designs accepted in the marketplace." ■

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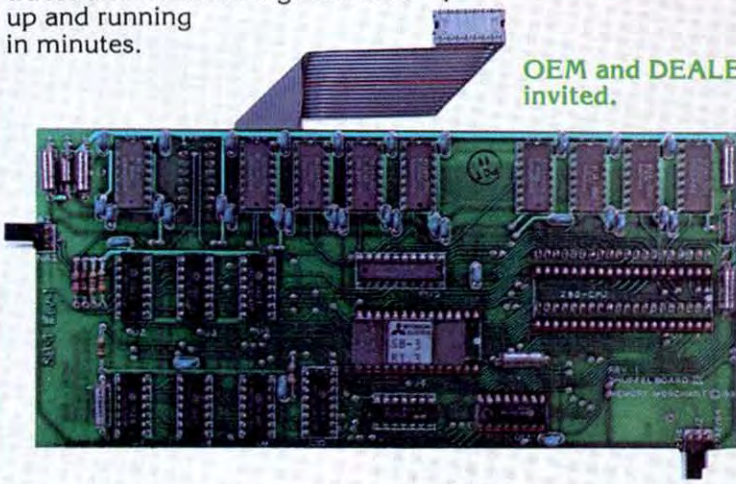
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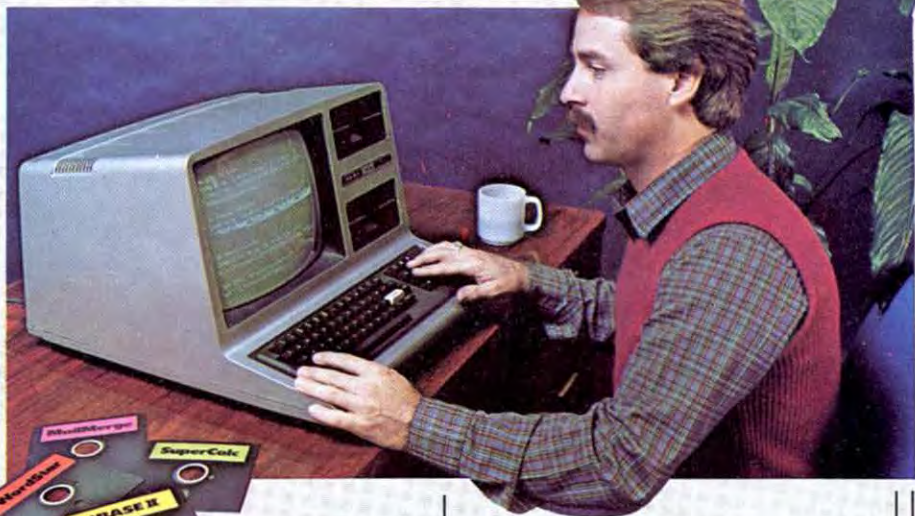
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PULSE TRAIN

Tandy: What, me worry?



After six years of stiff competition, Tandy's share of the computer market has been trimmed to 17 percent. And it could lose another percentage point or two this year, according to *The Wall Street Journal*.

But, *The Journal* reported, Radio Shack maintains losing some of its market share isn't so bad—so long as the total market is booming.

And that seems to be the case. Personal computer sales hit \$4.7 billion last year, and are expected to increase about 65 percent to \$7.76 billion this year.

"Our experience is that in almost every product category, we lose market share after the boom stage in a market," Tandy's Director of Financial Planning Garland Asher told *The Journal*.

"But we just don't care about market share," he added. "What counts are profits."

While Radio Shack's low-end competition are engaged in cutthroat price-cutting, Asher told the daily, Tandy has refused to further cut the price of its comparable \$300 model. "In the next 12 months, we'll lose market share in the low end of the home computer market," the financial planning director said. "But we're simply not going to shoot ourselves in



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the foot" to make sales.

Still, small-computer sales will constitute an increasing share of Tandy's overall sales, he noted. In the fiscal year ending June 30, the company said it expected 35 percent of its projected \$2.5 billion in total sales to come from small computers, up from 31 percent in 1982. Tandy boasts that it expects to be the first of the top three personal computer makers (Apple and IBM are the other two) to reach \$1 billion in annual sales from the equipment.

The Journal said Tandy is the only company offering a product in every segment of

the small-computer market.

According to the newspaper, Asher doesn't believe radically new hardware will hit the market in the near future. "No one is going to blow the market away with a new piece of hardware at this point," he said, explaining everyone has access to the same hardware components. Rather, he expects to see spinoffs of existing hardware, particularly of IBM's personal computer.

Asher added Tandy may soon fill the niche between its top-of-the-line home computer and personal computers costing \$1,000 or more. And he doesn't rule out

joining other computer marketers in bringing out a product closely resembling IBM's \$2,900 personal computer.

Although Tandy's network of retail stores has given it an edge on competition so far, some people wonder if the company is as well-positioned to sell its small computers to large corporations. That market is growing at a rate of 45 percent or so a year and is expected to account for \$1.2 billion in sales of computers by 1983. It's doubtful, *The Journal* said, that purchasing agents of the nation's biggest corporations do a great deal of buying at the local Radio Shack, and Tandy has only 25 national sales representatives.

The spiritual CoCo



For Color Computer owners bent on finding Nirvana, New Yorker Alan

Rogers has software for you. The 48-year-old producer of TV commercials has created programs on his CoCo for expanding people's spiritual awareness.

Rogers—a true hacker, spending five hours a night developing and refining programs—has been giving away the software, *InfoWorld* reported, although he's paid \$20,000 for computer consultants, psychiatrists, and

PULSE TRAIN

cybernetic engineers to evaluate his soulware, and for trips to the West Coast to promote his programs.

However, those costs may soon force him to start charging for his "Infinity Programs." So far, he's given away 200 of them.

Originally, Rogers created Infinity to help people pray more effectively. Then, for people uncomfortable with prayer, he developed other versions to help women develop their intuition, businessmen forecast better, and truth seekers become more meditative.

InfoWorld described the last program as a "generic, all-purpose, nonoffensive" program for people who don't want to make commitments but want to explore the different levels of their minds.

Rogers, born in Canada, likes hawking his software on the West Coast because people there are interested in spiritual things. "New York is so blasé you could set off an atom bomb and no one would react," he told the microcomputer weekly.

After loading Infinity—an Eliza program for the soul—your guardian angel, hunch, soul, or spirit commands you to begin. You type in questions and the program replies.

Rogers told *InfoWorld*:

"You contact different levels of the mind, the conscious, subconscious, unconscious, id, ego, higher self, or soul.

"You become aware of each part of the mind. The system allows you to alter your state of consciousness.

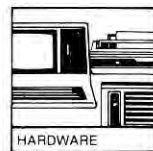
In five minutes, you've gone through five levels.

"You get levels of your mind to communicate to you through your fingertips. In a way it's true you are talking to yourself, but it's a higher level of your mind."

Rogers isn't stopping with Infinity. He plans to gather all the information in the world on the mind and computers and create the Mind Computer Research Institute.

And his next software project: use the Bible as a data base to answer users' questions.

Stringy floppy revival



Sporting a new name, the firm that pioneered stringy-floppies has landed support for its technology from one major computer maker and has piqued the interest of two others, including the Tandy Corporation.

The *Electronic News* reported Entropo had licensed Coleco to use the Sunnyvale firm's Microdrive tape cartridge and microwafer technology for the ColecoVision Super Game Module #3 unveiled at the Toy Fair.

It said Coleco would wait until August to market the Entropo technology. Entropo's agreement with Texas

Instruments, the weekly reported, allows the Sunnyvale enterprise to manufacture the technology to other companies, but bars them from licensing other firms to make it until mid-1983.

The *Electronic News* said Coleco plans to make portions of the system at its Gloverville, NY, plant and subcontract other portions to Entropo and manufacturers in Taiwan and Japan.

It said Entropo's Coleco system provides 100K of storage and retails for \$90. Texas Instruments' "wafer tape" drives cost \$139.95. The stringy floppies come in four sizes: 50 feet (\$7.95), 25 feet (\$6.95), 10 feet (\$5.95), and 5 feet (\$4.95). The largest size can hold up to 48K of data.

According to the *Electronic News*, Entropo is ramping up its production to meet the demands of Texas Instruments, Coleco and others. It hopes to produce 500,000 drives and 5 million tapes by the end of 1983.

The newspaper also said Entropo is talking to Commodore about customizing a storage system for the VIC-20 and Commodore 64 computers. The president of Entropo, Robert McDonald, served briefly as the president of Commodore's professional computer division, the newspaper said.

Texas Instruments has inked a licensing agreement with Entropo Corporation (formerly Exatron) of Sunnyvale, CA, to use stringy-floppies as mass storage devices for its 99/2 portable computer.

Tandy is also looking at

the technology, according to the *Electronic News*. Vice President for Computer Merchandising John Shirley told the weekly, "We're looking at the product. It's pretty high-speed. If they can make it as cheaply as they say they can, it's interesting to us."

The newspaper also reported Coleco had purchased a license to use the stringy-floppy technology. That was denied to *80 Micro* by Mark Yoseloff, executive vice president for Coleco. "The *Electronic News* misstated an awful lot of facts in that article," he said. "Coleco hasn't bought any such license."

"Coleco is looking at the Entropo technology along with other kinds of mass storage technology," he noted. "We haven't definitely entered into any agreements."

He added, "I think the problem was we used some samples from Entropo to make some samples we showed at the [American] Toy Fair [in New York City]. That in no way implied anything was final or that an agreement had been reached."

Hottest private cools down



Since it's gone public, Altos—the San Jose, CA, computer maker that topped *INC.* magazine's hottest growing private companies (*80 Micro*, April

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TM TRS80 color

From the January 1981 issue of the CSRA Computer Club newsletter:

There was some amusement at the November meeting when the Radio Shack representatives stated that the software in the ROM cartridges could not be copied. This month's 68 Micro Journal reported they had disassembled the programs on ROM by covering some of the connector pins with tape. They promise details next month. Never tell a hobbyist something can't be done! This magazine seems to be the only source so far of technical information on the TRS-80 color computer. Devoted to SS-50 6800 and 6809 machines up to now, 68 Micro Journal plans to include the TRS-80 6809 unit in future issues.

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PULSETRAIN

1983)—has experienced a slump in profits and sales.

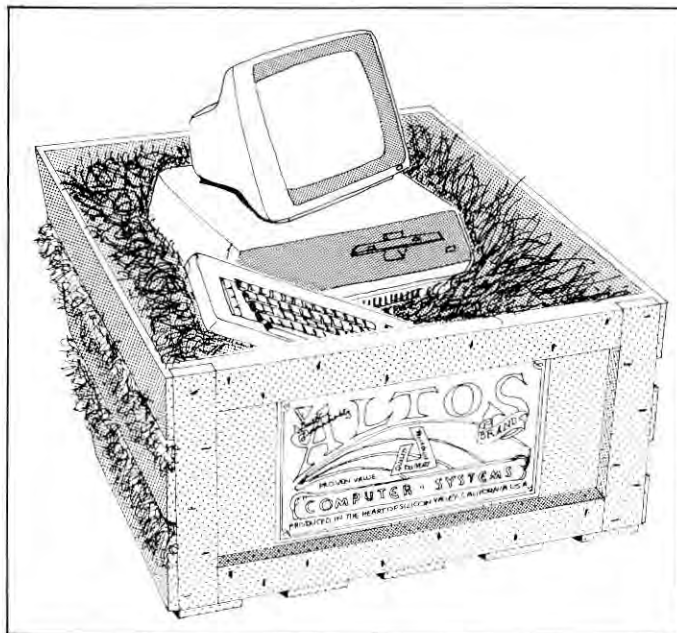
The slump in profits was attributable to increased advertising costs; increased research, development, and engineering expenses; and additions to the sales force.

Altos said low sales figures were caused by volume production delays of the Model 586 16-bit microcomputer introduced last year and by a major West Coast storm last Dec. 22 causing a one-day power outage at a critical point in the shipping cycle.

Altos Finance Vice Presi-

dent David Zacarias told *Computer Systems News* his firm's projections for its 16-bit machine were too aggressive and optimistic. He said the firm expected 50 of the 586s to be shipped in December. The number actually shipped was significantly less than that.

Wall Street took the company's changed projections and sales shortfall very hard. Altos' initial public offering was \$21 a share. Within a month, it was selling at \$37 a share. Lately, the stock's been trading at \$25 or less.



New CoCos?

Predictions about **NEW TANDY PRODUCTS** abound. In *Creative Creations*, **CLIVE SMITH**, an analyst with the Yankee Group, said expect Tandy to introduce a low-cost replacement for the **COLOR COMPUTER** and a low-cost black-and-white model at

\$100 to compete with the Sinclair. ■ The **W5YI REPORT** said final figures for 1982 show Timex-Sinclair the winner in the microcomputer unit-sales department with 600,000. The VIC-20 placed second with 400,000, TI's 99/4A third, Atari fourth with 300,000, and the Color Computer fifth with 200,000. ■ On the publishing front, **SCHOLASTIC INC.** has announced two new magazines. *Teaching and Computers*, a monthly magazine for elementary school teachers, will provide "specific, clearly understandable information for classroom teachers." *Family Computing*, slated for September publication, is touted as the first national consumer magazine aimed at families with computers. And for the software publishing industry, **JEFFREY TARTER** is publishing a bi-weekly newsletter called the *Soft • letter* out of Cambridge, MA. ■ **ADAM OSBORNE**, an industry mainstay and man of direct language, laid it on the line about office computers at the Canadian Computer Conference. "You can be one of the first in your office to get one or one of the last," he said, "or you can get a new job." ■ **BOSOM BUDDIES**. After Atari and Imagic settled their differences over the latter's "Demon Attack," the pair appeared to be the best of

friends. In a joint statement, the pair said they would be "working together" on game design copyrights, with the goal of developing industry-wide standards. ■ So you thought **COMDEX '82** was big. Well, Comdex '83 will be even bigger, according to its promoters. Last year, the megashow had 3,200 booths. With this year half-gone, 4,600 booths have been sold, and the show's sponsor, the Interface Group, said it's hoping to sell 5,500 booths before the festivities begin November 29. ■ If you like programming, **BRIDGE** may be the game for you. World class bridge player Chip Martel notes that among bridge buffs the most common profession is computing because of the logic required to succeed in the game. ■ In the **TASTELESS GAMES DEPARTMENT**, Wizard Video Games of Los Angeles has developed entertainment based on the film *Texas Chainsaw Massacre*. In the game, the player is Leatherface, who chases people in a field and kills them with a chainsaw. ■ There must have been some red faces at the U.K. fortnightly **MICROSCOPE** when it published its story on the Model 16 using the Xenix operating system. With the piece, the newspaper ran a photo of "Tandy chairman Gates." The pic was of **BILL GATES**, chairman of Microsoft. ■ **GREED** probably accompanies any booming industry, and the microcomputer business is no exception. For that reason, it should not have surprised the editors here when one of our readers requested Bruce Tonkin's address because he thought we'd forgot to publish it with Tonkin's Creator article in January. The reader was crestfallen when informed we had published Tonkin's whereabouts. He had intended to sell the address to other chipsters. ■

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TAKE II



This column will feature Model II, 12, and 16 conversions of earlier programs. Readers who have converted programs for their own use are encouraged to submit them.

Star Track first appeared in an article by Joey Robichaux entitled "To Boldly Go..." on p. 156 of the 1983 Anniversary Issue of *80 Micro*. This Model II conversion was submitted by Byron Lott, 913 Inverness Way, Sunnyvale, CA.

The program lets you determine the position (right ascension and declination), distance from Earth, angular size, and phase of any planet in the solar system. You can determine the positions of the sun and moon, and their rise and set times. You can calculate precession from the three most common epochs (1950, 1975, 2000), and determine rise and set times for any celestial object. Star Track also helps you convert mean standard time to sidereal time, and vice versa.

Star Track is not so accurate that it considers refractions or planetary perturbations, but it's fine for amateurs.

Dictionary of Terms

Terms introduced in Star Track include: right ascension (RA), declination (DEC), precession, and epoch. The concepts involved are simple, and once you understand them you can locate any celestial object with star charts.

RA and DEC, similar to latitude and longitude, help locate objects in the sky. Latitude refers to how far up or down an object is from the equator. Numbers range from zero to 90 degrees; zero degrees is a point on the equator, while 90 degrees north or south is either of the two poles. Latitude is expressed in degrees, minutes, and seconds; 60 seconds equal one minute, and 60 minutes equal one degree.

Longitude refers to how far around the Earth a point is on its surface. Since no north-south circle exists from which one can measure longitude, Greenwich, England has long been designated zero degrees longitude. Points west of this are west longitude; points east are east longitude. Longitude is also expressed in degrees, minutes, and seconds.

Declination (DEC), is similar to latitude and uses the same reference point, the equator. For example, if the Earth is a spinning ball in the center of a giant sphere, and the circle formed by the Earth's equator were to expand until it touched this celestial sphere, it would trace a great celestial equator. Declination is measured in degrees north and south of this imaginary equator.

Like longitude, right ascension (RA) has an arbitrarily assigned reference point: the vernal equinox, or the first point of Aries. Star charts and positions are computed using this

reference point.

Until now, RA and DEC have been almost identical to latitude and longitude. Now RA is expressed in hours, minutes, and seconds instead of degrees, minutes, and seconds. An hour isn't a unit of time here, it's a unit of measure equal to 15 degrees. There are 24 hours in a circle, just as there are 360 degrees in a circle ($24 \times 15 = 360$).

Right ascension is measured traveling west from the vernal equinox—RA 0h 0m 0s. If you travel 90 degrees to the west, you're at RA 6h 0m 0s. Continue to 270 degrees and you're at RA 18h 0m 0s. When you complete the circle, you're back at RA 0h 0m 0s, so that RA 24h = RA 0h 0m 0s.

Precession applies to bodies that move a certain distance over a set period of time. Some stars move one degree in a particular direction each year; others have a steady precession—their locations or coordinates are always changing.

Star charts are written for particular epochs—currently either epoch 1950 or epoch 2000—since star coordinates aren't the same each year. While neither of the epochs is exactly correct now, the error is slight and doesn't affect amateur observing. Star Track uses epoch 1975 as a compromise between 1950 star charts and 2000 star charts; it refigures coordinates to new epochs.

Using the Program

When you load and run the program, three title pages appear. Each remains on the screen for three seconds while the program loads the necessary variables. The master menu has six options. Selecting option 1 gives you another menu that lets you choose from the nine planets and an option to return to the master menu. Once you select a planet, enter a date in MMDDYY format; use any date from 1950 to 2000.

Star Track then displays the RA and DEC of that planet. Press 1 to see the angular size, phase, and distance from Earth in AU, or press the space bar to return to the last menu.

The menu for option 2 lets you determine the sun's coordinates, distance and angular size, time of sunrise or sunset, or return to the master menu.

If you select option 3 (the moon menu) you are prompted for your approximate latitude. The number should be positive if you live north of the equator, negative if you live south of the equator. This option lets you determine the moon's coordinates, distance, angular size and phase, and rise and set times. When you are prompted for the time, enter it using the military format (i.e., 1800 = 6 p.m.).

Option 4 on the menu lets you convert coordinates to another epoch. The epoch is a four-digit year with an additional decimal digit denoting the parts of the year. So, since June 1982 is halfway through the year, it is entered as 1982.5.

Once you enter the epoch you desire, enter the RA in HHM-MSS format and DEC in DDMMSS format. Once again, declinations north of the celestial equator are positive; those south of the equator are negative.

Option 5 lets you convert mean time to sidereal time, and vice versa.

