January 1981
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80 microcomputing™

the magazine for TRS-80 users*

CRAYON COLOR YOUR 80!

Color Graphics Issue

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Inside Reports:
- ☐ Percom Data's Electric Crayon
- ☐ Tandy's Newest Color Computer

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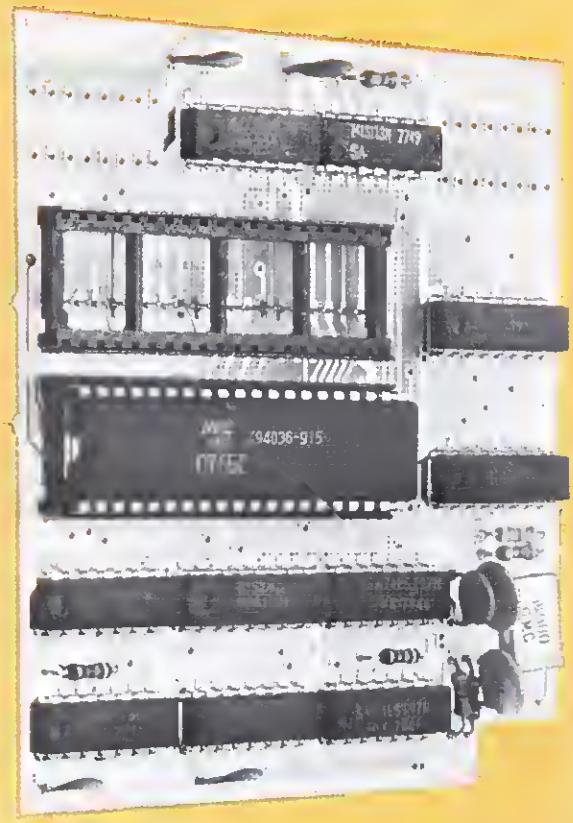

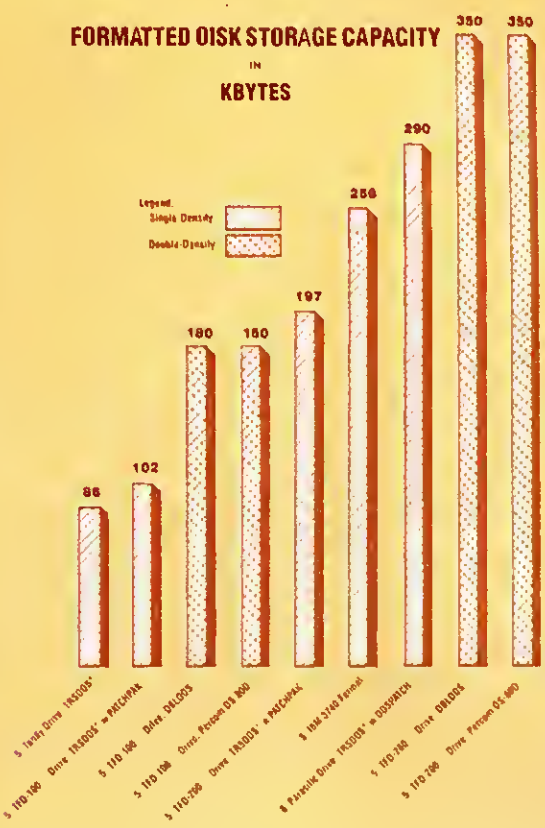

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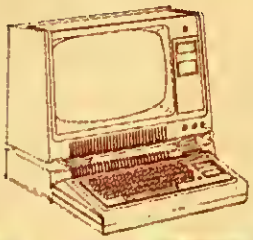
TRS-80* Model I Computer Owners . . .



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Each DOUBLER also includes an on-card high-performance *data separator circuit* which ensures reliable disk read operation.

The DOUBLER works with standard 35-, 40-, 77- and 80-track drives rated for double-density operation.

Note. Opening the Expansion Interface to install the DOUBLER may void Tandy's limited 90-day warranty.

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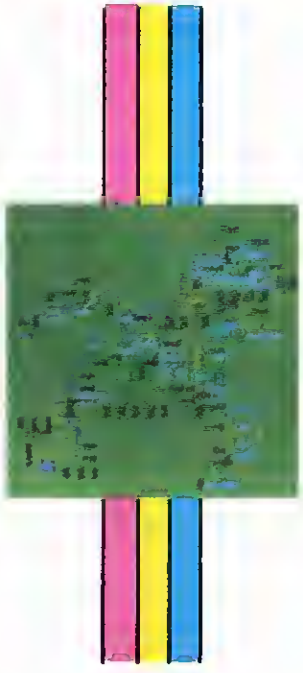
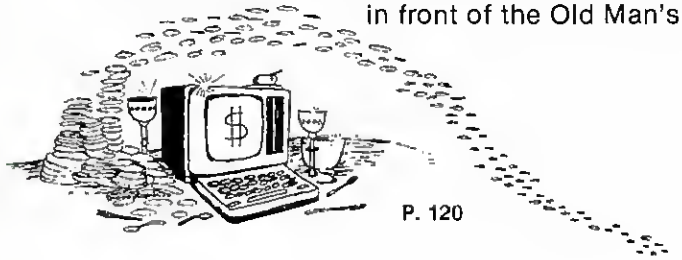


Color Graphics Issue!



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COMING NEXT MONTH

Special Education Issue

On the heels of Tandy's venture into the education market, 80 will take a look at a school computer lab in Westwood, MA that's been running for 13 years!

We'll be featuring an article—the start of a series—on writing programs for the education market.

Plus a special review section of Tandy's learning manuals.

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80 REMARKS
by Wayne Green

"I departed China without a lot of enthusiasm for the future of microcomputers there."

China

With about one billion people, China makes an attractive target for future sales of almost anything. Why not microcomputers? In October I visited China to see how viable such an idea was and what time frame might be involved. I must say, I departed China without a lot of enthusiasm for the future of microcomputers there. It's going to be a *long* time.

There are two major problems involved, both of which are discouraging.

First there is the progress the country has made in getting into the modern world. To be blunt: It hasn't. The management of the country has kept it in many ways about a hundred years behind the more advanced nations of the world. In a country where, as far as the average person is concerned, the transistor radio has yet to be invented, and where the individuality of a person is expressed by an occasional odd-colored bicycle seat, there is much to be overcome both in adapting to progress and making tools (such as computers) available.

The other problem is a serious one and, since it also affects countries using the Chinese language such as Taiwan, Hong Kong and Singapore, begs for resolution. The Chinese language is basically incompatible with computers. Japan has coped with this problem by using a subset of their language, *Kata Kana*, which is usable on microcomputers. Korean is a 22-character phonetic language and thus easily adapted to computers. Chinese requires typing and displaying thousands of characters and is a mess to computerize.

The 580-key keyboard (Photo 1) is one approach to tackling the Chinese language with the computer. You don't learn to use this keyboard with any speed in a day or two. This isn't much more difficult to handle than the average Chinese typewriter, but that isn't saying much.

When we look closer at the keys (Photo 2) we see that each one of them has nine different characters which can be used—including the English alphabet and some graphics. Thus with over 500 keys the keyboard can provide several thousand