Hints

- All rise and set computations require your approximate latitude.
- Daylight-saving time is not used.
- Once you have entered the date, press enter to following date prompts: that same date will be used. ■

Program Listing

```

10 REM 14-DEC-82 *BDL*
20 REM - PROGRAM ASTROTRK/BAS
30 CLS: CLEAR500: DEFDBL0-Z: DEFINTI-K,M,N: RA=.01745329: RE=23.43*RA: ID=0: DE$="DEG"
: GOSUB2620: GOSUB2660: GOSUB2670: TH=37.3: US$="###"
40 DIMT1(8), T2(8), T3(8), T4(8), T5(8), T6(8), T7(8), T8(8), T9(8), PS(8), UB(25): UA=.065
709: UC=1.002743: UD=.997257
50 SYSTEM"CLOCK": GOSUB2590
60 PRINT"ASTRO-TRACK MAIN MENU": PRINT
70 PRINT"1 - DETERMINE PLANET COORDINATES"
80 PRINT"2 - DETERMINE SUN INFORMATION"
90 PRINT"3 - DETERMINE MOON INFORMATION"
100 PRINT"4 - DETERMINE PRECESSION / RISE & SET"
110 PRINT"5 - TIME SYSTEM CONVERSIONS"
120 PRINT"6 - EXIT PROGRAM": PRINT
130 PRINT"ENTER SELECTION";
140 QQS=INKEY$: IFQQS<"1"ORQQS>"6"THEN140
150 I=VAL(QQS)
160 IFI<1THEN130
170 IFI>6THEN130
180 ONIGOTO190,460,640,910,1210,400
190 CLS: PRINT@20,"PLANET POSITION LOCATOR": PRINT
200 PRINT"MENU": PRINT: PRINT"1 - MERCURY": PRINT"2 - VENUS": PRINT"3 - EARTH"
210 PRINT"4 - MARS": PRINT"5 - JUPITER": PRINT"6 - SATURN"
220 PRINT"7 - URANUS": PRINT"8 - NEPTUNE": PRINT"9 - PLUTO"
230 PRINT"0 - RETURN TO MAIN MENU": PRINT
240 PRINT"ENTER SELECTION";
250 QQS=INKEY$: IFQQS="M"THENIP=10: GOTO260ELSEIFQQS<"1"ORQQS>"9"THEN250ELSEIP=VAL
(QQS)
260 IFIP<1ORIP>10THEN240
270 IFIP=10THENCLS: GOTO60
280 IP=IP-1
290 PRINT: PRINT: INPUT"ENTER THE DESIRED DATE (MMDDYY)": D
300 GOSUB2200: IFNO=1THEN290ELSEIFIP=2THEN410
310 SS=PS(IP)
320 ID=IM
330 GOSUB1400: GOSUB1520
340 IFIP<3THENGOSUB1650ELSEGOSUB1710
350 GOSUB1940
360 GOSUB2150
370 PRINT: PRINT"DEPRESS <ENTER> TO RETURN TO LAST MENU, <SPACE-BAR> FOR ANGULAR
SIZE,": PRINT"DISTANCE FROM EARTH, & PHASE OF PLANET";
380 QQS=INKEY$: IFQQS=CHR$(13) THEN190ELSEIFQQS=CHR$(32) THENGOSUB1860ELSE380
390 GOSUB2570: CLS: GOTO190
400 CLS: SYSTEM"CLOCK OFF": PRINT"PROCESSING COMPLETE": PRINT: END
410 FORI=1TO300: NEXT
420 CLS: PRINT: PRINT"ON"; D; ", THE EARTH WAS LOCATED:"
430 PRINT: PRINT"DIRECTLY UNDER YOUR FEET!"
440 GOSUB2570
450 CLS: GOTO190
460 CLS: PRINT@28,"SUN MENU": PRINT
470 PRINT"1 - DETERMINE COORDINATES OF SUN": PRINT"2 - DETERMINE DISTANCE AND ANG
ULAR SIZE": PRINT"3 - DETERMINE SUNRISE/SUNSET": PRINT"4 - RETURN TO MAIN MENU": PR
INT
480 PRINT"ENTER SELECTION";
490 QQS=INKEY$: IFQQS<"1"ORQQS>"4"THEN490ELSEIP=VAL(QQS)
500 IFIP=4THENCLS: GOTO60
510 PRINT: PRINT: INPUT"ENTER THE DESIRED DATE (MMDDYY)": D
520 GOSUB2200: IFNO=1THEN510ELSEID=IM
530 ONIPGOTO540,560,580
540 GOSUB1770: GOSUB1940: SS="THE SUN": GOSUB2150
550 GOSUB2570: CLS: GOTO460
560 GOSUB1770: GOSUB1800: GOSUB2530: CLS: PRINT"ON"; D; ", THE SUN WILL HAVE": PRINT: P
RINT"AN ANGULAR SIZE OF "; IX; DES; IY; " "; IZ; " "; IZ; " "; IZ; " ": PRINT: PRINT"AT A DISTANCE OF "US
ING"#####"; SR; ": PRINT" KILOMETERS."
570 GOSUB2570: CLS: GOTO460
580 PRINT: KH=0
590 GOSUB1810
600 TG=TR: GOSUB2540: TM=TG: GOSUB2530: I1=IX: I2=IY: I3=IZ: TG=TS: GOSUB2540: TM=TG: GOSU

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B2530: I4=IX: I5=IY: I6=IZ
610 PRINT: PRINT"THE SUN WILL RISE AT APPROXIMATELY "; I1; " "; I2; " AM"
620 PRINT: PRINT" AND WILL SET AT APPROXIMATELY "; I4; " "; I5; " PM"
630 GOSUB2570: CLS: GOTO460
640 CLS: PRINT@27,"MOON MENU": PRINT
650 PRINT"1 - DETERMINE COORDINATES OF MOON": PRINT"2 - DETERMINE DISTANCE, ANGUL
AR SIZE, AND PHASE": PRINT"3 - DETERMINE RISE/SET TIMES": PRINT"4 - RETURN TO MAIN
MENU": PRINT
660 PRINT"ENTER SELECTION";
670 QQS=INKEY$: IFQQS<"1"ORQQS>"4"THEN670ELSEIP=VAL(QQS)
680 IFIP=4THENCLS: GOTO60
690 PRINT: PRINT: INPUT"ENTER DESIRED DATE (MMDDYY)": D
700 GOSUB2200: IFNO=1THEN690ELSEID=IM
710 PRINT: INPUT"ENTER DESIRED TIME (HHMM=0000-2400, 99 FOR PRESENT), (HHMM)": C
720 IPC=99THENGOSUB2660
730 CH=INT(C/100): CM=C-CH*100: CH=CH/60: CH=(CH+CM)/24: ID1=ID+CH
740 ONIPGOTO750,770,840
750 GOSUB1770: GOSUB1880: GOSUB1940: SS="THE MOON": GOSUB2150
760 GOSUB2570: CLS: GOTO460
770 GOSUB1770: GOSUB1880: D1=180-X6+VL: IPD1<0THEND1=D1+360ELSEIFD1>360THEND1=D1-360
0
780 F=(1+COS(D1*RA))/2: IFF>.99THENF=1.0
790 P=(1-.0549*2)/(1+.0549*COS((VM+VC)*RA)): TH=.5181/P: P=P*384401
800 P=INT(P): TM=TH: GOSUB2530
810 CLS: PRINT"THE DISTANCE FROM EARTH IS "USING"#####"; P; ": PRINT" KILOMETERS"
820 PRINT: PRINT"THE ANGULAR DIAMETER IS "; IX; DES; IY; " "; IZ; " ": PRINT: PRINT"THE
PHASE IS "; F
830 GOSUB2570: CLS: TH=37.3: GOTO640
840 PRINT: INPUT"ENTER THE OBSERVER LATITUDE (LL.L)": TH: IFTH<0ORTH>90THEN840
850 CH=0: GOSUB1770: GOSUB1880: GOSUB1940: DB=.05*COS((VL-VN)*RA): DA=.55+.06*COS(VM*
RA): XG=XI: XH=XU: XA=XA+(12*DA): XB=XB+(12*DB): GOSUB1940
860 GOSUB1940
870 YB=XG: YA=XH: GOSUB1820: A1=TR: A2=TS: YB=XI: YA=XU: GOSUB1820: B1=TR: B2=TS
880 TR=(12*A1)/(12+A1-B1): TS=(12*A2)/(12+A2-B2)
890 TG=TR: GOSUB2540: TM=TG: GOSUB2530: I1=IX: I2=IY: I3=IZ: TG=TS: GOSUB2540: TM=TG: GOSU
B2530: I4=IX: I5=IY: I6=IZ
900 PRINT: PRINT"THE MOON WILL RISE AT APPROXIMATELY "; I1; " "; I2; " "; I3: PRINT: PRI
NT"AND WILL SET AT APPROXIMATELY "; I4; " "; I5; " "; I6: GOSUB2570: CLS: TH=37.3: GOTO640
0
910 CLS: PRINT@24,"PRECESSION & RISE/SET": PRINT
920 PRINT"MENU": PRINT: PRINT"1 - DETERMINE PRECESSION FROM YEAR 1950": PRINT"2 -
DETERMINE PRECESSION FROM YEAR 1975": PRINT"3 - DETERMINE PRECESSION FROM YEAR 20
00": PRINT"4 - DETERMINE RISE AND SET TIMES": PRINT"5 - RETURN TO MAIN MENU"
930 PRINT: PRINT"ENTER SELECTION";
940 QQS=INKEY$: IFQQS<"1"ORQQS>"5"THEN940ELSEIP=VAL(QQS)
950 IFIP=5THENCLS: GOTO60
960 IFIP=4THEN1100
970 IFIP=1THEN1950: MS=3.07327: NS=1.33617: AS=20.0426: GOTO1000
980 IFIP=2THEN1975: MS=3.07374: NS=1.33603: AS=20.0405: GOTO1000
990 E1=2000: MS=3.07420: NS=1.33589: AS=20.0383: GOTO1000
1000 CLS: INPUT"ENTER DESIRED EPOCH (YYYY.Y)": E: IFE<1950THEN1000
1010 PRINT: INPUT"ENTER RIGHT ASCENSION (HHMMSS)": A: I1=INT(A/10000): IFI1<0ORII>24
THEN1010
1020 PRINT: INPUT"ENTER DECLINATION (+/- DDMSS)": B
1030 IX=INT(A/10000): IY=INT((A-IX*10000)/100): IZ=INT((A-IX*10000-100*100): GOSUB252
0: A1=TM
1040 IX=INT(B/10000): IY=INT((B-IX*10000)/100): IZ=INT((B-IX*10000-100*100): GOSUB252
0: B1=TM
1050 AD=A1*15: SW=(MS+NS*SIN(AD*RA))*TAN(B1*RA))*(E-E1): SW=SW/3600: TM=A1+SW: GOSUB2
530: I1=IX: I2=IY: I3=IZ: S2=AS*COS(AD*RA))*(E-E1): S2=S2/3600: TM=S2+B1: GOSUB2530: I4=I
X: I5=IY: I6=IZ
1060 PRINT: PRINT"THE ADJUSTED VALUES FOR EPOCH": E; "ARE:"
1070 PRINT: PRINT"RIGHT ASCENSION = "; I1; "H"; I2; "M"; I3; "S"
1080 PRINT: PRINT" DECLINATION = "; I4; DES; I5; " "; I6; " "
1090 GOSUB2570: CLS: GOTO910
1100 PRINT: INPUT"ENTER THE DESIRED DATE (MMDDYY)": D: GOSUB2200: IFNO=1THEN510ELSEI
D=IM: PRINT: INPUT"ENTER THE OBSERVER LATITUDE (LL.L)": TH: IFTH<0ORTH>90THEN1100
1110 KH=0: PRINT: INPUT"ENTER RIGHT ASCENSION (HHMMSS)": A: I1=INT(A/10000): IFI1<0OR
I1>24THEN1110
1120 PRINT: INPUT"ENTER DECLINATION (+/- DDMSS)": B
1130 IX=INT(A/10000): IY=INT((A-IX*10000)/100): IZ=INT((A-IX*10000-100*100): GOSUB252

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Listing continues

TAKE II

Listing continued

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0: A1=TM
1140 IX=INT(B/10000): IY=INT((B-IX*10000)/100): IZ=INT(B-IX*10000-IY*100): GOSUB 252
0: B1=TM
1150 YB=B1: YA=A1: TW=(-TAN(TH*RA)*TAN(YB*RA)): IFABS(TW)>1 THEN I160 ELSE GOSUB 1820: GO
TO 1170
1160 PRINT "THE OBJECT EITHER DOES NOT RISE ABOVE THE HORIZON OR IT IS CIRCUMPOLA
R.": PRINT "IT DOES NOT RISE AND SET!": GOTO 1200
1170 TG=TR: GOSUB 2540: TM=TG: GOSUB 2530: I1=IX+KH: I2=IY: I3=IZ: TG=TS: GOSUB 2540: TM=TG:
GOSUB 2530: I4=IX+KH: I5=IY: I6=IZ
1180 PRINT: PRINT "THE OBJECT WILL RISE AT "; I1; ": "; I2; ": "; I3
1190 PRINT " AND WILL SET AT "; I4; ": "; I5; ": "; I6
1200 GOSUB 2570: CLS: GOTO 910
1210 CLS: PRINT @25, "TIME & COORDINATES": PRINT
1220 PRINT "MENU": PRINT: PRINT "1 - CONVERT MEAN SOLAR TIME TO SIDEREAL TIME"
1230 PRINT "2 - CONVERT SIDEREAL TIME TO MEAN SOLAR TIME"
1240 PRINT "3 - RETURN TO MAIN MENU": PRINT: PRINT "ENTER SELECTION";
1250 QQ$=INKEY$: IF QQ$<"1" OR QQ$>"3" THEN I250 ELSE IP=VAL(QQ$)
1260 IF IP=3 THEN CLS: GOTO 60
1270 PRINT: PRINT: INPUT "ENTER THE DESIRED DATE (MMDDYY) "; D: GOSUB 2200: IF NO=1 THEN I2
70
1280 YY=D-(INT(D/100)*100): IF YY>0 AND YY<74 THEN I270
1290 PRINT: INPUT "ENTER THE DESIRED TIME {HHMM=0000-2400, 99 FOR PRESENT}, (HHMMSS
)" : T
1300 IF IP=1 THEN IFT=99 THEN GOSUB 2670
1310 CH=INT(T/10000): CM=INT((T-(CH*10000))/100): CS=T-(CH*10000)-(CM*100)
1320 IF CH<0 OR CH>24 THEN I290 ELSE IF CM>59 OR CM<0 THEN I290 ELSE IF CS>59 OR CS<0 THEN I290
1330 IX=CH: IY=CM: IZ=CS: GOSUB 2520: IF YY=0 THEN IY=25 ELSE IY=YY-75
1340 ON IP GOTO 1370, 1350
1350 UT=UA*KM-UB*(YY): IF UT<0 THEN UT=UT+24
1360 TM=TM-UT: IF TM<0 THEN TM=(TM+24)*UD: GOTO 1380 ELSE TM=TM*UD: GOTO 1380
1370 UT=UA*KM-UB*(YY): TM=TM*UD+UT: IF TM>24 THEN TM=TM-24 ELSE IF TM<0 THEN TM=TM+24
1380 GOSUB 2530: IF IP=1 THEN I390 ELSE PRINT: PRINT "THE CORRESPONDING MEAN SOLAR TIME I
S "; IX; ", "; IY; ", "; IZ: GOSUB 2570: CLS: GOTO 1210
1390 PRINT: PRINT "THE CORRESPONDING SIDEREAL TIME IS "; I1; ", "; I2; ", "; I3: GOSUB 2570
: CLS: GOTO 1210
1400 OP=(360/365.25)*(ID/T1(IP)): OP=OP-(INT(OP/360)*360)
1410 X1=OP+(360/3.1415927)*T4(IP)*SIN((OP+T2(IP)-T3(IP))*RA)+T2(IP)
1420 IF X1>360 THEN X1=X1-360 ELSE IF X1<0 THEN X1=X1+360
1430 VP=X1-T3(IP)
1440 XR=(T5(IP)*(1-T4(IP)^2))/(1+T4(IP)*COS(VP*RA))
1450 X2=SIN((X1-T7(IP))*RA)*SIN(T6(IP)*RA)
1460 X2=ATN(X2/SQR(-X2*X2+1))
1470 X2=X2*57.29578
1480 X3=ATN(TAN((X1-T7(IP))*RA)*COS(T6(IP)*RA))*57.29578+T7(IP)
1490 GOSUB 1590
1500 X4=XR*COS(X2*RA)
1510 RETURN
1520 PN=(360/365.25)*(ID/T1(2))
1530 PN=PN-(INT(PN/360)*360)
1540 PL=PN+(360/3.1415927)*T4(2)*SIN((PN+T2(2)-T3(2))*RA)+T2(2)
1550 IF PL>360 THEN PN=PL-360 ELSE IF PL<0 THEN PN=PL+360
1560 PV=PL-T3(2)
1570 PR=(1-T4(2)^2)/(1+T4(2)*COS(PV*RA))
1580 RETURN
1590 XZ=X1*.05
1600 FOR JJ=-360 TO 360 STEP 180
1610 XQ=X3+JJ
1620 IF ABS(XQ-X1)<XZ THEN X3=XQ: RETURN
1630 NEXT JJ
1640 PRINT "ERROR": END
1650 XA=ATN((X4*SIN((PL-X3)*RA))/(PR-X4*COS((PL-X3)*RA)))
1660 XA=(XA*57.29578)+PL+180
1670 IF XA>360 THEN XA=XA-360 ELSE IF XA<0 THEN XA=XA+360
1680 XB=ATN((X4*TAN(X2*RA)*SIN((XA-X3)*RA))/(PR*SIN((X3-PL)*RA)))
1690 XB=XB*57.29578
1700 RETURN
1710 XA=ATN((PR*SIN((X3-PL)*RA))/(X4-PR*COS((X3-PL)*RA)))
1720 XA=(XA*57.29578)+X3
1730 IF XA>360 THEN XA=XA-360 ELSE IF XA<0 THEN XA=XA+360
1740 XB=(ATN((X4*TAN(X2*RA)*SIN((XA-X3)*RA))/(PR*SIN((X3-PL)*RA))))
1750 XB=XB*57.29578
1760 RETURN

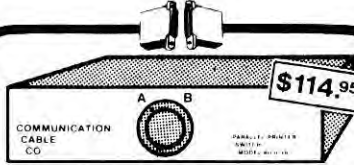
```

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1770 SN=(360/365.25)*ID: SN=SN-(INT(SN/360)*360): SM=SN+279.041470-282.510396: IF SM
<0 THEN SM=SM+360
1780 SE=(360/3.1415927)*.01672*SIN(SM*RA): XA=SN+SE+279.04147: IF XA>360 THEN XA=XA-3
60
1790 XB=0: RETURN
1800 SV=SM+SE: SF=(1+(.01672*COS(SV*RA)))/(1-.01672^2): SR=149595850/SF: S0=SF*.533
128: TM=S0: SR=INT(SR): RETURN
1810 INPUT "ENTER OBSERVER LATITUDE (+/- LL.L) "; TH: GOSUB 1770: GOSUB 1940: IX=I1+KH: I
Y=I2: IZ=I3: GOSUB 2520: YA=TM: IX=I4+KH: IY=I5: IZ=I6: GOSUB 2520: YB=TM
1820 TW=(-TAN(TH*RA)*TAN(YB*RA)): TW=-ATN(TW/SQR(-TW*TW+1))+1.5708: TW=TW*57.29578
/15
1830 TR=24+YA-TW: IF TR>24 THEN TR=TR-24
1840 TS=YA+TW: IF TS>24 THEN TS=TS-24
1850 RETURN
1860 P2=PR^2+XR^2-(2*PR*XR*COS((X1-PL)*RA)): AU=SQR(P2): AT=T8(IP)/AU: WD=X1-X1: AF=
(1+COS(WD*RA))/2: IF AF>.99 THEN AF=1.0
1870 PRINT: PRINT: PRINT "THE DISTANCE FROM EARTH IS "; AU; "ASTRONOMICAL UNITS (AU) "
: PRINT: PRINT "THE ANGULAR DIAMETER IS "; AT; "": PRINT: PRINT "THE PHASE IS "; AF: RET
URN
1880 VL=(360/27.3217)*ID+124.8756: VL=VL-(INT(VL/360)*360): VM=VL-(360/365.25)*(I
D/18.61)-145.9601: VM=VM-(INT(VM/360)*360): VN=248.6441-(360/365.25)*(ID/18.61): V
N=VN-(INT(VN/360)*360)
1890 X6=X1
1900 VE=1.274*SIN((2*(VL-XA)-VM)*RA): VA=0.186*SIN(SM*RA): V3=0.37*SIN(SM*RA): VM=V
M+VE-VA-V3: VC=6.289*SIN(VM*RA): VL=VL+VE-VA-VC
1910 VV=.658*SIN(2*(VL-XA)*RA): VL=VL+VV: VN=VN-.16*SIN(SM*RA): XA=ATN((TAN((VL-VN)
*RA)*COS(5.1453*RA)))*57.29578: XA=X1+VN: X1=VL-X3=XA: GOSUB 1590: XA=X3
1920 XB=SIN((VL-VN)*RA)*SIN(5.1453*RA): XB=ATN(XB/SQR(-XB*XB+1))*57.29578
1930 RETURN
1940 XB=XB*RA: XA=X1*RA
1950 XT=SIN(XB)*COS(RE)+COS(XB)*SIN(RE)*SIN(XA)
1960 XT=ATN(XT/SQR(-XT*XT+1))
1970 XT=XT*57.29578
1980 X9=(TAN(XA)*COS(RE))-((TAN(XB)*SIN(RE))/COS(XA))
1990 X9=ATN(X9)*57.29578: XA=X1/RA
2000 IF XA<90 THEN IQ=1 ELSE IF XA<180 THEN IQ=2 ELSE IF XA<270 THEN IQ=3 ELSE IQ=4
2010 IF X9<0 THEN X9=X9+90: GOTO 2010
2020 IF X9>360 THEN X9=X9-90: GOTO 2020
2030 IF X9<90 THEN IJ=1 ELSE IF X9<180 THEN IJ=2 ELSE IF X9<270 THEN IJ=3 ELSE IJ=4
2040 X9=X9+(IJ-JQ)*90
2050 X9=X9/15
2060 IF X9<0 THEN X9=X9+24
2070 XU=X9: XI=XT
2080 I1=INT(X9): X9=X9-I1
2090 I2=INT(X9*60): X9=(X9*60)-I2
2100 I3=INT(X9*60)
2110 I4=INT(XT): XT=XT-I4
2120 I5=INT(XT*60): XT=(XT*60)-I5
2130 I6=INT(XT*60)
2140 RETURN
2150 CLS: PRINT "ON"; D; ", "; S; " WILL BE AT:"
2160 PRINT: PRINT "RIGHT ASCENSION = " USINGUS; I1; : PRINT " H" USINGUS; I2; : PRINT " M" US
INGUS; I3; : PRINT " S"
2170 IF S$="THE SUN" THEN IF I4<-23 AND I5>30 THEN I4=-23: I5=30: I6=0
2180 PRINT: PRINT "DECLINATION = "; I4; DES; I5; " "; I6; " "
2190 RETURN
2200 IM=INT(D/10000): 'MONTH
2210 ID=INT((D-IM*10000)/100): 'DAY
2220 IY=(D-(IM*10000)-(ID*100)): KY=IY: 'YEAR
2230 IF IM<10 OR IY<12 THEN NO=1: RETURN ELSE IF ID<10 OR IY<31 THEN NO=1: RETURN
2240 NO=0
2250 IL=INT(IY/4)*4
2260 IF IL=0 THEN LL=0 ELSE IF IL=IY THEN LL=1 ELSE LL=0
2270 IF IM>2 THEN I2300
2280 IM=(IM-1)*(63-LL): IM=IM/2
2290 GOTO 2320
2300 IM=INT((IM+1)*30.6)
2310 IM=IM-63-LL
2320 IM=IM+ID
2330 IF IY<75 THEN IY=IY+100
2340 KM=IM
2350 IY=IY-75: IF IY=0 THEN RETURN ELSE IY=1

```

Listing continues



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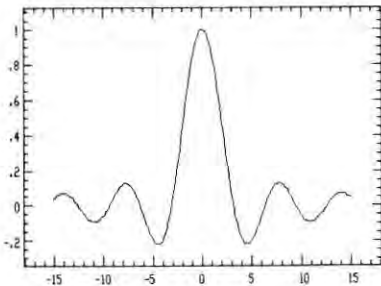
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TAKE II

Listing continued

```

2360 KM=IM
2370 FORI=1TOIY
2380 IFI=IHTHENIM=IM+366:IH=IH+4ELSEIM=IM+365
2390 IFIH=25ANDI=IHTHENIM=IM-1
2400 NEXTI
2410 RETURN
2420 DATA"MERCURY",.24085,320.66305,77.06645,.205629,.387099,7.00427,48.03493,6.
74,1.918E-6
2430 DATA"VENUS",.61521,310.97453,131.21928,.006785,.723332,3.39428,76.45475,16.
92,1.721E-5
2440 DATA"EARTH",1.00004,99.53431,102.51044,.016720,1,0,0,0,0
2450 DATA"MARS",1.88089,249.62919,335.59881,.093382,1.523691,1.84983,49.36466,9.
36,4.539E-6
2460 DATA"JUPITER",11.86224,355.21414,13.91992,.04846,5.202804,1.3045,100.19608,
196.74,1.994E-4
2470 DATA"SATURN",29.45771,104.17278,92.55833,.05563,9.538844,2.48933,113.43842,
165.6,1.74E-4
2480 DATA"URANUS",84.01247,205.78286,170.25472,.04725,19.181854,.77316,73.87283,
65.8,7.768E-5
2490 DATA"NEPTUNE",164.79550,249.91462,44.40592,.008586,30.05796,1.77236,131.505
06,62.2,7.597E-5
2500 DATA"PLUTO",246.378,202.3345,224.2580,.246115,39.29976,17.14451,109.9965,8.
20,4.073E-6
2510 DATA,397221,.413525,.363611,.379644,.395588,.411473,.361678,.377595,.393506
,.409421,.359625,.37554,.391454,.407368,.357573,.373487,.389402,.405316,.355521,
.371435,.387349,.403264,.353468,.369383,.385297,.401211
2520 TM=((I2/60)+IY)/60:IX:RETURN
2530 IX=INT(TM):TM=TM-IX:IY=INT(TM*60):TM=(TM*60)-IY:I2=INT(TM*60):RETURN
2540 W1=RM*UA-UB(KY-75):IPW1<0THENW1=W1+24
2550 TG=TG-W1:IFPG<0THENTG=(TG+24)UDELSETG=TG*UD
2560 RETURN
2570 PRINT:PRINT"DEPRESS <SPACE-BAR> TO RETURN TO LAST MENU";
2580 QO$=INKEY$:IFQO$<>CHR$(32)THEN2580ELSERETURN
2590 PRINT@26,"ASTRO-TRACK":PRINT@180,"STANDBY - LOADING DATA"
2600 FORI=0TO8:READP(I):READT1(I):READT2(I):READT3(I):READT4(I):READT5(I):READT
6(I):READT7(I):READT8(I):READT9(I):NEXTI
2610 FORI=0TO25:READUB(I):UB(I)=UB(I)+17:NEXT:PRINT@180,"
:RETURN
2620 JAS=MIDS(DATES,7,2):IFLEP$(JAS,1)=" "THENJAS="0"+RIGHT$(JAS,1)
2630 JBS=MIDS(DATES,11,2)
2640 JCS=MIDS(DATES,16,2):IFLEP$(JCS,1)=" "THENJCS="0"+RIGHT$(JCS,1)
2650 D=VAL(RIGHT$(JCS+JAS+JBS,6)):RETURN
2660 JXS=MIDS(TIMES,1,2):JYS=MIDS(TIMES,4,2):C=VAL(JXS+JYS):RETURN
2670 JX$=MIDS(TIMES,1,2):JY$=MIDS(TIMES,4,2):JZ$=MIDS(TIMES,7,2):T=VAL(JXS+JYS+J
Z$):RETURN

```

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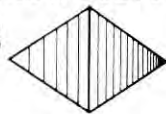
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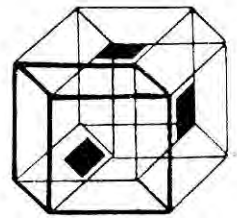
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CALENDAR

June

- 1-2 Hewlett-Packard, Palo Alto, CA. **Productivity '83** Grand Hyatt Hotel, New York, NY.
- 1-4 **Sunbelt Educational Computing Conference** Texas Tech University, Lubbock, TX.
- 3-5 Northeast Expositions Inc., Chestnut Hill, MA. **East Coast Computer Faire** Hynes Auditorium, Boston, MA.
- 4 North Area Repeater Association, Hopkins, MN. **Computers/Software Swapfest and Exposition** Minnesota State Fairgrounds.
- 6-8 IEEE Computer Society, Silver Spring, MD. **National Educational Computing Conference** Convention Center, Baltimore, MD.
- 8-10 **Principles of Software Engineering** Ohio State University, Columbus, OH.
- 9-11 Technical Education Research Centers, Cambridge, MA. **Microcomputers in Education** Wampanoag, CT.

- 11-12 Kengore Corp., Franklin Park, NJ. **NJ/NY/CT Microcomputer Show and Flea Market** Meadowlands Hilton Hotel, NJ.
- 13-16 **PC '83/International Printed Circuits Conference** New York Hilton, New York, NY.
- 14-15 Hewlett-Packard, Palo Alto, CA. **Productivity '83** Constellation Hotel, Toronto, Canada.
- 14-16 Electronic Conventions Inc., El Segundo, CA. **Ohmcon/83 Electronic Show and Convention** Detroit, MI.
- 19-22 IEEE Computer Society, Silver Spring, MD. **12th Annual Computer Elements Workshop** Vail, CO.
- 19-23 IEEE Computer Society, Silver Spring, MD. **Conference on Computer Vision and Pattern Recognition** Crystal City Hyatt, Arlington, VA.
- 24-26 **EastCon Games Convention** Glassboro State College, Glassboro, NJ.
- 26-29 IEEE Computer Society, Silver Spring, MD. **Design Automation Conference** Fontainebleau Hotel, Miami, FL.
- 26-30 National Computer Graphics Association, Fairfax, VA. **NCGA '83** McCormick Place, Chicago, IL.

- 27-28 Hewlett-Packard, Palo Alto, CA. **Productivity '83** Sheraton Boston Hotel, Boston, MA.
- 27-29 London Online Inc., New York, NY. **Videotex '83 Conference and Exhibition** New York Hilton, NY.
- 27-29 Institute for Professional Development, Princeton, NJ. **Computers in Education '83 Conference** Rutgers State University of New Jersey, New Brunswick, NJ.

July

- 10-11 **Microcomputers in Music Education** Triton College, River Grove, IL.
- 18-19 Hewlett-Packard, Palo Alto, CA. **Productivity '83** Westin Hotel, Seattle, WA.
- 20-22 University of Oregon, Eugene, OR. **Computers in Education Conference** Hilton Hotel and Convention Center, Eugene, OR.
- 25-28 IEEE Computer Society, Silver Spring, MD. **Softfair Software Development Conference** Hyatt Regency, Crystal City, Arlington, VA.
- 26-29 University of Illinois at Urbana-Champaign, Urbana, IL. **Computer-Based Music Instruction Workshop** UIUC campus.

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Coming Next Month

The most important TRS-80 since the Model I has arrived. The Model 100 was introduced as we went to press; in July, you'll see the most thorough review yet. We're even working on some portable programs.

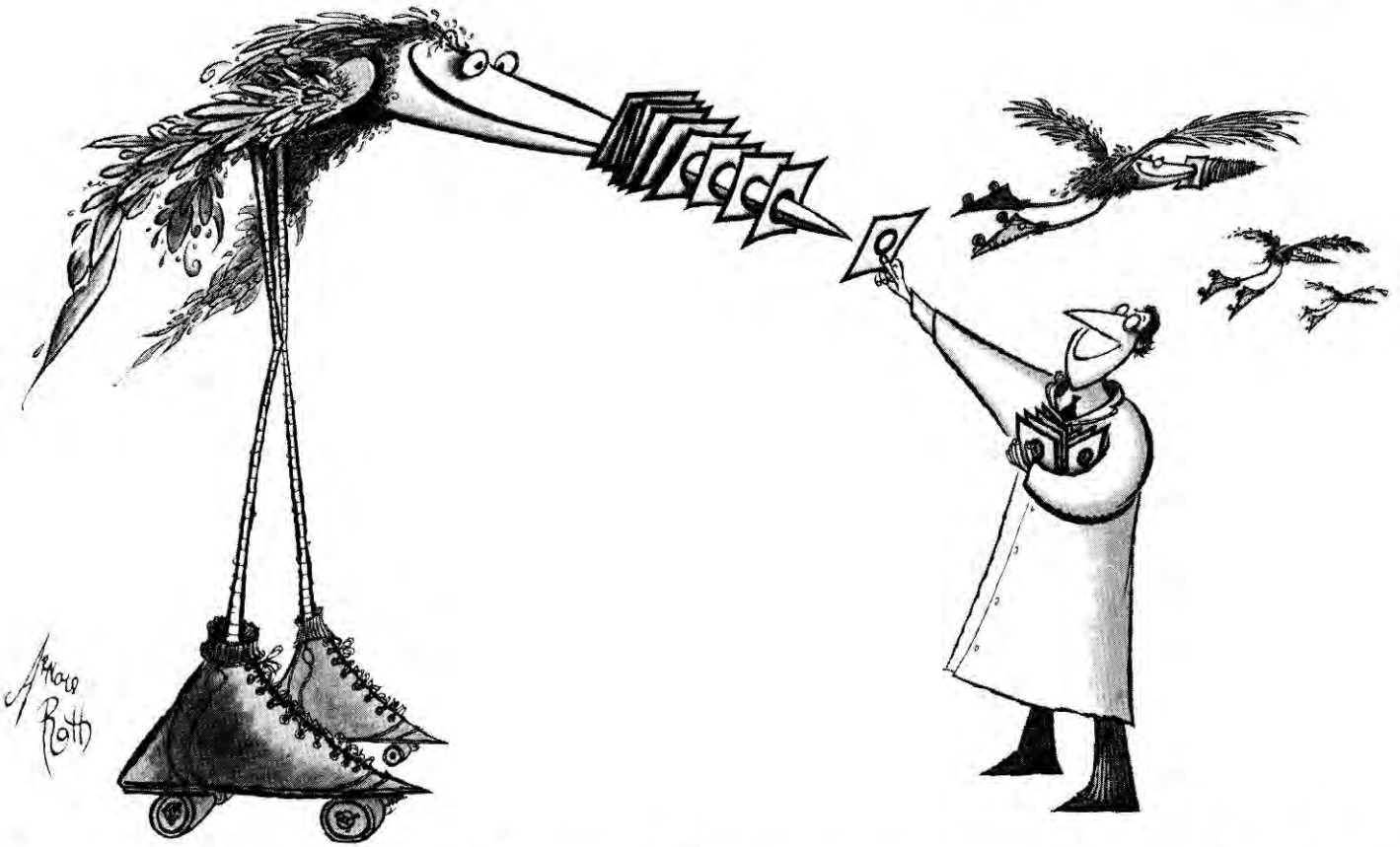
Also, the July *80 Micro* will have you speaking in tongues—or at least in different programming languages, as the issue takes a special look at that topic.

We'll have Cobol studies, a Fortran library routine, a mini-assembler, and a lesson in Assembly-language disk input/output. Richard Sprague's August

1981 race-car game reappears in *Forth* thanks to Art Wetmore, and Barry Hunt translates *Pac-Man* into *Tiny Pascal*.

Getting back to Basic, there's Don Rowe's anticompile—a program that reverses the compiling process for *USR* users, producing Basic code from machine language. Karl Townsend offers a tutorial on random access for tape-based systems, and Edward Johnson's utility lets you take time out for mathematical calculations while writing a program. ■

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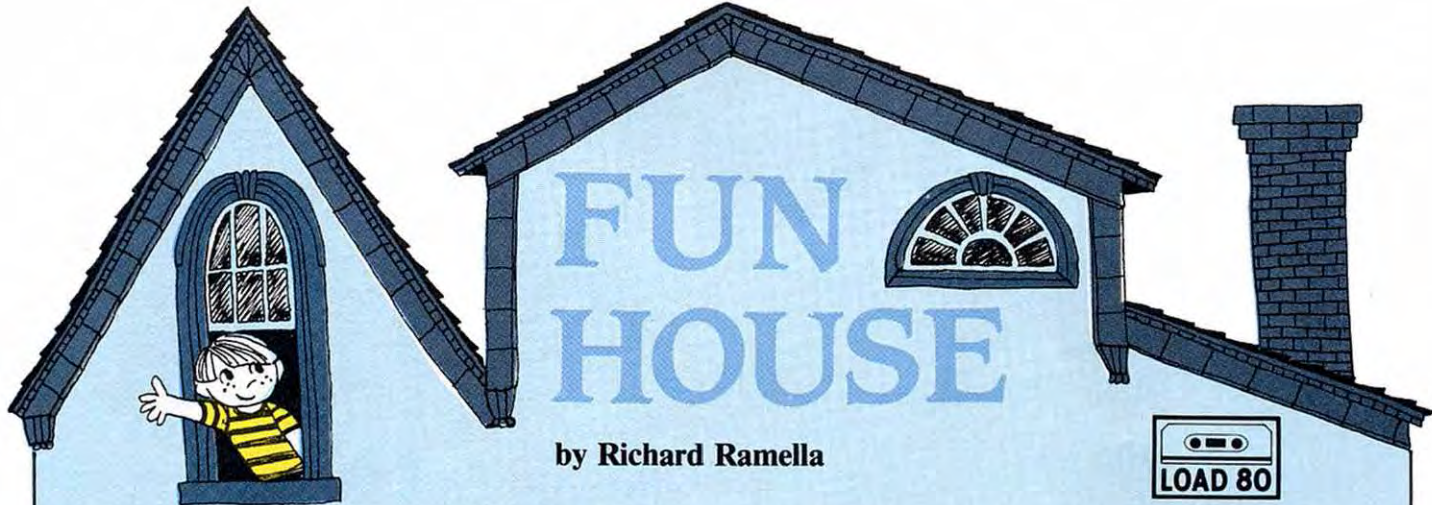
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by Richard Ramella

Traveling Games

Soon hundreds of thousands of kids will be loaded into cars and forced to ride hundreds of miles. This is called the summer vacation trip.

During these trips, kids make five standard remarks and their parents make five time-worn replies:

Child: *I'm hungry!*

Parent: *Do you want another cracker?*

Child: *Are we there yet?*

Parent: *No.* (This answer is always no.)

Child: *I'm sick!*

Parent: *Don't look out the window and get dizzy.*

Child: *I have to go to the bathroom!*

Parent: *How long can you wait?*

Child: *I'm bored!*

Parent: *How about a game?*

To this last suggestion, the child might well reply: *Oh no, not license-plate bingo again!*

Indeed not. This month in the Fun House we're passing

Fizzbuzz

```

100 REM * FIZZBUZZ / TRS-80 LEVEL II OR COLOR BASIC
110 REM * FUN HOUSE / JUNE / RAMELLA
120 CLS
130 PRINT "PREPARE FOR FIZZBUZZ"
140 FOR T=1 TO 1000
150 NEXT T
160 CLS
170 N=1
180 PRINT "WE START WITH THE NUMBER 1..."
190 INPUT "WHO GOES FIRST -- <Y>OU OR <M>E";A$
200 IF A$<>"Y" AND A$<>"M" THEN PRINT "AHEM... I SAID ";: GOTO 190
210 IF A$="Y" THEN G=1 ELSE G=2
220 A$=STR$(N)
230 IF N>19 AND MID$(A$,2,1)="7" THEN B$="BUZZY": GOTO 260
240 IF N>19 AND MID$(A$,2,1)="5" THEN B$=B$+"FIZZY": GOTO 260
250 IF N>9 AND B$="" THEN B$=MID$(A$,2,1)
260 IF N/7=INT(N/7) OR RIGHT$(A$,1)="7" THEN B$=B$+"BUZZ": P=P+1
270 IF N/5=INT(N/5) OR RIGHT$(A$,1)="5" THEN B$=B$+"FIZZ": P=P+1
280 IF P>0 GOTO 300
290 B$=B$+RIGHT$(A$,1)
300 IF G=1 THEN PRINT "MY TURN": FOR T=1 TO 600: NEXT: PRINT B$: GOTO 350
310 IF G=2 THEN PRINT "YOUR TURN": INPUT Z$
320 IF Z$=B$ THEN PRINT "RIGHT!"
330 IF N=99 THEN PRINT "WHEW! WE MADE IT TO THE END. WELL DONE!"
340 IF Z$<>B$ THEN PRINT "NO... THE ANSWER IS ";B$: PRINT "YOU LASTED "N"NUMBERS.": END
350 IF G=1 THEN G=2 ELSE G=1
360 P=0
370 B$=""
380 N=N+1
390 GOTO 220
400 END
  
```

This game runs on the Model 100



out game packets for emergency highway use.

Yes, I know you don't have a computer in the back seat of your car. The idea is to learn games on a computer so you can play them on the highway. Also, one person can play the games with the computer acting as referee, scorekeeper, and sometimes opponent.

All four of this month's pro-

grams run in either Level II or on the Color Computer. Only Wordstep needs a bit of modification.

Fizzbuzz

This is the shortest and trickiest program of the month. You've probably played the game called Buzz. In it, you and one or more other players start counting, but you must say

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Taffy

```
00 REM * TAFFY / TRS-80 LEVEL II OR COLOR COMPUTER
110 REM * FUN HOUSE / JUNE / RAMELLA
120 CLS
130 CLEAR 500
140 DATA HANDY,BROWN,JUMPS,QUICK,RUSTY,SANDY,WORTH,SMILE,FOXES,H
UMAN
150 DATA GUILT,POINT,GNOME,FOUND,HEAVY,MOIST,GAMES,SCORE,ROUND,B
OARD
160 DATA DEPTH,WORLD,WIDTH,SMACK,WRECK,UNDER,BELOW,FORT,CRUST,BA
KER
170 DATA BLOCK,THYME,SNAIL,BROAD,BIRDS,SLUMP,ELBOW,BRAIN,CLEAR,T
RUCK
180 DATA MONEY,SPICE,CHILD,EXACT,GHOST,SCARE,RIGHT,REPLY,BINGO,W
ATCH
190 FOR A=1 TO 32
200 X$=X$+"*"
210 NEXT
220 N=1
230 DIM A$(50)
240 FOR B=1 TO 50
250 READ A$(B)
260 NEXT
270 C=RND(50)
280 PRINT "I HAVE THOUGHT OF A WORD."
290 PRINT "TAKE YOUR FIRST GUESS."
300 PRINT X$
310 PRINT "GUESS"N;
320 INPUT D$
330 IF LEN(D$)<>5 THEN PRINT "YOU MUST GUESS 5-LETTER WORD.": GO
TO 310
340 IF D$=A$(C) THEN PRINT "YOU WIN IN"N"TRIES.": END
350 FOR A=1 TO 5
360 FOR M=1 TO 5
370 IF MID$(D$,M,1)=MID$(A$(C),A,1) THEN P=P+1
380 NEXT M
390 NEXT A
400 PRINT "TRY NUMBER"N"--"P"POINT";
410 IF P>1 THEN PRINT "S" ELSE PRINT
420 IF N=30 GOTO 460
430 N=N+1
440 P=0
450 GOTO300
460 PRINT X$
470 PRINT "30 TURNS UP. I AM SO SORRY."
480 PRINT "I WIN. THE WORD WAS "A$(C)
490 PRINT
500 PRINT "TO PLAY AGAIN, TAP ENTER."
510 INPUT X
520 N=1
530 GOTO 270
540 END
```

Wordstep

```
100 REM * WORDSTEPS / TRS-80 LEVEL II
110 REM * TO ADAPT FOR COLOR COMPUTER, SEE LINE 630
120 REM * FUN HOUSE / JUNE / RAMELLA
130 CLS
140 CLEAR 500
150 DIM B$(14)
160 A=RND(21)+64
170 IF A=81 OR A=84 OR A=75 OR A=57 OR A=73 OR A=74 OR A=57 GOTO
160
180 PRINT "YOUR WORDSTEP LETTER IS..."
190 PRINT
200 PRINT "      "CHR$(A)
210 PRINT
220 PRINT "TAP ENTER. THEN YOU HAVE"
230 PRINT "UNTIL THE TIMER REACHES 100"
240 PRINT "TO BUILD YOUR WORDSTEP."
250 INPUT X
260 CLS
270 Z=64
280 C=2
290 N=1
300 B$(1)=CHR$(A)
310 PRINT B$(1)
320 A$=A$+INKEY$
330 PRINT @ Z,A$;"      ";
```

Wordstep continues

buzz if the number has a 7 in it or is evenly divisible by seven.

Fizzbuzz is like that, only more so. You also have to say fizz if the number ends in a 5 or is evenly divisible by five.

There are more rules, so put on your thinking cap. Let's start by counting to 10 according to the rules: 1, 2, 3, 4, FIZZ, 6, BUZZ, 8, 9, FIZZ. The number 5 has a 5 in it, and the number 10 is evenly divisible by five, so they are fizzes. The number 7 has a 7 in it, so it's a buzz.

Above 10, it gets trickier. The number 14 would be 1BUZZ; you say the first number and buzz because 14 is divisible by seven. In the same way, 15 is 1FIZZ.

The number 35 has a 5 in it and is also divisible by seven, so it's 3BUZZFIZZ.

Oh, did I say that numbers beginning with 5 start with FIZZY, as in FIZZY1 for 51? And did I mention that numbers starting with 7 begin with BUZZY, as in BUZZY8 for 78?

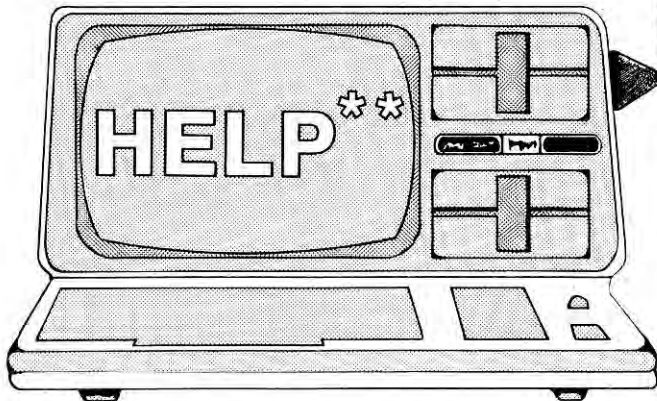
I could tell you more, but I'll let you find BUZZYBUZZ-FIZZ, FIZZYBUZZ, and BUZZYBUZZ on your own.

You don't have to know how to play to start. The computer plays against you—perfectly, of course—and the object is to see how close to the number 99 you can get.

To start, the computer asks who will play first. Enter Y if the computer plays first or M if you want first turn. Then the count begins. Whenever you make a mistake, the computer tells you the answer and invites you to play again.

Fizzbuzz could use up quite a few miles, couldn't it? Also,

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137

Wordstep continued

```

340 H=H+1
350 PRINT @ 15,"TIMER:"INT(H/50);
360 IF C=15 OR H=5000 GOTO 540
370 IF LEFT$(A$,1)<>CHR$(A) THEN A$="": GOTO 320
380 IF RIGHT$(A$,1)="/" THEN A$="": GOTO 320
390 IF RIGHT$(A$,1)=CHR$(13) AND LEN(A$)=<C THEN A$="": GOTO 320

400 IF LEN(A$)>C AND RIGHT$(A$,1)<>CHR$(13) THEN A$=LEFT$(A$,C):
  GOTO 320
410 IF LEN(A$)=C+1 AND RIGHT$(A$,1)=CHR$(13) THEN B$(N)=A$: A$="
": GOTO 430
420 GOTO 320
430 CLS
440 PRINT @ 0,CHR$(A)
450 F=1
460 FOR G=64 TO Z STEP 64
470 PRINT @ G,B$(F);
480 F=F+1
490 NEXT
500 Z=Z+64
510 C=C+1
520 N=N+1
530 GOTO 320
540 PRINT @ 416,"";
550 IF H=5000 THEN PRINT "TIME IS UP...";
560 IF C>5 THEN Z$="GOOD"
570 IF C>8 THEN Z$="EXCELLENT"
580 IF C>10 THEN Z$="AMAZING 1"
590 IF C>14 THEN Z$="THE BEST !!!"
600 PRINT@ 480,"SCORE:"C-1"-Z$;
610 GOTO 600
620 END
630 REM *****
640 REM * TO ADAPT FOR COLOR COMPUTER,
650 REM * ENTER FOLLOWING LINES:"
660 REM *      270 Z=32
670 REM *      460 FOR G=32 TO Z STEP 32
680 REM *      500 Z=Z+32
690 REM *      520 PRINT @ 448,"";
700 REM *****
710 END

```



Essay

```

100 REM * ESSAY / TRS 80 LEVEL II OR COLOR BASIC
110 REM * FUN HOUSE / JUNE / RAMELLA
120 DATA THIS SUMMER,I,RAN,TO,THE FARM,DANCED WITH,RED,MARTIAN
130 DATA IN JULY,MY DAD,DROVE,TOWARD,DISNEYLAND,GAVE A HAMBURGER T
O,YOUNG,COW
140 DATA GUESS WHAT?,MY MOM,TOOK A TRAIN,AWAY FROM,VENUS,PLAYED FO
OTBALL WITH,CRABBY,LADY
150 DATA NOT LONG AGO,MY DOG,FLEW,INTO,CHINA,RESCUED,WORRIED,BOY
160 DATA JUST FOR FUN,OUR CAT,SWAM,OVER,A SUPERMARKET,SEWED A SHIR
T FOR,SILLY,ELF
170 DATA ONLY LAST WEEK,MY FRIEND ELMO,CRAWLED,THROUGH,THE PACIFIC
OCEAN,TOLD STORIES TO,SILLY,ELF
180 CLEAR 700
190 CLS
200 PRINT "ESSAY: MY SUMMER"
210 PRINT
220 X=6
230 DIM A$(X),B$(X),C$(X),D$(X),E$(X),F$(X),G$(X),H$(X)
240 FOR A=1 TO X
250 READ A$(A),B$(A),C$(A),D$(A),E$(A),F$(A),G$(A),H$(A)
260 NEXT
270 G$=A$(RND(X))+ " "+B$(RND(X))+ " "+C$(RND(X))+ " "+D$(RND(X))+ " "
+E$(RND(X))+ " AND "+F$(RND(X))+ " A "+G$(RND(X))+ " "+H$(RND(X))+ ".
"
280 FOR N=1 TO LEN(G$)
290 H$=MID$(G$,N,1)
300 PRINT H$;
310 FOR T=1 TO 40
320 NEXT
330 O=O+1
340 IF O>15 AND H$=" " THEN PRINT: O=0
350 NEXT N
360 GOTO 270
370 END

```

learning the game on a computer will make you a Fizzbuzz expert.

Taffy

This word game isn't about candy. It's called Taffy because of the way you pull words apart and put them together as you play.

The computer has a list of 50 words from which it chooses a secret five-letter word that you must guess within 30 tries. That list is in data lines 140-180. It is best that all the letters of your guess word be different.

The computer gives you one point for each letter in your guess word that matches the secret word. You might have two points in one turn and none in the next. The computer gives you clues about letters in its word.

A good way to play is to write out the alphabet. Using logic, cross out letters that do not seem to be in the secret word. In time, if you're good at this, you'll guess the five letters. Then you must guess the letters in the right order—the secret word—to win.

Notice that all the secret words have no repeated letters, so it's to your advantage to guess with words that don't repeat letters either.

Wordstep

This is an easily played but tough-to-beat game. If your computer runs in Level II, type the program to line 620 END and stop.

If you have a Color Computer, do the same thing, then re-type lines 270, 460, 500, and 520 as they are given at the bottom

of the program where it says, "To adapt for Color Computer, enter following lines:".

In Wordstep, the computer shows you a starting letter. First, you type a two-letter word starting with that letter, then a three-letter word, then a . . . you get the idea.

You have until the timer reaches 100 to create a wordstep ending in a 14-letter word. All words must start with the letter you're given at the beginning.

The program plays referee. It refuses words that are the wrong lengths or don't start with the correct letter. To erase a try that's no good, type /, the slash mark on the same key with the question mark. To register a word, tap enter.

If you reach a 14-letter word, you have my sincere congratulations.

Essay

I know summer vacation is just beginning, so maybe this isn't the time to talk about going back to (yuck) school in September.

Even so, now is the time to gather material for the first task your teacher will give you when you return: the What-I-Did-This-Summer essay.

To show you how much fun an essay can be, I've written an essay generator. There are no rules, thank goodness. You just run it and read it. Every time it should be different.

This morning a very large crate was delivered to the Fun House. On it was a sign that said *Materials for July Fun House Visit*. I wonder what's inside. Be here to open it next month. ■

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Load 80 has a new disk-transfer system! This means that Load 80 disks boot on both the Model I and III and let single-drive users transfer Load 80 files without begging or borrowing a second drive.

To use the new disks, transfer their files to your TRSDOS system or data disk as follows:

- Back up a TRSDOS disk and purge it of any old visible files.
- Insert the Load 80 disk in drive zero of your Model I or III.
- Press the reset button. After your computer boots the Load 80 disk, it displays the Load 80 logo for a moment, and then a list of programs on the disk appears.
- Two-drive users: Insert your TRSDOS disk in drive 1. This is the destination disk and drive.

Single-drive users: When the com-

Load 80's new transfer system

puter prompts for the destination drive, press the zero key. The computer then tells you to mount the destination disk.

- If there is not enough space on the disk to transfer all files, the computer offers to transfer only the files you specify. The computer won't transfer a file if there isn't enough room on the destination disk.

- Two-drive users: The computer

transfers the files, reports on each file as it does, and tells you when it's finished.

Single-drive users: Swap the source and destination disks one time for each file transferred, and one more time to transfer the directory. The computer prompts you through the procedure, but be careful not to confuse your source and destination disks.

One final point: Because the new Load 80 disks contain both single- and double-density tracks, you can't back up this disk. However, once you've transferred the files, you can (and should) back up the disk you've created.

Old Business

Last month, Art Huston began discussing the differences between TRSDOS and DOSPLUS. Let's continue with the Build and Do commands.

These commands let you build a list of DOS commands and then process them in order. A sample application would be to take a directory, turn on the clock and enter Basic every time you boot-up.

The syntax for building a file is:

BUILD filename

If you don't specify an extension, the file is given an extension of /BLD. Then type as many DOS commands as you want, pressing enter after each. To end the build session and return to DOSPLUS, press break. To extend a file, type "BUILD filename" again. You cannot edit a Build file; you must kill and then reconstruct it.

To execute a Build file, type:

DO filename

The default extension is /BLD. Each DOS command is executed in order.

You may want to use the Auto command to do a file each time you press reset.

The Pause command is included to halt the operation of a Build file until the operator presses enter. The syntax is:

PAUSE message

The Basic included on DOSPLUS is compatible with TRSDOS in all but one respect: The proper command to go from Basic to the operating system is CMD, not CMD"S". ■

Index	Page	Article	File Spec	Comments
A			COPYRGHT/BAS	None
B	330	Fun House	FIZZBUZZ/BAS	None
C	330	Fun House	WORD/BAS	None
D	330	Fun House	TAFFY/BAS	None
E	24	The Next Step	NXTSTEP/BAS	None
FEA	24	The Next Step	NXTSTEP/SRC	Ed/Asm
GEA	68	Drivers and DCBs	FLASH/SRC	Ed/Asm
H	68	Drivers and DCBs	FLASHDIRS/BAS	None
IEA	78	Apple Core Emulator	APPLE/SRC	Ed/Asm
JEA	78	Apple Core Emulator	AP6502SM/SRC	Ed/Asm
KEA	116	The 80 Goes Color—Part II	COLORIO/SRC	Ed/Asm
L	116	The 80 Goes Color—Part II	COLORDMO/BAS	None
M	246	Flowchart Generator	FLOW/BAS	None
N	302	Robot Reader	ROBOTRDR/BAS	None
O	300	Ordering via Recursive Routines	PERMOFN/BAS	None

Note: All programs indexed with a letter followed by EA need an editor/assembler (Ed/Asm).

June 1983 Load 80 Directory

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Color Load 80 Directory

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The GAMER'S CAFE

by Rodney Gambicus

Sandusky, OH, Spring 1983. A battered yet beaten old van sits on the beach at Cedar Point beneath an azure morning sky. Across the bay lies the amusement park, its pinnacles of pleasure pasted to the horizon. An occasional burst of gaiety from the ferris wheel wafts across the sand, tickling the nose of the van before drifting out to sea.

The van's door slides open. A man, known to his comrades only as Mad Max, steps out, dressed in shorts and reflecting sunglasses. He stretches, inhales deeply the pungent breeze.

"Ah... I love the smell of Erie in the morning!" he says.

"I'm hungry. What do we have to eat around here?" Mercedes asks as she emerges from the van.

"You're always hungry," I reply. "For heaven's sake, we ate just last week."

"Let's go into town and get some food," she continues.

I smile. The witty repartee amuses me. But why are hundreds of little hamburgers emerging from the sand?

I hear strains of Wagner music. From the causeway? The hunger! The hunger!

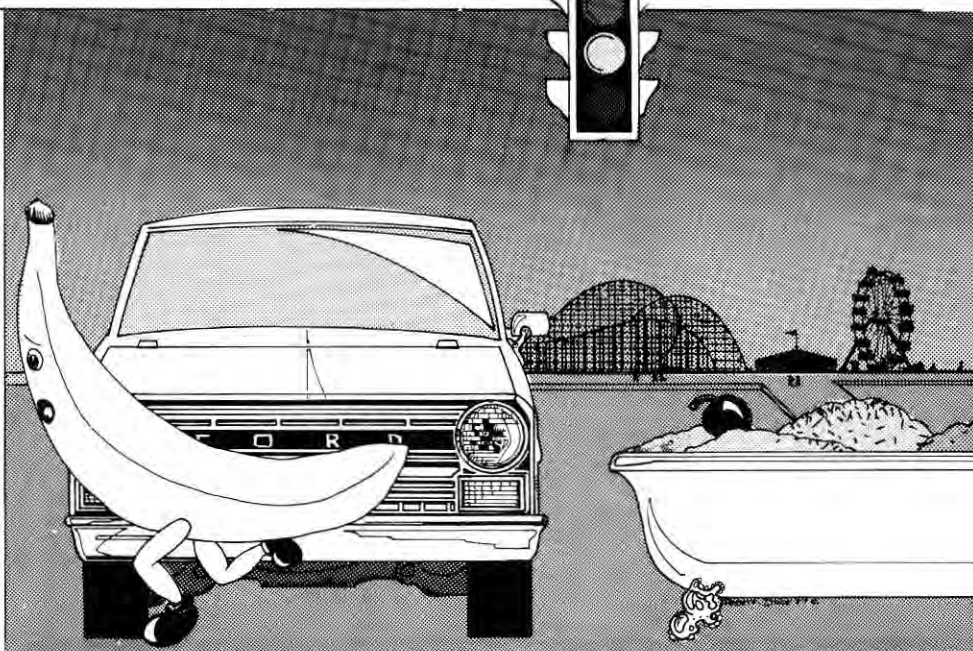
* * * * *

I am driving. Mercedes sits next to me. Max is in the back playing Cosmic Fighter. We are cruising down Columbus Avenue.

"I'm worried about Max," Mercedes says. "I mean, ever since that Ken Jackway blew him off the board in Cosmic Fighter, he's been acting very weird."

Max screams.

"He seems OK to me," I say.



Strictly from hunger

"It's impossible! 581,280 can't be done!" he cries.

"There's a store," I hear Mercedes say. "Let's stop and get some peanut butter and crackers."

Suddenly, a giant banana runs across the road. Six guys with a bathtub full of ice cream are chasing it. The banana is whimpering, and I am profoundly disturbed.

* * * * *

We are sitting on a park bench, munching our crackers. We didn't have enough money for peanut butter. In front of us is a statue of a boy holding a boot from which water pours. He is laughing at us.

Mercedes reads the mail. "Take a look at this one," she says. "This guy Rich Fiore has figured out how to cheat at Poltergeist and Microbes."

"On Level I of Poltergeist, if you hold down either joystick button, few or no cars will appear. On Level II, I've noticed that it is possible to walk through the obstacles and even the Poltergeist! In Microbes you can cheat by pressing the shift and @ buttons at the same time when the prompt 'What's your name?' is displayed. Your ship rotates faster and shoots more often."

"He also wants some tips on how to get out of Pyramid."

Max is indignant. "Cheat on your taxes, cheat on your exams," he spits through his crackers. "But cheat on a game? My God! Has he no honor? I hope he never finds his way out of Pyramid!"

Max is a harsh man, I think, as I watch him trample a cluster of M&Ms scurrying across the pavement.

```
10 CLS:PRINT"PRESS ANY KEY WHEN <ELIMINAT/CMD> IS IN DRIVE"  
20 IF INKEY$="" THEN 20  
30 CMD"LOAD ELIMINAT/CMD"  
40 INPUT "DO YOU WANT (R)APID FIRE OR (N)ORMAL":A$  
50 IF A$="N" THEN GOTO1000  
60 POKE-28483,0  
100 INPUT"HOW MANY SHIPS DO YOU WANT (1-99)":S$  
110 IFLN(S$)=1 THEN POKE-29778,VAL(S$):GOTO140  
120 POKE-29778,S  
130 POKE-19679,ASC(LEFT$(S$,1)):POKE19653,ASC(LEFT$(S$,1))  
140 POKE 19678,ASC(RIGHT$(S$,1)):POKE-19652,ASC(RIGHT$(S$,1))  
150 INPUT"HOW MANY BOMBS DO YOU WANT (1-99)":B$  
160 IFLN(B$)=1 THEN POKE:29773,VAL(B$):GOTO190  
165 B=VAL(RIGHT$(B$,1))+VAL(LEFT$(B$,1))*16  
170 POKE-29773,B  
180 POKE-19670,ASC(LEFT$(B$,1)):POKE-19662,ASC(LEFT$(B$,1))  
190 POKE-19669,ASC(RIGHT$(B$,1)):POKE-19661,ASC(RIGHT$(B$,1))  
200 DEFUSR1=-29927:C=USR1(0)
```

Eliminator patch by Greg Hanssen (Honolulu, HI). Runs on Model I under NEWDOS80.

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*8" drive operation requires special cable. 8" double-density requires 3.55MHz CPU speed-up modification or LNW-80 4MHz computer.

I have finally topped Dean Mitchell's high score of 271,300 in Eliminator.

"Anybody can get 500,000 with 99 ships and 99 bombs," says Mercedes scornfully.

We are in the parking lot at the Cedar Lanes bowling center. The lot is empty except for the van, our computers on

card tables, and 500 square-dancing eggplants.

"You aren't actually going to publish this program, are you?" Max asks.

"Sure," I say. "It's just another tomato in the chef's salad of computing."

"This is disgraceful!" he bellows. "First we let cheaters give tips in the column. Now we tell everybody how to get

as many ships and bombs as they want in Eliminator! It's anarchy! It's a sham! It's the end of civilized gaming as we know it!"

Max starts quoting long passages from Toynbee and Emerson, and I turn my attention to the weather. It is raining lentil soup.

"Hey, let's at least finish off the scoreboard," grumbles Mercedes.

"What about my high scores in Bable Terror and Time Runner?" says Max.

"You're just upset because John Hope deep-sixed your Sea Dragon score," Mercedes replies.

"Ah, that's a wimpy game anyway," Max mutters.

"This Richard Uglum got 74,800 in Donkey King," Mercedes reads from the pile of letters.

I am distracted by an English muffin crawling out of the PMC's disk drive.

"He says there's an error in the second barrel screen," Mercedes continues. "You can go under the first barrel by jumping out from under it. Problem is, you sometimes get points."

I grab the muffin and start eating it.

"Rodney," says Mercedes. "How come you're chewing on Armored Patrol?"

Midnight. We are roaring down the Ohio Turnpike. The hum of dark thoughts is in our ears. We are headed east, but sunrise is still hours away. The roadside reflectors dance like moths in the corner of my eye. Mercedes sleeps, her head on the armrest of the door. Max is in the back, quiet for once; the only spaceships he battles are the headlights in the westbound lane.

We are on the road again. How we managed isn't important; suffice it to say that we reached the end of a fantasy, and there found food and fuel.

Still, the night is unsettled. It flickers like a failing screen, inhabited by video ghosts of uncertainty, inhibited only by the will of its guests. The aliens that surround us, that linger on the fringes of our glow, are patient. Only occasionally do we hear them, their laughter echoing across the bay of darkness from a causeway we cannot see.

I shudder, take another sip of coffee, and step on the gas. The van hesitates and then leaps forward, and we continue our journey on the crest of the phosphorescent wave. ■

The Big Board

Alien Defense	91,320	Carl Pflanzner, Gillette, NJ
Armored Patrol	81,000*	Winthrop
Astro Blast (CC)	15,225	Andrew Puglise, Aliquippa, PA
Attack Force	153,470	Mark Brinkman, Emporia, KS
Bable Terror	7,858	Mad Max
Bounceoids	2,028,450	Scott McClure, Winter Park, FL
Caterpillar	95,644	Matthew Holmes, Nelson, N.Z.
Chicken	8,922	Halfdan Hansen, Nelson, N.Z.
Cosmic Fighter	581,280	L. Ken Jackway, Phoenix, AZ
Defense Command	126,170	Bette Dufraigne, Bolton, CT
Demon Seed	77,970	Christopher Healey, Falmouth, MA
Donkey King (CC)	74,800	Richard Uglum, Milwaukee, WI
Eliminator	271,300	Dean Mitchell, Edmonton, Alta.
Flying Saucer	1,270**	James Oh, Pebble Beach, CA
Fortress	187,600	Mark Brinkman, Emporia, KS
Galactic Attack (CC)	41,340	Rich Fiore, Clemson, SC
Galaxy Invasion	7,185,230 +	James & Richard Oh, Pebble Beach, CA
Galaxy Invasion Plus	1,113,600	Geordon Portice, Twining, MI
Ghost Hunter	41,190	John Kane, Nelson, N.Z.
Jovian	133,320	Mark Brinkman, Emporia, KS
Laserball	72,530	Neil Matson, Panama City, FL
Laser Defense	199,490	Matthew Holmes, Nelson, N.Z.
Liberator	306,300	Rodney
Lunar Lander	9,600	Nelson Kruger, Duarte, CA
Meteor Mission 2	63,520	L. Ken Jackway, Phoenix, AZ
Meteoroids (CC)	25,270	Andrew Puglise, Aliquippa, PA
Microbes (CC)	69,400 + +	Rich Fiore, Clemson, SC
Missile Attack	41,430	John Kane, Nelson, N.Z.
Monkey Kong (CC)	746	Andrew Puglise, Aliquippa, PA
Monster Maze (CC)	14,340	Rich Fiore, Clemson, SC
Outhouse	26,650	Halfdan Hansen, Nelson, N.Z.
Pac Attack (CC)	56,235	Andy Lehtola, Mound, MN
Paddle Pinball	861,680	James Oh, Pebble Beach, CA
Planet Invasion (CC)	57,500	Andrew Puglise, Aliquippa, PA
Polaris (CC)	53,879	Rich Fiore, Clemson, SC
Poltergeist (CC)	4,840	Rich Fiore, Clemson, SC
Robot Attack	14,780	James Oh, Pebble Beach, CA
Scarfman	303,580	Raimo Hansen, Mesa, AZ
Sea Dragon	552,890	John Hope, Kingston, Ont.
Space Castle	37,650	Mark Brinkman, Emporia, KS
Stellar Escort	53,350	Geordon Portice, Twining, MI
Storm (CC)	170,775	Andrew Puglise, Aliquippa, PA
Super Nova	1,166,340	Mark Brinkman, Emporia, KS
Swamp Wars	39,200	Winthrop
Time Runner	89,479	Mad Max

* Mohan Ramaswamy (Altamonte Springs, FL) reports 368,000. He doesn't say whether it was Method I or II.

** Played at the highest level.

+ Solo record: 2,026,850 (Nelson Kruger, Duarte, CA).

+ + Level 6.

Gamer's Cafe readers are invited to submit their high scores, for these and other TRS-80 games. We'll print unvalidated scores, but validated ones (a photo of the screen) will, of course, rank higher in prestige.

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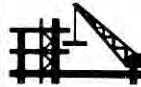
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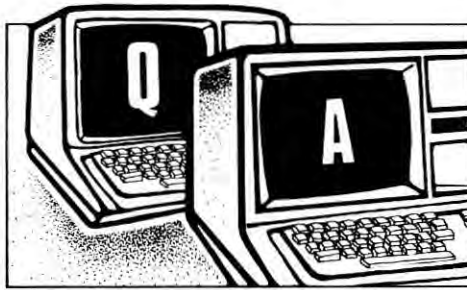
I own a Model I and I would like to speed up the Z80 clock. Many articles in 80 Micro offer speed-up kits boasting increases of up to 150 percent. The circuits shown have a bunch of flip-flops and logic gates. My question is: If the Z80 operates at 4 MHz, why hasn't anyone come up with the idea to exchange the crystal in the clock circuit for a 4 MHz crystal? Also, why did Tandy decide to have the TRS-80 operate at 1.77 MHz instead of the top speed of 4 MHz?

J.L.
Lowell, MA

The reason RS doesn't replace the present crystal with a 4 MHz crystal is because the present crystal has a 10.6445 MHz frequency. The logic gates and flip-flops are used to divide this 10 MHz frequency down to the desired frequency. The chips in the TRS-80 can't be used without extensive modifications to the circuit board, so most speed-up kits use their own divider networks to do this.

Tandy didn't design the TRS-80 for 4 MHz operation because it's expensive. Consider that you'd have to use 200-nanosecond RAM chips to operate at that frequency, which are more expensive than the 300-nanosecond chips originally used. Also consider that the other chips in the computer would have to be upgraded to higher quality, and higher priced, chips before the full speed could be achieved. In fact, several of the speed-up kits warn you that in order to reach the higher speeds it may require replacing several key chips with ones of higher quality (such as replacing the Z80A chip with a Z80B).

Designing the TRS-80 to operate at 4 MHz would have increased the production cost as much as 20-50 percent. Since the designers were interested in making it as inexpensive as possible, they decided to use the cheaper chips and a slower clock rate. The machine was originally designed for the home hobbyist and not the business or scientific community, so the slower speed doesn't matter. After all, in most cases the TRS-80 is waiting for people, printers, modems, and other slower devices



Problems and solutions

to do their stuff before it can proceed with its job.

At present I own 10 of Scott Adams' 12 adventures, loaded from tape to disk. I did this by using Jake Commander's Macro Monitor and copying the programs from 8000H-BCFFH and adding a loader at BCFFH to BD0F to load it over the overlay region after being put in memory by the DOS.

I've tried many times, unsuccessfully, to replace the cassette save and load routines with disk save and load routines and relocating the programs to 7000H-ACFF so that the DOS isn't destroyed. Do you know of a patch that can do this?

C.J.
Monaca, PA

I remember trying to do that myself several years ago. Unfortunately, I couldn't get it to work for me either. I suggest that you contact Adventure International and ask about trading in your cassette programs for disk programs.

I own a Model III and would like to use the Superzap utility to change some files and to transfer Model I programs. Would you please suggest some books that define in detail the Model III disk structure? Books such as TRS-80 Disk and Other Mysteries appear to be written for the Model I.

L.S.
Maple Glen, PA

The IJG book (IJG Inc., 1953 West 11th St., Upland, CA 91786) was written before there was a Model III on the market. Fortunately, most of the information about the directory in *TRS-80 Disk and Other Mysteries* also applies to the Model III, although there are differences. *The Alternate Source* had an article in issue 12 (Vol. II, No. 6) entitled "Reconstructing Model III TRSDOS Directory Entries" that details the differences between the Model I and Model III directories. The single issue is no longer available, but you can buy it bound with issues 7 to 12 in TAS Volume II for \$19.95.

Additional information on the general structure of Model III files can be found in an article entitled "Supercop" in issue 11 which is also included in the TAS Volume II.

I have two TRS-80 systems; System A is a 48K Model I with a single-density, single-sided 40-track drive, and system B is a 32K Model I with a single-density, single-sided 35-track disk drive.

For some reason, system B won't go to Basic. When I type Basic in at the DOS Ready prompt, Basic appears for a few seconds, and then either reboots or locks up. I've tried two 40-track DOSes and one 35-track DOS. Basic is stored on tracks below track 35, so the lack of the upper five tracks shouldn't cause any problems. What makes this confusing is that all my machine-language programs load properly.

I don't suspect the keyboard and interface because when I switch disk drives to the 40-track drive from the other system, Basic loads just fine. The Radio Shack repairman insists that nothing is wrong with the 35-track drive. What could be the problem?

R.G.
North Hollywood, CA

The first thing that occurs to me is: What stepping speed are you using with your DOSes? The 35-track drives sold by Radio Shack can't step as rapidly from track to track as most of the 40-track drives on the market.

I once had a similar problem with a friend's computer. My disk wouldn't go into Basic on his system, but worked fine with mine. I finally realized that my

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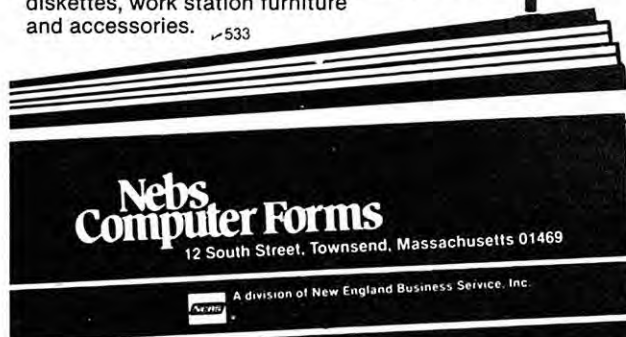
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DOS was using a track-to-track stepping time of 3 milliseconds, but his drives were slower and required a stepping speed of 12 ms. When my DOS was on his computer, it kept expecting data back from the drive before the drive could get it to the DOS. The result: Data Lost, Track not Found, and similar error messages. When I increased my DOS's stepping rate to 12 ms, the problem disappeared completely. Try this and let me know if it works.

I own an early TRS-80 Model I, Level II computer which won't execute the USR command. I've been told that this isn't an isolated incident. Does anyone have a way around this problem?

*T.M.
Rural Hall, NC*

I checked with my technical friends and none of them have ever heard of any problems with the USR function not working. The FC error means that the address you've given for the location of the machine-language routines location isn't where the machine-language routine is really located. You've either miscalculated the routine location (hexadecimal to decimal conversion error) or you haven't given the right Memory Size to protect the routine from Basic.

First, make sure that you're not using the Disk Basic command DEFUSR to tell Basic the location of your routine. It won't work in Level II Basic.

Second, make sure that you haven't reversed the numbers in the USR address. 16526 must contain the least significant byte (LSB) of the machine-language routine's address, and 16527

must contain the most significant byte (MSB) of the address. They must be POKEd into memory in that order.

And last, make sure your math conversion routines are giving you the correct addresses. If you have the decimal address, divide it by 256 to get the decimal value of the MSB. Throw away the portion that's to the right of the decimal place, and then convert that number to hexadecimal using the table in your Level II manual. Subtract the decimal MSB (multiplied by 256, of course) from the decimal address of the routine to get the decimal value of the LSB, and then look up the hexadecimal value. Now that you have the values in hexadecimal, work them backwards to get the decimal address you started with. Any difference means you've made an error and need to double check your math.

If you're interested, type in Program Listing I. It's a simple, quick, and dirty program for converting from decimal to hexadecimal and back again. Not very structured or elegant, but it'll do the job.

I have a Model I, 48K, three-disk drive system with double-density, lowercase modifications, and a Line Printer VII. I have a few problems that I can't seem to get anyone to answer.

First, when I run the RS MEMTEST, ROM A should return AE5D or AE60. Mine returns B078. ROM B should be either DA84 or DA45; mine is DA45. And ROM C should return 4002, 40BA, 3E3E, or 40ED. Mine returns 4006. Everything seems to be OK, but are these numbers correct?

Second, I can't get the 48K versions of Basic Programming Assistant by Instant Software and Packer by Cottage Software to load and run with TRSDOS 2.77D. When it loads, it checks to see if the lowercase modification is installed. If it is, it loads the lowercase driver, which apparently clobbers these programs. I don't know how to relocate, so do you know of a utility program that will help?

*O.L.
North Little Rock, AR*

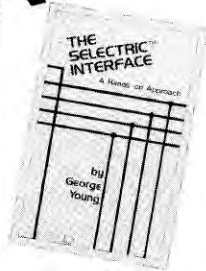
```
10 CLS: CLEAR500
20 PRINT: INPUT "HEXADECIMAL OR DECIMAL NUMBER (H/D) "; A$
30 IF A$="H" THEN 270
40 IF A$<>"D" THEN 20
50 INPUT "DECIMAL ADDRESS"; A$
60 IF A$="" OR VAL(A$)<1 OR VAL(A$)>65535 THEN 50
70 A=VAL(A$)
80 IF A<256 THEN A1=A : E=0 : M$="00" : GOT0150
90 D=INT(A/256)
100 IF D>16 THEN E=INT(D/16) ELSE E=0
110 F=D-E*16
120 X=E : GOSUB250 : M$=X$
130 X=F : GOSUB250 : M$=M$+X$
140 A1=A-D*256
150 IF A1>16 THEN B=INT(A1/16) ELSE B=0
160 C=A1-B*16
170 X=B : GOSUB250 : L$=X$
180 X=C : GOSUB250 : L$=L$+X$
190 PRINT "LSB = "; A1
200 PRINT "MSB = "; D
210 PRINT "HEXADECIMAL NUMBER = "; M$+L$
220 PRINT "LSB = "; L$
230 PRINT "MSB = "; M$
240 RUN20
250 IF X<10 THEN X$=CHR$(X+48): RETURN
260 X$=CHR$(X+55): RETURN
270 INPUT "HEXADECIMAL NUMBER"; A$
280 IF A$="" OR LEN(A$)>4 THEN 270
290 C=0 : FOR I=LEN(A$) TO 1 STEP -1
300 B$=MID$(A$, I, 1)
310 IF B$<"0" OR B$>"F" OR (B$>"9" AND B$<"A")
    THEN PRINT "ERROR IN HEXADECIMAL NUMBER": STOP
320 IF B$>"@" THEN A=ASC(B$)-55 ELSE A=VAL(B$)
330 IF A>0 THEN B=A*16[(LEN(A$)-I) ELSE B=0
340 C=C+B
350 NEXT
360 PRINT "DECIMAL EQUIVALENT = "C : RUN20
```

Program Listing

Your first problem is that you're using an old version of the RS MEMTEST program. The values you

Continues on p. 349

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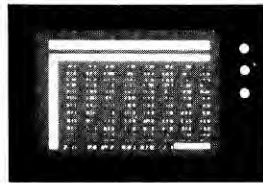
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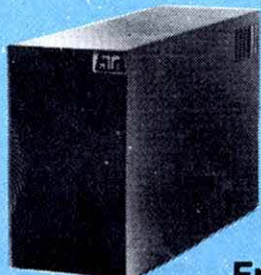
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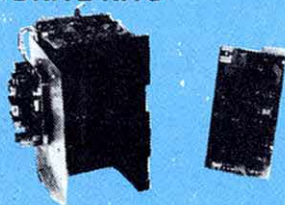
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Continued from p. 346

get are the correct ones for the revision A ROM, which powers up with Mem Size? instead of Memory Size?.

Your other problem is much more difficult. There isn't an easy way to relocate machine-language programs from one place to another, unless they've specifically been written to be relocatable. Some machine-language programs, when you load them, check to see what the highest available memory position is, taking care to respect `HIGH$` (the DOS equivalent of a Memory Size). Usually these programs are loaded last. Unfortunately, neither of your two programs falls into this category.

Is there anyone who has a modified version of these programs that'll work with TRSDOS 2.77's lowercase driver installed?

I have an unmodified Model I with two disk drives and an Epson MX-80 printer. Before buying Electric Pencil, I called IJG and asked if it supports lowercase on an unmodified Model I. They said that it would, except that lowercase wouldn't be displayed on the screen. If I hit shift zero, a different set of characters is displayed on the screen. Lowercase prints on the printer, but how can you write in this manner? I wrote to IJG, but haven't received an answer.

The Pencil manual states on page one that I must make the lowercase modification to take full advantage of Pencil (direct contradiction of what I was told). The manual also states that there's a coupon at the back of the book for a Teknopak kit I can install. No coupon at the back of the book. Strike two!

I looked up some back issues of 80 Micro, and installed the lowercase modification written by Dennis Kitz on the December 1981 issue on p. 46. I made the modification as per his instructions, but it doesn't work: no lowercase displayed, strange symbols on the video, and lowercase to the printer. In addition, I now find that some graphics displays are messed up. Should the modification I made print lowercase on the screen when driven by Pencil? And if not, is there one that will? Also, how can I reach Teknopak?

D.N.
Valparaiso, IN

Teknopak no longer sells the kit, but Progressive Electronics (537 E. Main St., Lancaster, OH 43130, 614-687-1019) is selling two versions of their kit. For those of you who've already made the modification but don't like the printed characters, you can buy the character generator chip alone for \$18.95. It displays true upper/lowercase characters with proper descenders and no displaced letters.

For those who want the entire kit, it's available for \$21.95 and contains the 2102 RAM chip, character generator chip, wire, and instructions for making the modification. The method Progressive uses is similar to the one used by Radio Shack: they jumper two wires, add the 2102 RAM to the video memory, and make one trace cut on the circuit board.

I talked with Dennis about the December issue modification. He has that modification in his own system, and uses Electric Pencil 2.0 as his word processor. He suggests that you carefully compare your work with the article instructions and check for solder bridges or cold solder joints that might not be connecting the wires properly.

I'd like to add a hex keypad, but the keyboard PCB already has the additional 12 key sockets wired in place which limits me to those 12 keys only. Do you have the part numbers for the switch set, caps set, and possibly the bezel?

My keyboard came from the factory with the following VCG chip installed in socket Z29: #SCM 37530 (AXX3027 or #8046673). From what I've read, this is the necessary character chip for the upper/lowercase modification. Is this right?

I'm also looking for a business program that's written specifically for an over-the-road trucker's accounting end of the business.

L.B.C.
Toledo, OH

Yes, you can buy the parts from National Parts (900 East Northside Drive, Fort Worth, TX 76102, 817-870-5662). The keyswitches (AS0992) cost \$1.04 each, as do the keycaps. When ordering, tell the operator if the keyswitch is for the ALPS or Hitex keyboard (Hitex

was the original keyboard, ALPS is the newer bounceless keyboard). There is no generic part number for the keycaps, you'll have to tell the operator the character you want. Installing all 12 switches costs you about \$24 plus your time and labor.

What might be easier and cheaper in the long run would be to buy a 19-key Hex keypad (#K-19) from Jameco Electronics (1355 Shoreway Road, Belmont, CA 94002, 415-592-8097, \$14.95), and install the keypad in parallel with your keyboard (see *80 Micro*, 80 Applications, September 1980, or *The Custom TRS-80* from IJG for details on this).

As far as my sources indicate, you have the correct chip. All you need to do is install the upper/lowercase modification and you'll be in business. See the previous letter for details.

Can anyone help L.B.C. with his business program need?

I have a cassette-based, 16K Model I Level II with RS lowercase modification, 16K Expansion Interface with buffered cable and a Line Printer VII.

When I turn the system on and start keying in a program, I sometimes notice that the text starts swaying back and forth, starting at the bottom and working its way to the top. At times it's mild, but other times the letters move over an entire position.

Is the problem with the video display or the video divider chain? I've also noticed that the video plug socket is loose, not the solder joints but the part that holds the pins from the DIN plug.

S.M.
Port Richey, FL

Your problem is caused by RFI from another source, not your computer. There's no real cure, unless you build a faraday cage around your computer (see the May 1983 column for more information). RFI is most commonly caused by light dimmers, fluorescent lights, neon lights, fading LEDs, and even motors (furnace, refrigerator, etc.) that are slightly out of specification.

The easiest way to track the RFI source down is to wait for it to manifest itself, then start turning off everything in the house. If you live in an apartment building, the trouble could be from someone else's faulty equipment. One

last word: your LPVII and keyboard both use an LED, but in these cases the trouble is almost always evident.

I've been doing a lot of work with the directory program of the TRS-80. I've found out how the password for a program is generated, but I would like to have a routine to decode the passwords. Can you help?

C.D.
Towson, MD

You don't say which computer system you're using. If it's a Model I, you're in luck: Instant Software (Peterborough, NH 03458, 603-924-9471) has a package called Disk Scope (#139) for the Model I disk-based computer containing a program that decodes the directory password for any program. It retails for \$24.95.

I don't know of any package that operates like that for the Model III. Can anyone help with a Model III directory password decoder?

I'm using my double-disk-drive Model III with a Daisy Wheel II printer for word processing, using Scripsit with Acorn's Superscript patch. To earn additional income, I'd like to get into electronic typesetting. Is there software that inserts Compugraphic typesetting codes into my files? Do you know of any printers in New York City willing to accept ASCII files via modem, and then insert their own printing codes?

I'd also like to know if there's software available that will permit Model III users to communicate with the Westlaw data base. Westlaw tells me that they'll serve only Model II users. I understand there are compactors that'll give me 80 characters on my screen. If so, will this permit me to use Westlaw?

L.K.
New York, NY

Yes, you can use the Model III to send ASCII files to typesetting services. There're two ways that this can be done. The first works with almost any word processor, but depends on the typesetting service's computer for success. When you contact the service, they'll supply you with a chart of control codes

that are simple character combinations (i.e., *B means boldface, *L means underline, etc.). You create your file just as you always do, using these codes in place of your word processor's print formatting codes. When the file is completed, save it in ASCII form and load a communications program. Then send the ASCII file to the typesetting service over the modem. As the file arrives at their computer, the computer uses a substitution table to replace the ASCII letter codes in your file with their corresponding typesetting control codes.

The other method requires a word processor, such as SuperScript, NewScript or LazyWriter, that can control codes in your file. When you contact the typesetting service, they'll give you a chart of typesetting codes used with their equipment. As you write your file, you put these codes directly into your file. When you're finished, save the file in ASCII format, load a communication program, and send the file to the service. When they receive it, they store it in their machines and print it out. Their equipment doesn't alter your file in any way.

Right off, I don't know of any companies in New York that offer this service, but more and more companies are joining this bandwagon so check the telephone book and make a few phone calls.

Finally, the "compactors," as you call them, are actually hardware boards that allow the video to display 80 characters by 24 lines. To use this capability, you must have the appropriate software to drive the hardware. TRSDOS and Basic can't do it. Most of these hardware boards are supplied with CP/M, which uses an 80 by 24 display and 64K of RAM. If you were to convert your Model III to CP/M capability, you should be able to use the Westlaw data base without difficulty since it won't recognize whether you're using a Model III or a Model II.

I purchased a 16K cassette-based Model III in August. Due to a lack of funds, I can't afford to upgrade to a disk system but I would like to go to 48K of memory. I don't want to send the machine out for a week, so please tell me how to do it myself.

K.V.
Mahopac, NY

It's no problem at all. You want to use 4116 RAM chips: the 200 nanosecond is fine, the 150 ns even better, and the 100 ns is best. Prices range from \$12.95 for a set of eight from mail order firms to almost \$32 if you buy them from Radio Shack (Radio Shack uses 250 ns memory). No other parts are needed.

Installing the chips is simple: unplug your computer and carefully remove the cover of your Model III (unscrew all the screws and lift the top off to the side). Locate the two rows of eight empty sockets on the circuit board. If you examine the board beneath the 16 empty sockets, you'll see that there are silkscreened outlines of the DIP packages. One end of each outline is marked with a notch. When you plug the memory chips in place, make sure that the notched end of each RAM chip lines up with the notch silkscreened on the circuit board. Be careful that you don't bend or fold any chip legs between the chip and the socket when you push each chip in place. The legs should position directly over the socket holes. If they're too far apart, gently roll the chip on a table top and bend the legs closer together. If they're too close together, gently pry them apart with a popsicle stick (avoid metal contact). If you're unsure of your abilities, get the Radio Shack inserter/extractor tool set (#276-1574, \$6.95).

After installing the chips, inspect the chips and sockets closely. Check for bent chip legs and chips that are reversed in direction from the other chips. As a general rule, all chips on a circuit board are oriented the same way (notches all facing the same direction). Notes of caution: Opening your computer case voids your 90-day warranty. DO NOT touch the legs of the RAM chips with your fingers. Handle them by their ends only!

Put the case back together (don't put the screws in yet), plug in your computer and turn it on. In response to the message PRINT MEM, you should get something on the order of 48K. If you don't, check the memory chips. It's possible, but unlikely, that a chip is bad the first time you use it. When you get the 48K installed, run an all-night memory test program on the machine. If you're going to have memory problems, 90 percent of them will show up in the first 48 hours.

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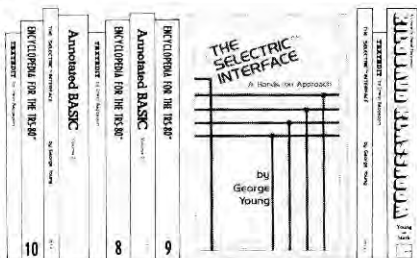
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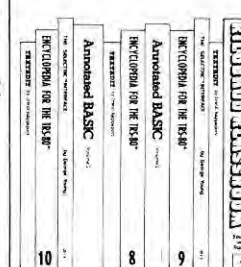
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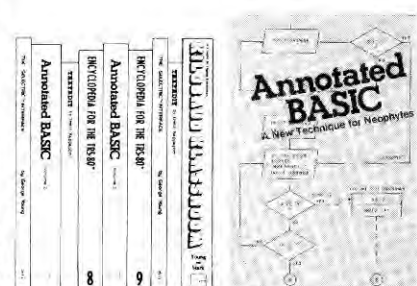
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My Model I works only at one's own risk. It's subject to disk reboots and syntax errors (which aren't there when the line is listed). The cable connectors have been cleaned.

I also have the same problem as D.S. of Austin, TX (February 1983, p. 406): My cassette tapes won't load. What do you suggest?

W.C.
Cary, NC

You don't mention the age of your computer or its Expansion Interface, so it's possible that your Expansion Interface is an earlier model that needs the buffered cable fixed or the MUX modification, or both. Both the reboot problem and the spurious syntax error result from the keyboard-to-Expansion Interface interface problem. Cleaning the contacts is the first step. If that fails, try lightly sanding the contacts with emery paper (unplug your computer, sand it, and then carefully and thoroughly clean the contacts after sanding). Check for a

tight fit on the cable when you're finished. If the connector is loose, you might have to add solder to the circuit board edge connectors by lightly resoldering them.

Now test the computer. Set a disk program in memory and, while it's running, wriggle the keyboard/Expansion Interface connector several times. If you still get reboots or syntax errors, get Gold-Plug 80 connectors to replace the tin-lead edge connectors you now have (EAP Company, Box 14, Keller, TX 76248, 817-498-4242, \$18.95 for the CPU/EI set of gold connectors).

If you have a tight fit on the connector, and the contacts have been thoroughly cleaned (and sanded if needed), the next choice is to check your RAM for defective bits. Several memory tests have been published in this magazine and many more are available on the market.

If you are still unsuccessful, take the computer to the RS computer center for a check. Explain the problem, tell the technician all that you have done to the

computer and have him run his diagnostic programs.

I just purchased an LNW system expansion interface. When connected to my TRS-80 it shorts out the CPU power supply. On my friend's newer TRS-80 I found pin 37 and pin 39 to be ground on the keyboard expansion port. On my computer, pin 37 is ground and pin 39 is +5V. I tried cutting the trace on pin 39 and putting a jumper in to make it ground, but now I get @ on the screen and no boot.

A.C.
Eules, TX

Your problem is the jumper. The trace to pin 39 has to be cut. Remove at least 1/8 inch of the trace to prevent problems. Remove the jumper, too, as it's not needed. Next, carefully check the CPU board-to-keyboard cable. It's possible, if you took apart your computer to cut the trace, that you also

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pulled loose a connector to the keyboard. When this cable fouls up, all kinds of strange problems result, including no disk drive response, spurious resets, memory changes, and other equally weird behavior.

If you intend to modify your computer more than once or twice, do what the RS technicians do: buy an extra CPU to EI cable (non-buffered), cut slots in the sides of the connectors deep enough to allow the connectors to fit over the edge of the CPU circuit board, remove the keyboard/CPU cable, and use your modified CPU/EI cable to connect the keyboard to the CPU. The circuit pin spacing is just right to match the cable. The next time you take apart your computer, unplug the keyboard from the CPU. It takes most of the worry out of working on the CPU board.

It seems EPSET won't work with LDOS, although it does work with TRSDOS, MULTIDOS, NEWDOS, and DOSPLUS. I'm a confirmed

LDOS user and therefore EPSET turned out to be a waste of money. Win some, lose some.

80 Micro reviewed the Doughflo program (February 1983, p. 64), and according to the article, Alphanetics is going to make the program available without backup protection. I'm going to see if I can return my original disk for "unlocking." I still think the Doughflo program is great, I just can't chance using it without being able to back it up.

*E.S.
York, ME*

As you said, win some, lose some.

I enjoy your column very much and I want to thank you for your kind words about my program Floppy Doctor. There are, however, a couple of things regarding the program you should be aware of.

There're two distinct versions, one for the Model I (\$24.95) and one for the Model III (\$29.95). The Model III ver-

sion is more expensive because it has enhanced capabilities including hard copy error reports and a formatting test, among other things. The Model I version won't work on Radio Shack's double-density adapter, but it is compatible with Percom-like doublers. There are two separate programs supplied on each disk: the disk-test program and the RAM test program. Neither version works on any other computer, nor will either work on anything other than 5¼-inch drives. However, I believe they're the most inexpensive and comprehensive diagnostics available for the Model I and III computers.

One last thing: I no longer handle direct sales of the programs. Please contact either Apparat (4401 S. Tamarac Parkway, Denver, CO 80237, 303-741-1778) or Meta Technologies (26111 Brush Ave., Euclid, OH 44132, 800-321-3552, 216-289-7500).

*D.S.
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Anyone who needs a comprehensive disk/RAM diagnostic package for their Model I or Model III computer, I suggest that you get The Floppy Doctor. You won't regret it.

I'm writing in response to N.K.'s letter in the December 1982 Feedback Loop (p. 440). She was interested in audio output from a Model I for word processing for a blind person. A unit that'll get her started is the Microvox, available as a kit from MicroMint (917 Midway, Woodmere, NY 11598, \$215 plus \$4 shipping). The unit is available ready-to-go for \$295 (plus \$4) as the Intex-talker from Intex Micro Systems (Suite 1717, 755 West Big Beaver Road, Troy, MI 48084). The unit is described in detail in the September and October 1982 issues of Byte.

The unit has both serial and parallel outputs. I haven't used the serial output, but the parallel output works fine. Just unplug the printer from its cable to the TRS-80 and attach the Microvox in-

stead. Anything sent to the printer port is now either spoken or spelled. This includes word processor outputs, LPRINTS, LLISTS, and so forth. N.K. must be prepared for some difficulty with the accent. It takes about an hour to get the hang of it (it's as rough as a strong West Indian accent). Nevertheless, it does read your material back to you, and has a good go at telling you what errors have been made, if you can get them to print. I use NEWDOS80, so a quick JKL will make the screen contents audible at any time.

For sighted users, Microvox isn't fast enough to be used for proofreading and the incomplete intonation control is tiring, but at \$295 it's a bargain and should certainly help N.K.

Incidentally, if N.K. can get hold of a speech recognizer, such as the Cognivox from Voicetek (\$149), she could arrange it so that certain commands from her would cause the computer to reply. This might be handy to find out whether the system is working or not. On my sys-

tem, calling Fred gets the response Yes?, and Help starts an emergency phone dialing procedure, with a spoken commentary on what's happening for reassurance. The Microvox output is good enough to read prerecorded messages into a telephone.

Finally, N.K. should be aware of the information put out by the Trace Center for the Severely Handicapped at the University of Wisconsin, Madison. They have all kinds of information on computer programs and hardware for the handicapped. They are intended for home construction and use, and are fairly priced. Communication Outlook is another excellent source and is published by the Artificial Language Laboratory, Computer Science Dept., Michigan State University, East Lansing, MI 48824.

M.B.
Pierrefonds, Quebec

Thanks for the good advice and information.

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I upgraded my Model I to include the RS double-density board and TRSDOS. I'm pleased with the increased disk storage capacity and the additional commands available, but there are three irritants in TRSDOS with which I'd like your help.

● How can I modify the boot program to go directly to the TRSDOS Ready prompt instead of having to answer the Date and Time prompts first?

● How can I modify Debug to allow it to display memory below 5400H?

● How can I modify the Copy command so that it copies single-density to double-density with a one-drive system?

D.C.V.
Scott AFB, IL

I'm sorry, but I don't know the patches that do what you want, especially the modification to the Copy command. I fear that that patch is very difficult.

What you should do, if you can af-

ford it, is to buy another DOS that has the capabilities you want. I know that MULTIDOS, NEWDOS80 and DOSPLUS will let you use the Radio Shack doubler, and they don't have the drawbacks you complained about. But this is a rather radical solution to your problem.

Does anyone have the patches to double-density TRSDOS that D.C.V. wants?

The advent of the TRS-80 Model 16 and other 16-bit computers makes number-crunching (i.e., the execution of large-scale engineering programs and partial differential equation formulations) on microcomputers cost-competitive with minicomputers; but only if floating-point hardware co-processors are readily available and integrated into existing 16-bit microcomputer designs.

Inquiries to Tandy relative to this application haven't produced any useful response. I'm curious to know if a floating-point hardware option is likely for

the Model 16 and if it's already available on other 68000-based microcomputers. Number-crunching micros will revolutionize heavy scientific computing to the extent that mainframe computer manufacturers should be worried.

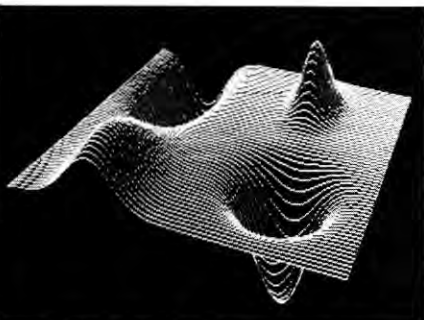
C.A.J.F.
New South Wales, Sydney, Australia

As far as I know, there isn't a floating-point co-processor board for the Model 16, although I've heard rumors that the boards are being developed for the 68000. Mainframe manufacturers are worried about microcomputers. Why else do you think IBM introduced a personal computer and DEC is opening retail stores all over the place? ■

Terry Kepner is a freelance writer and programmer, and the vice president of Interpro. He's been writing about microcomputers since 1979.

Surface Plot

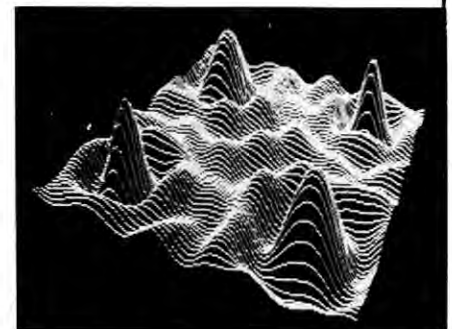
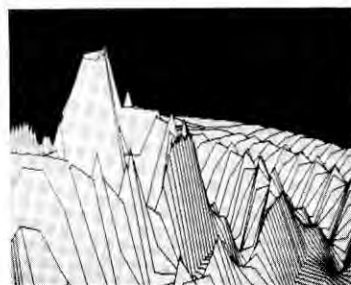
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Outstanding Grafyx. SURFACE PLOT lets you broaden your imagination by creating amazing three-dimensional views with Grafyx Solution. Micro-Labs' Grafyx Solution is a plug-in, clip-on board which gives you 98,304 points in a 512 x 192 matrix. That's sixteen times as many points as a standard Model III! Another unique feature is the ability to display the hi-res screen along with the normal text and low-res screen.

Flexible Grafyx. SURFACE PLOT allows you to enter an equation of the form $Z=F(X,Y)$ where Z is the height above the surface for a given X, Y coordinate. For example, entering the equation $Z=10-X^2$ draws a hill. The final picture can be viewed from any position in space so you can see an image from underneath, above, or even inside a hill or valley on the plot surface. You can also specify the size of the resulting image.

Complete Grafyx. The program automatically removes hidden lines for



best results. The documentation contains complete instructions and sample equations so that you will have your computer hard at work without delay. The finished plot can be saved on disk or printed on any of 20 popular printers.

The Grafyx Solution package is shipped from stock and includes the board, 44 programs including an 80-Column display driver and Extended Graphics Basic, and a 54 page manual all for \$299.95. The SURFACE PLOT program, twelve hi-res pictures, and manual is \$39.95. Shipping is FREE on pre-paid or COD orders. (Tx. residents add 5% sales tax.)

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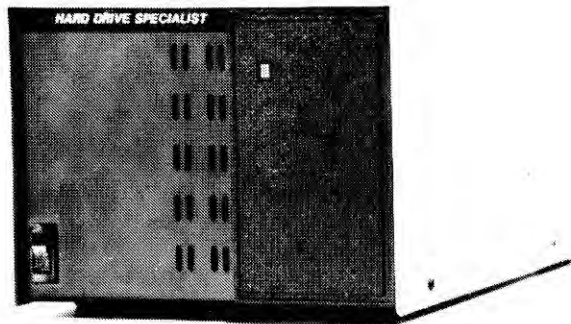
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Newbasic

Newbasic 2.0 is an enhancement that adds up to 40 commands to Model I/III Disk Basic.

Over 10 graphics commands combine the speed of Assembly language with the ease of Basic, even for animation. Additional commands handle sound generation, RS-232 initialization and input/output, definable keys, line labeling, string execution, using a Do/Until loop, and more.

The Newbasic disk is \$39.95 from Modular Software Associates, 209 18th St., Huntington Beach, CA 92648, 714-960-6668.

Reader Service ✓570

Upgraded Dot-Matrix

An enhanced version of Okidata's Microline 84 dot-matrix printer is now available. The Step 2 printer offers 200-cps bidirectional printing and a 50-cps correspondence mode with proportional spacing.

In addition, the unit is fully compatible with VisiCalc, WordStar, and other popular software packages, accepting them in correspondence mode with no modifications. Other improvements include select/deselect control, a Spanish character set, and

forward-feed super- and sub-script printing.

A Super Speed RS-232C interface provides switch-selectable transmission speeds of up to 19.2K baud and supports normal, correspondence, and graphics print data. Monitor and self-test modes provide diagnostic capabilities.

The Step 2 Microline 84 sells for \$1,495 (serial interface) or \$1,395 (parallel) from Okidata Corp., 111 Gaither Drive, Mt. Laurel, NJ 08054, 609-235-2600.

Reader Service ✓571

Screen Expander

The Screen Expander gives the 64K Color Computer a 51-by-24-character upper- and lowercase display for word processing, Extended Basic, and Assembly programs that use text displays. It includes an easy-to-use character editor and a PRINT@ command enhancement.

The program transfers ROMs to RAM and modifies them to use its high-resolution display. It does not affect any software, and is maintained even after re-setting.

Price is \$24.95 (cassette) or \$29.95 (disk), plus \$2 shipping and handling, from Computerware, Box 668,

4403 Manchester Ave., Encinitas, CA 92024, 619-436-3512.

Reader Service ✓561

L-Monitor

The L-Monitor is a tape-loading aid for the Model I that assures first-time program loads and precisely monitors program saves. It is attached between your micro and cassette recorder using standard 1/8-inch connectors (included), and is adjustable for individual computers.

An output for earphone, amplifier, or tape duplication is provided; instructions cover normal use of the L-Monitor as well as tips on tape head alignment and tonal balance.

An assembled and tested unit is \$23.50, and a kit \$17.50, from L-Monitor, 819 Kenyon Lane, Newark, DE 19711.

Reader Service ✓569

II/16 Telex Software

The SmarTelex package lets 64K Models II and 16 communicate with any telex terminal in the world. Its menu includes international (50 baud) and domestic telex, as well as the Easylink mailbox service and Autosafe store-and-forward.



Transtector SL

SmarTelex uses your word-processing program to create, delete, and edit messages. Telex utilities list all messages sent, to be sent, or received (with date and time). Other programs, such as a spreadsheet or accounting system, can be added to the main menu for no-reboot convenience.

The price is \$449.95 from Cappcomm Software Inc., 1 World Trade Center, Suite 1453, New York, NY 10048, 212-938-5702.

Reader Service ✓578

Rapid Transients

The Transtector SL surge protector fits between a three-pronged plug and a grounded 110-volt outlet to clean the powerline of over-voltage transients and spikes. The unit dissipates transients



Okidata Microline 84



L-Monitor



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80 Track SS	269
80 Track Dual Head	339
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8 inch Dual Head Thinline	499

MODEL III DRIVES

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SOFTWARE

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↪252

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Tasman Turtle and Apple II

within five nanoseconds or less, and has an instant reset for uninterrupted protection.

Available in black, blue, ivory, and beige, the SL measures 3 by 3 by 3 inches and carries a 90-day warranty. It sells for \$99 from Transtector Systems, E. 5250 Seltice Way, P.O. Box 1299, Post Falls, ID 83854, 800-635-2537.

Reader Service ↪577

Sentry, a high-security version designed for applications such as guard-force scheduling, is \$850. For more information, contact Key-1 Computer Systems, 178 Spring St., Newport, RI 02840, 401-849-4053.

Reader Service ↪574

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Sched:Planner is a Model III program that automates the process of creating and assigning weekly work schedules for large organizations. It also provides "what-if" analysis and forecasts alternate schedules, and can be used without computer experience.

The program handles up to 1,800 employees and up to nine separate schedules. Updating a weekly schedule for a worker takes less than a minute, with arrow keys and arcade-style graphics eliminating most typing. A composite schedule, automatically printed for each day of the week, displays a time line for each employee, showing when and at what assignment he or she will work.

Sched:Planner costs \$750;

The Australian Crawl

The Tasman Turtle, a programmable robot beneath a clear plastic shell, has crossed to America after wheeling around Australia since 1980.

Directed by any micro-computer with a parallel or RS-232 interface, the Turtle moves and turns, toots its horn, blinks its eyes, draws with a pen, and "feels" through touch sensors. A talking Turtle, with a vocabulary of 150 words (expandable to over 600) and a Yankee accent, is available at extra cost.

Prices start at \$999.95 from Harvard Associates Inc., 260 Beacon St., Somerville, MA 02143, 617-492-0660.

Reader Service ↪581

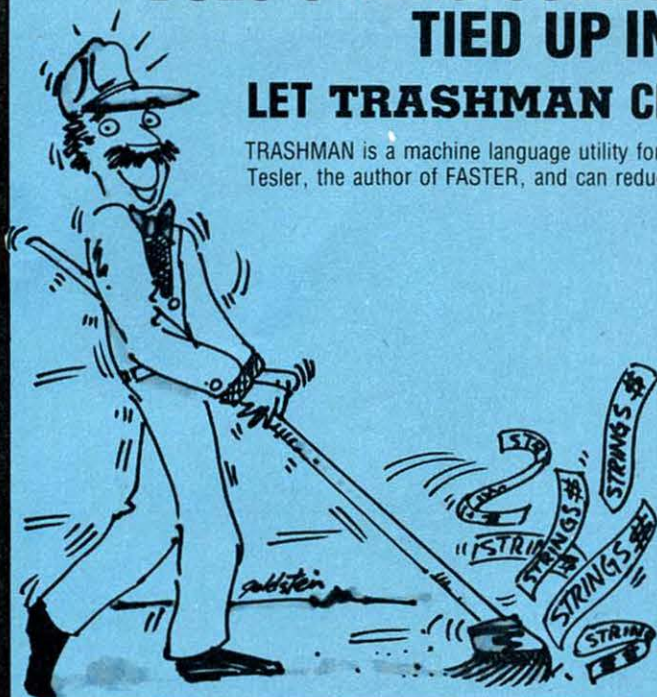
Help for LDOS

Users new to the LDOS operating system find that it lacks one important feature—

DOES STRING COMPRESSION HAVE YOU TIED UP IN KNOTS?

LET TRASHMAN CLEAN UP THE MESS!

TRASHMAN is a machine language utility for the TRS-80 Models I and III. It was written by Glenn Tesler, the author of FASTER, and can reduce BASIC's string compression time by 95% (see table below).



WHAT'S STRING COMPRESSION?

When a BASIC program changes a string (words, names, descriptions), it moves it to a new place in memory, and leaves a hole in the old place. Eventually, all available memory gets used up and BASIC has to push the strings together to free up some space. This takes time. Lots of time. The computer stops running for seconds or minutes, and you may even think it's "crashed". The keyboard won't work, and until all the strings have been collected, you just have to sit and wait. Then things run for a while, until string compression is needed again. And again.

If you're using your computer for business, that wastes your money. If you're using it personally, it wastes your time.

WHAT'S THE SOLUTION?

As soon as you start using TRASHMAN, those delays almost disappear. It uses less than 600 bytes of memory, plus 2 bytes for each active string. It works with other machine language programs and with all major operating systems. It's easy to use, comes with complete instructions, and can be copied to your own disks.

WHAT'S THE CATCH?

If a BASIC program uses only a few strings, very little time is wasted in string compression, and TRASHMAN won't be helpful. But, if hundreds of strings, including large string arrays, are used, TRASHMAN is just what you need.

TRASHMAN is available on disk for just \$39.95.

ATTENTION SOFTWARE PUBLISHERS:

Trashman may be licensed for use with your packages. Call for details.

# STRINGS	SECONDS DELAY NORMAL	SECONDS DELAY TRASHMAN	PERCENT IMPROVEMENT
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500	45.8	1.6	96.5
1000	179.6	3.5	98
2000	713.2	7.8	98.9

(All timings done on TRS-80 Model I. Model III 15% faster, but pct. improvements identical. Listing of timing program available on request.)

SAVE TIME WITH FASTER



"FASTER" speeds up most TRS-80 BASIC programs by 20-50%. It's helped hundreds of satisfied people and it can help you. Detailed instructions make it easy to use. FASTER analyses your BASIC programs while they run, then displays a simple change, usually one line, that sequences program variables so the ROM will find them faster.

You can use FASTER to speed up programs you've bought, as well as programs of your own. Since it isn't a compiler, your BASIC programs can be read and changed afterwards. FASTER works on business programs, models, and games. The more complex your program, the better the results.

Does FASTER really work? Yes! Just check the reviews in *Personal Computing*, May, 1981, p. 116: "FASTER is effective and easy to use"; *80 U.S. Journal*, April, 1982, p. 106: "I recommend FASTER to everyone"; and *80 MICRO* (April, 1982, p. 40): "If you...would like a significant increase in the run-time speed, then buy FASTER."

FASTER runs on the TRS-80 Models I and III, 16-48K tape or disk, and all major operating systems. **\$29.95**

"QUICK COMPRESS" takes only 276 bytes of memory, and removes the blanks and remarks from even the largest BASIC program in less than 3 seconds. It produces smaller, faster programs without altering their logic. **\$19.95**

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A complete course in assembly language.

This book is written for the beginner who has some knowledge of BASIC programming and wants to understand just how the Model III works. The book explains basic concepts of the computer, the Z-80 instruction set, complete Model III ROM and RAM information, and numerous practical programming examples, complete with programs you can type in and use for different purposes. Details of the Model III's disk controller, the TRSDOS 1.3 disk operating system, and RS-232-C interface are explained in detail.

The book contains a complete listing of Monitor #5, a comprehensive machine language monitor program including a disassembler, memory displays, memory search, compare and modify commands, disk and cassette input and output commands, RS-232-C commands, and a complete debugging package including the setting and displaying of registers, setting breakpoints, and single stepping through program instructions. MON-5 is also available in a Model 1 version.

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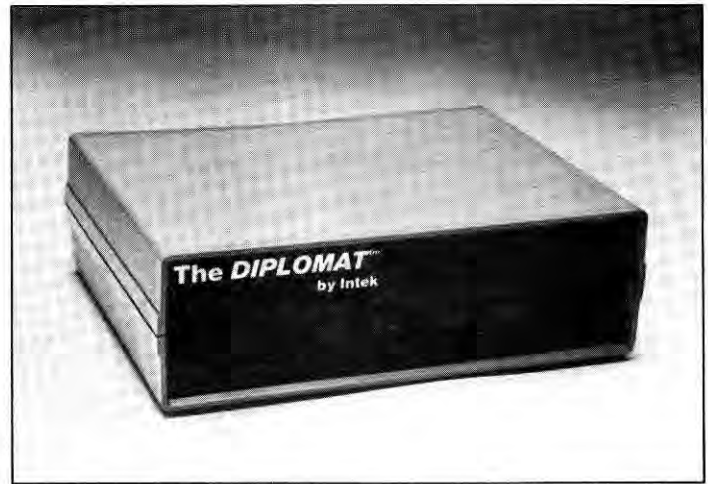
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Diplomat Switch Box

a Help command. The LDOS Help utility, written in machine language, provides assistance. It displays the command format, a list of parameters, and the relevant page number in the manual.

The utility can be called from LDOS Ready or from LBasic using CMD"HELP (command)". If no command is specified, a list of all the commands and utilities is displayed.

Help is available for \$19.95 plus \$1.50 shipping and handling from Vinzant and Associates, P.O. Box 174, Hobart, IN 46342 (Indiana residents add 5 percent sales tax).

Reader Service ✓567

The Diplomat

The Diplomat, an intelligent interface switch box, lets you connect four devices to your TRS-80. Possible combinations include several microcomputers accessing one printer, or one micro and a variety of peripherals, regardless of whether serial or parallel. Any input device can be connected to one or more output devices through either software or hardware switching.

Besides handling RS-232 and parallel interfaces, the Diplomat can drive a Qume or Diablo-style printer directly, as well as translate printer protocols. An intelligent 16K

RAM buffer (64K optional) divides its space among transmitting devices. Sixteen communication speeds, eight of which are switch-selectable, range from 50 to 19.2K baud.

The Diplomat measures 8.1 by 2.5 by 6.25 inches, and sells for \$595 or more (depending on memory and options). It is available from Intek Manufacturing Co., 780 Charcot Ave., San Jose, CA 95131, 408-946-9041.

Reader Service ✓558

Color Talk to Me

Color Talk to Me is a voice-recognition program that uses your cassette recorder's condenser microphone as an input port for the Color Computer. Over 200 words can be stored in a 16K machine, and the manufacturer claims recognition accuracy of 80 to 90 percent.

The two-cassette software package includes the machine-language Color Talk to Me subroutine, a Basic subroutine to merge voice input with your existing programs, and two application programs: Screen Painter, which paints the screen in one of the CoCo's nine colors when the color is spoken; and Voice Calc, which listens to spoken arithmetic problems and displays the solution.

The price is \$49.95 plus \$2 shipping and handling from

NEW PRODUCTS

ColorSoft Software Co.,
11764 Raintree Court, Utica,
MI 48087.

Reader Service ✓554

Model 16 Data Base

CCDS is a relational data base management system for the Model 16. Implemented in 68000 code, it uses menus and an English-subset query language. It supports single-access intelligent sequential, indexed sequential, hashed random, and pile files.

The program costs \$595 from Data Management Systems, 211 N. El Camino Real, Suite 101C, Encinitas, CA 92024, 619-942-0744.

Reader Service ✓557

Protect Your Disks

Info-Guard is a disk envelope that protects floppies during transportation and storage. It shields disks from distortion or erasure due to electrical storms, power-

generating equipment, airport security X-rays, or other electromagnetic interference.

An 8-inch envelope is \$14.50, and a 5¼-inch envelope costs \$9.50, from C-Line Products Inc., P.O. Box 1278, 1530 E. Birchwood, Des Plaines, IL 60018.

Reader Service ✓575

Android Attack

Android Attack is a machine-language action game for a joystick-equipped Color Computer. The player runs through an infinite number of room patterns, earning extra points for getting the crown in each room and leaving before time runs out, while firing at and dodging fire from angry androids. Further complications include ghost androids, mines, and suit protection; the game's graphics allow you to jump or duck and to fire at angles.

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Machine Language

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At last, a true Graphic Drawing program that permits the creation of graphic pictures on the screen storing them in one of 4 locations, and recalling them as needed for review.

The pictures can be saved to disk to be loaded into the micro works disk editor. The graphics are saved in Assembler format or Basic Data Statements, but details are provided for using the information in a BASIC program. Works on cassette or disk systems.
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Dennis Black ✓184

Info-Guard



Head Cleaning Kit

among 16 skill levels, with one to eight androids per room. Both 16K and 32K versions are included on the game cassette (\$21.95) or disk (\$25.95); the 32K version talks, with androids making such remarks as "Intruder alert" and "Human beware."

The game is sold by Spectral Associates, 141 Harvard Ave., Tacoma, WA 98466, 206-565-8483.

Reader Service ✓550

I/III Statistical Package

SPM (Statistical Package for Microcomputers) 2.2 is a versatile and flexible series of disk programs for the 48K Models I and III. According to the manufacturer, it supports features found in no other microcomputer statistical package, including non-linear regression, unequally sized groups for analysis of variance, and variables addition to multiple linear regression, complete with subcorrelation statistics.

The programs include descriptive statistics, one-way

frequency analysis, and XY plots, pie charts, and histograms for the printer. Two file utility programs, Edit and Filetran, provide sophisticated editing and data manipulation, such as adding, changing, or deleting variables or scores, application of up to 17 mathematical transformations nested up to 30 deep, and transferring files from one structure to another.

The SPM package is \$119.95, and individual programs are \$39.95, from A-Priori Software, 1005 W. Main St., Vermillion, SD 57069, 605-624-4214. Add \$5 for shipping and handling.

Reader Service ✓552

Clean Your Drives

Head Computer Products' disk drive cleaning kit includes two non-abrasive cleaning disks and a four-ounce bottle of cleaning solution. Running a cleaning disk in a drive for 30 seconds removes oxide deposits, smoke particles, and oil from the

drive head.

The \$7.50 kit lasts for 30 cleanings. It can be ordered from Head Computer Products Inc., 18533 Burbank Blvd., Tarzana, CA 91356, 213-342-9600.

Reader Service ✓553

Ready-Made Subroutines

Comsub is a collection of common subroutines for the 16K Model I/III Level II programmer. It serves as a skeleton of a program, to which you add applications-dependent routines, accessing the needed subroutines via GOSUB and a line number of over 1000. A five-second pause, for example, is called by setting a time variable (TM = 5) and coding GOSUB 1050, which accesses Comsub's pause routine.

The package's several dozen routines include tape I/O initialization and error handling, automatic lower-case shift, printer-ready check, printer column justification, full error message printout, Break and List enable/disable, and more.

The tape version (\$10) includes two 500-baud copies of Comsub; the disk version (\$15) is in Model I 35-track single-density format on a nonsystem disk. For more information, contact Practical Programs, 1104 Aspen Drive, Toms River, NJ 08753, 201-349-6070.

Reader Service ✓555

Cores-64

Cer-Comp (5566 Ricochet Ave., Las Vegas, NV 89110, 702-452-0632) has upgraded its Cores-9 editor/assembler package to fit 16K, 32K, or 64K Color Computers. The package leaves 3K, 19K, and over 52K of workspace on the machines respectively, and does not require a disk system.

The editor has over 25 commands, including string

search and replace, line or block move or copy, and automatic line editing. The assembler supports the full complement of the 6809 instruction set with all addressing modes, as well as standard assembler directives.

The standard Cores-9 tape is \$29.95; a Cores-64 upgrade for Cores-9 owners is \$14.95; and the enhanced Cores-64 tape is \$34.95. Add \$2.50 for shipping and handling.

Reader Service ✓556

II/16 Disk Status

The Stat utility for the Models II and 16 displays disk name, type, and free space and directory status information for disks in all four drives, with each drive shown in a separate column.

The program also checks to see that the system still uses the primary directory. This is the only way to determine whether the system has switched to the alternate directory.

The price is \$50 from Custom Software Services, P.O. Box 150, Porterville, CA 93258, 209-784-7966.

Reader Service ✓576

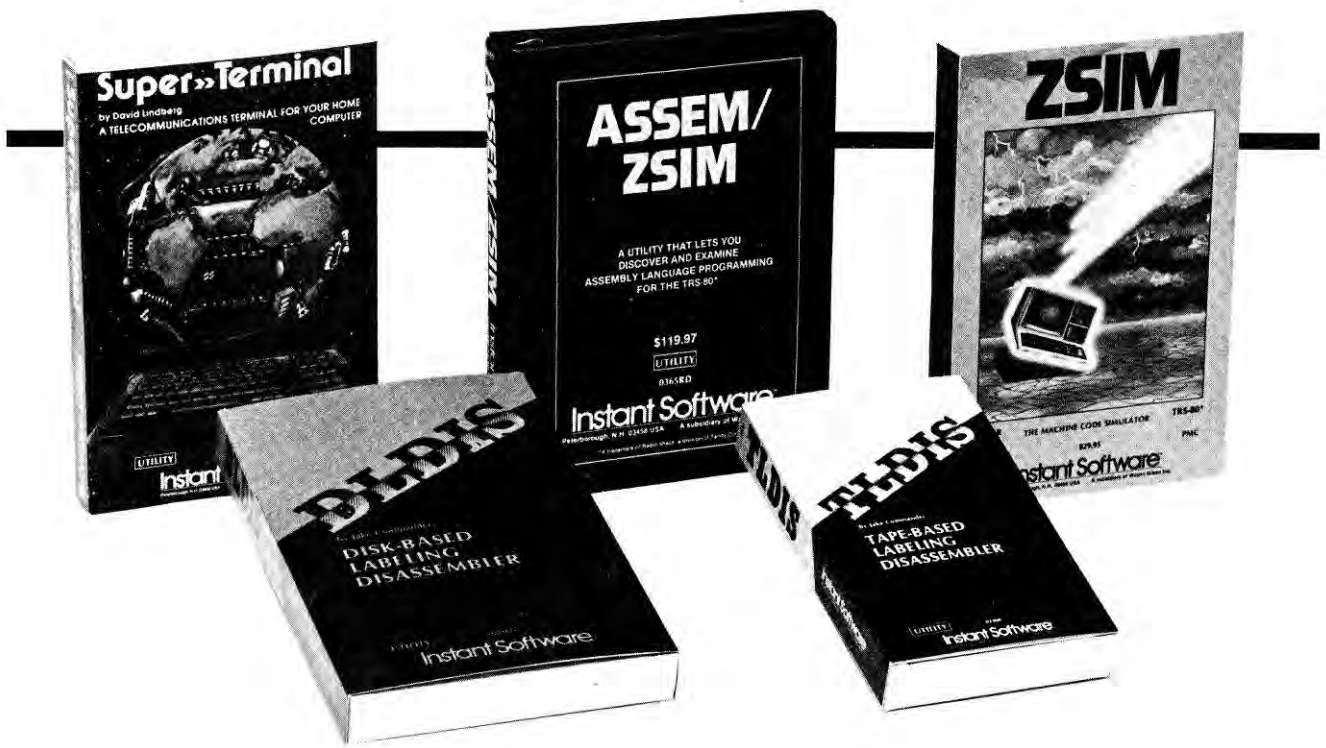
Two CoCo Keyboards

Two firms have introduced standard keyboards to replace what some consider the Color Computer's most serious deficiency.

Mark Data Products (24001 Alicia Parkway #226, Mission Viejo, CA 92691, 714-768-1551) offers the Super-Pro, a full-travel keyboard that retains the same layout and nomenclature as the original. The board costs \$69.95; a \$4.95 plug adapter is required for computers made after October 1982.

The WP keyboard from Spectrum Projects (93-15 86th Drive, Woodhaven, NY 11421, 212-441-2807) adds four user-definable function keys to the standard 53 keys

Continues on p. 368



EXPANDDDD

Utilities for your TRS-80* from Instant Software

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Debug larger, more complicated programs with this simulating, labeling debugger! Any debugger will enhance the usefulness of your assembler, but only ZSIM can make your programming tasks easier! ZSIM:

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ZSIM works on ROM as well as RAM since you don't need breakpoints to train execution control (although breakpoint operation is also available). This is the best tool available to examine your code in DETAIL! TRS-80 Tape Mod I 16K 0376R **\$29.95**

ASSEM/ZSIM

Assembly language programmers: solve all your programming problems from Assem to ZSIM! ASSEM, the 3-pass editor/assembler, uses little RAM; provides a powerful line editor, is compatible with any parallel-port printer; and executes w/out modification on 16, 32, or 48K systems, w/1, 2, 3, or 4 disk drives! And ZSIM, the machine code simulator/debugger, emulates instructions using simulated registers; displays mnemonics for each instruction using ASSEM's symbol table; works as well in ROM as in RAM! Assemble directly to disk, tape or

memory—directly from disk, tape or memory! Trace program execution through ROM to debug larger, more complicated programs with speed and accuracy!

TRS-80 Disk Mod I 32K 0365RD **\$119.97**

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The disk-based disassembler that automatically assigns labels to machine language program routines. Send the disassembly to your printer or save it on tape for editing and reassembly using Apparat's extension of EDTASM.

TRS-80 Disk Mod I 32K 0231RD **\$24.95**

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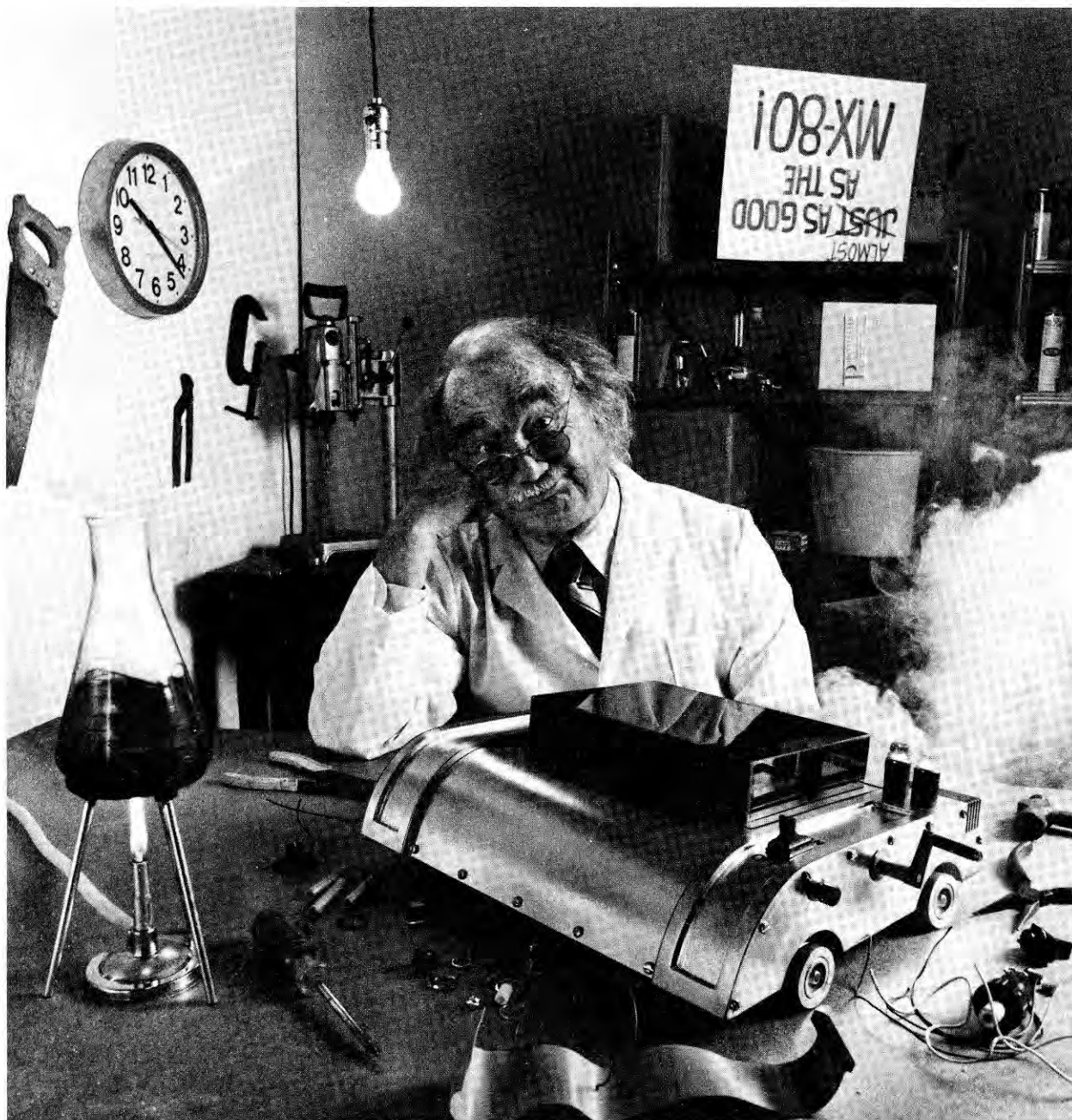
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The Epson MX-80 is the best-selling dot matrix impact printer in the world. It has been since its introduction. And despite the host of imitators it spawned, no one has been able to top it. Until now.

FX-80: Son of a legend.

The new Epson FX-80 is far more than just doo-dads added on to last year's model. It's the most astonishing collection of features ever assembled in a personal printer.

For starters, it's fast: 160 CPS. And clean. All the print quality Epson is famous for in a tack-sharp 9x9 matrix.

But that hardly scratches the surface.

Create your own alphabet.

With the new FX-80, you aren't limited to ASCII characters. You can create your own. Any character or symbol that can be defined in a 9x11 matrix can be added to the FX-80's already impressive library of type styles and stored in its integral 2K RAM.

So you can create "Sally's Gothic" or "Tom's Roman" just by downloading and modifying standard characters. Or you can create a custom set from scratch. Either way, you can store up to 256 new characters. And if you don't need a new alphabet, the RAM functions as a 2K data input buffer.

Who knows graphics better than Epson?

Nobody, that's who. And if you don't believe it, witness the FX-80.

With a 12K ROM capacity, the FX-80 gives you a few things the others don't. For example, not one, not two, but *seven* different dot addressable graphic modes are program

selectable. And can be mixed in the same print line. Everything from 72 DPI (dots-per-inch) Plotter Graphics to the 640 dots per line resolution designed to match the remarkable monitor clarity of the Epson QX-10 personal computer.

And *that* is in addition to an astonishing array of 136 different user-selectable type styles including Proportional, Elite and Italic as well as the more conventional faces you get on other printers.

Hard-to-beat hardware.

The FX-80 has all the hardware features you've come to know and love on the MX Series: logic seeking, bidirectional printing, the by-now-famous disposable printhead, and more.

The FX-80 features an adjustable pin platen or optional friction/tractor feed, so you can use fanfold, roll or sheet paper ... backwards or forwards. The FX-80 even gives you reverse paper feed.

And if you're printing forms, the FX-80 has a feature you're gonna love: a function that allows you to tear off the paper within one inch of the last print position.

Be the first on your block.

We'd be willing to bet that the FX-80 — like the MX-80 — will have its share of imitators. Don't be fooled. To make sure you get the genuine article, rush down to your local computer store right now and let them show you everything the FX-80 can do.

And while you're there ... ask them to show you how it works with our computers.



✓97

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✓ 486



Which TRS-80* Accounting Software Do I Buy . . .

That's a tough question. I know, I asked it myself not very long ago. I'm Mike Motta. As president of Shawmut Systems, specialists in TRS-80* custom software, my customers were asking me for Model II and 16 Accounting Software — GL, AR, AP and Payroll. But I said "Why write the software. There must be a good package already available." So I searched for the best I could find. And I found it!

Now, when I tell you that these are the best Accounting programs I've seen on a microcomputer, you probably think that you are just listening to another sales pitch. But you're not. You're listening to a businessman with over twenty years combined experience in sales, management, and programming. So when I say that these programs will work for you, it really means something.

Each program, designed for the Model II or 16, will work with one or more floppy or hard disks. With each program, I'll include a 200 page manual written with the first time user in mind, and a set of sample data files so you can start using the program right away.

But I won't stop there. If you have a question, or a problem, call me. You won't get an operator, or order taker. You'll get me. And if I can't talk to you on the spot, I'll call you back. And I'll fix your problem. FAST.

Now I could say a lot more about these programs, but you really won't know how good they are until you try them. So, order the programs you need, and try them for 14 days. If you're not convinced that these are the programs for you, send them back, and I'll refund your money.

My price for these programs is only \$289.00 each, postpaid. I could charge hundreds more, but I want you to have the best programs at the best possible price. So mail or call your order in today. I'll make sure you'll be satisfied.

Model II/16 Accounting Software Packages

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Mass. residents add 5% sales tax.

✓ 363

Continued from p. 364

in QWERTY layout. Its price is \$99.95.

Reader Service ✓ 565, 566

English Aid

Teachers' Friend, a series of educational programs for the Models I/III, teaches English as a second language to students who can read English at a second-grade level.

The 80 programs serve as a freestanding independent curriculum, but need not be followed sequentially. Each lesson teaches an English skill such as spelling, punctuation, parts of speech, syntax, or verb tenses. A lesson takes 10 to 15 minutes to complete, and each is geared to the student's rate of progress.

The lessons use six question formats, in personal and natural language. Students do not need microcomputer proficiency or typing skills.

Each Model I disk contains two lessons; each Model III disk, four. The price is \$15 per lesson from The Soft Spot Ltd., 800 E. Arapaho, Suite 110, Richardson, TX 75081, 214-669-1779.

Reader Service ✓ 560

Color Market Analysis

Fundgraf is an investment analysis program for the 16K Extended Basic Color Computer. It allows graphics and/or numerical comparisons for any stock or fund for any period, and gives buy and sell signals based on the calculated moving average.

In addition, the program displays graphs of prices and annual growth rates, tabulates the change in price (adjusted for dividends) for any time period, and lets you compare funds by superimposing one graph on top of another.

The tape version (\$49.95) supports files for seven funds or stocks and plots data for up to 70 weeks. For a greater number of stocks, simply

make another file tape.

The disk version (\$69.95) supports up to 52 funds and 200-week plots. A weekly file update requires about 10 and 15 minutes respectively.

Both are supplied with sample data for the Dow Jones Industrial Average and several mutual funds, and are available from Parsons Software, 118 Woodshire Drive, Parkersburg, WV 26101, 304-424-5191. Add \$2 for postage and handling.

Reader Service ✓ 562

Faster Cassette I/O

Leader Lopper, a utility for the Model I, reduces cassette input/output time by up to 80 percent, with average savings of approximately 55 percent, according to the manufacturer. It requires just 17 bytes of run-time memory, is totally invisible to your programs, and requires no hardware or software modifications.

The program sells for \$10.95 from Kensoft, 2102-50th St., Kenosha, WI 53140, 414-654-2722.

Reader Service ✓ 568

Economical Modem

The Comstar Research modem operates at up to 300 baud half-duplex (send and receive). It communicates in the originate mode, so you can talk to host systems.

The modem uses the Model I cassette port, needing no expansion interface or RS-232. Model III and Color Computer versions are forthcoming.

With software included, it sells for \$99.95 from Comstar Research, P.O. Box 771, Madison Heights, MI 48071, 313-541-4840.

Reader Service ✓ 584

Pocket Spreadsheet

Super SST is the first spreadsheet program for the Pocket Computer that uses machine-language routines

for fast operation. A typical 10- by 14-cell matrix can be analyzed in as little as 10 seconds; dozens of "what-if" projections can be made within five minutes.

The program is available on tape for the PC-2 Pocket Computer with 8K memory expansion module. A CE-150 or equivalent printer/cassette interface is required.

The price is \$49.95 (\$59.95 U.S. in Canada and Mexico, \$69.95 U.S. elsewhere) from *The Pocket Computer Newsletter*, P.O. Box 232, Seymour, CT 06483, 203-888-1946.

Reader Service ✓573

Pictures from VisiCalc

Datagraph transforms VisiCalc data into high-resolution scatter, line, or bar graphs. It accepts 1,000 data points and plots multiple data sets per graph, using custom symbols and line shapes.

The program plots data stored by VisiCalc or the user's own program using the DIF format. It features auto scaling, grid selection, text label entries, and selectable graph sizes from one square inch to 7 by 24 inches.

Datagraph (\$79.95) is available for the 48K Models I and III with Epson, NEC, C. Itoh, IDS, Okidata, or Radio Shack VIII/DMP-200 printers. A Colorplot version for the IDS Prism is \$89.95.

For more information, contact Micro Software Systems, 1815 Smokewood Ave., Fullerton, CA 92631, 714-526-8435.

Reader Service ✓564

Armdroid I

The Armdroid I, a robot arm for educational and hobby use, is available from Colne Robotics. The arm has five axes of rotation (base, shoulder, elbow, wrist up, wrist down, and wrist rotate) and a three-finger gripper; it lifts up to 10 ounces, has a gripping force of five

pounds, a 17-inch reach, and a resolution of 0.15 inches.

The firm plans to introduce accessories such as vision and tactile sensors for improved control. The Armdroid interfaces to a latched 8-bit parallel port. It sells for \$745 in kit form and \$895 complete. Software for the Models I and III (and other micros) is available at extra cost.

For more information, contact Colne Robotics Inc., P.O. Box 23416, Fort Lauderdale, FL 33307, 305-566-3101.

Reader Service ✓551

I/III Communications System

Ultra Term is a versatile, easy-to-use communications program for the Model I or III with any TRSDOS-compatible operating system. It features an intelligent terminal program, a self-relocating host program, and hex conversion utilities for bulletin-board downloading. The package supports any manual or auto-dial modem that accepts commands through the RS-232 port or by pulses on the RTS line or cassette relay.

A direct-to-disk file transfer allows full control from the transmitting computer, and unattended operation at the receiving end. The terminal mode's split-screen feature lets you type outgoing messages on the bottom half of the screen while incoming messages appear on the top.

The system supports both half and full duplex, lets you use printers on systems that don't send nulls after carriage returns, and allows up to a 33K input/output buffer for universal-format ASCII file transmission.

It sells for \$59.95 from United Software Associates, 734 Flamingo Way, North Palm Beach, FL 33408, 305-965-3496.

Reader Service ✓579

CAT CALLS



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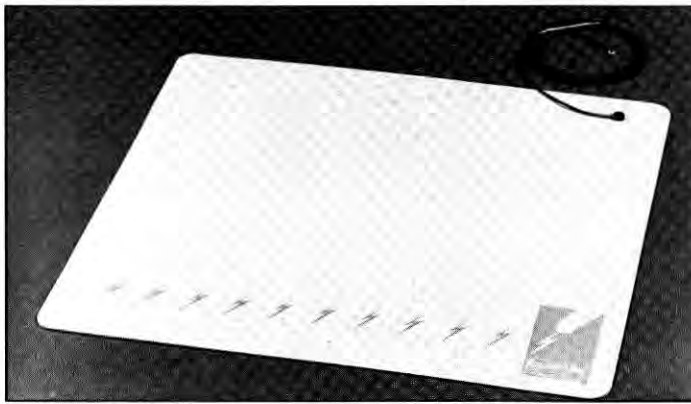
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FCC Registration Number: A909KE-68171-DM-N.



TouchMat

Flat Anti-Stat Mat

Even when you don't see or feel a spark, you may be carrying static electricity that can damage your computer. TouchMat, a three-layer static dissipative mat, lies beneath the computer, safely draining electricity via a grounding cord. Any time your hands or wrists rest on the mat, discharge is automatic.

Besides deterring static, TouchMat's cushioning material dampens noise and vibration and keeps the computer from sliding on the desktop. It is available in beige or medium brown, in 18-by-26-inch or 24-by-26-inch sizes.

Price is \$89 from Computerware Inc., 315 S. Third St., Stillwater, MN 55082, 800-328-0223 or 612-430-2060.

Reader Service ✓580

EPROM Programmer

Boulder Logical Testing Inc. (P.O. Box 902, Boulder, CO 80306) has an EPROM programmer available for under \$200 less cabling and connectors.

The programmer handles the 2716, 2732, 2732A, and 2532 EPROMs, and runs at any of four baud rates through the RS-232 port (110, 300, 1,200 and 9,600 baud). Its instruction set converts ASCII hexadecimal numbers to binary values internally; instructions include list, program, change byte,

verify, and dup.

The unit comes assembled and tested, with its own power supply. Specifications for cabling and software interface are included.

Reader Service ✓583

New Cassette Software

A new line of software for non-disk Models I, III, and Color Computers is available from Futureview Inc.

Their business programs, such as Check Systems (\$24.95), Electric Bookkeeper (\$49.95), and Sales/Inventory (\$49.95), feature a machine-language speed sort routine. They handle data in RAM, storing information to cassette only at the end of the work period.

Other programs range from a computer typing course (\$19.95) to arcade-style games like Giant Space Slug and Wormhole (\$19.95 each). For a catalog, send a stamped, self-addressed envelope to Futureview Inc., P.O. Box 101, Joplin, MO 64802; phone orders can be placed at 417-781-6999.

Reader Service ✓563

CoCo Voice Hardware

Unlike software speech programs that use the computer as a makeshift synthesizer, the Color Computer Voice is built around a large-scale integrated circuit, the Votrax SC-01. It reproduces any of 64 phonemes in four inflections.

Speech is channeled through the user's TV speaker or an external speaker connected to the built-in audio amplifier. A phono connector and volume control are provided.

The Voice is completely memory-decoded, so it does not conflict with the Radio Shack disk controller. Disk owners with an expansion in-

terface produce speech with the Voice in one slot and the controller in another.

Assembled, tested, and supplied with software and manual, the Voice costs \$179.95 from Speech Systems, 38 W. 255 Deerpath Road, Batavia, IL 60510, 312-879-6880.

Reader Service ✓582

DIFFERENT TRACK



Allied Micro-Pak

SCM Allied Paper, a division of SCM Corp. (the Smith-Corona people), wins this month's New Products spotlight with a bold debut in "the consumables segment of the micro aftermarket"—in other words, printer paper.

Current projections put this market at \$36 billion in eight years, says SCM, a large part of that involving the home or small-business user. Until now, such users had to purchase and store continuous forms in huge quantities. SCM's innovation is the Micro-Pak—an easy-to-handle, plastic-wrapped ream, compared to the less convenient and affordable carton.

Forms available in Micro-Paks include two- and four-part carbonless blank forms; bar forms in bond, two- and four-part carbonless sets; and letterhead-quality white bond with clean perforations for a smooth edge. They are available at office supply and stationery stores, or from SCM Allied Paper, Business Forms Division, P.O. Box 125, W. Carrollton Branch, Dayton, OH 45449, 513-866-7421.

Reader Service ✓572

New Products listings are based on information supplied in manufacturers' press releases. 80 Micro has not tested or reviewed these products and cannot guarantee any claims.

YOU WILL NEVER AGAIN HAVE TO WASTE TIME WAITING FOR YOUR PRINTER.

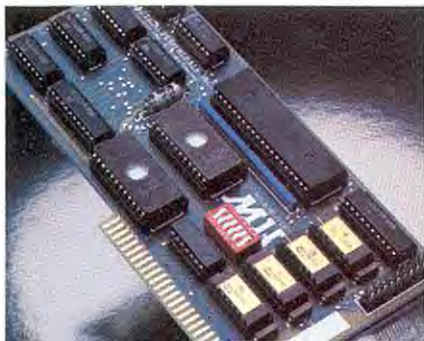
MICROBUFFER ALLOWS YOU TO PRINT AND PROCESS SIMULTANEOUSLY.

Microbuffer will instantly increase your efficiency — and eliminate the frustration of waiting for your slowpoke printer.

Now you can simply dump your printing data directly to Microbuffer and *continue processing*. Microbuffer accepts the data as fast as your computer can send. It stores the data in its own memory buffer, then takes control of your printer.

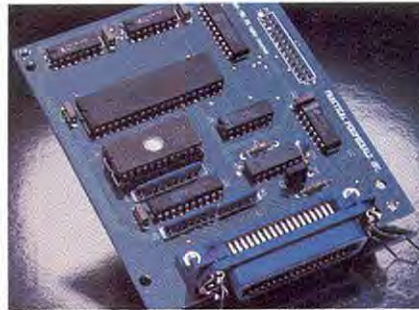
THERE IS A MICROBUFFER FOR ANY COMPUTER/PRINTER COMBINATION.

Whatever your system, there is a specific Microbuffer designed to accommodate it.



FOR APPLE II COMPUTERS, Microbuffer II features on-board firmware for text formatting and advanced graphics dump routines. Both serial and parallel versions

have a power-efficient low-consumption design. Special functions include Basic listing formatter, self-test, buffer zap, and transparent and maintain modes. The 16K model is priced at \$259 and the 32K, at \$299.



FOR EPSON PRINTERS, Microbuffer/E comes in two serial versions — 8K or 16K (upgradable to 32K) — and two parallel versions — 16K or 32K (upgradable to 64K). The serial buffer supports both hardware handshaking and XON-XOFF software handshaking at baud rates up to 19,200. Both interfaces are compatible with standard Epson commands, including GRAFTRAX-80 and GRAFTRAX-80+. Prices range from \$159 to \$279.



ALL OTHER COMPUTER/PRINTER COMBINATIONS are served by the stand-alone Microbuffer In-line.

The serial stand-alone will support different input and output baud rates and different handshake protocol. Both serial and parallel versions are available in a 32K model at \$299 or 64K for \$349. Either can be user-upgraded to a total of 256K with 64K add-ons — just \$179 each.

SIMPLE TO INSTALL.

Microbuffer II is slot-independent. It slips directly inside the Apple II in any slot except zero.

Microbuffer/E mounts easily inside the existing auxiliary slot directly inside the Epson printer.

The stand-alone Microbuffer is installed in-line between virtually any computer and any printer.

MICROBUFFER FROM PRACTICAL PERIPHERALS.

So what are you waiting for? Write to us for more information or ask your dealer for a demonstration.

When you see how much freedom Microbuffer will allow, you'll understand why it's so silly to be without one.

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Open your doors to a world of SOFTWARE with LNW computers. You'll get **MORE PERFORMANCE**¹ than with the IBM PC², the Apple II³, TRS80 MODEL II or TRS80 MODEL III⁴ along with software support of TRSDOS or CP/M, the TWO MOST WIDELY USED OPERATING SYSTEMS. This means you, the user, can select from the largest base of business or personal software.

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Standard Software: LNW BASIC and DOS PLUS operating system packages, commanding all the above features, are included.

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*TRSDOS is a trademark of Tandy Corp.

**CP/M is a trademark of Digital Research Corp.

1. Performance is based on bench mark test in the JAN 1982 issue of BYTE magazine, pg. 54, with LNW80 II as the comparison.

2. IBM PC is a trademark of IBM CORP.

3. APPLE II is a trademark of APPLE COMPUTERS.

4. TRS80 is a trademark of Tandy Corp.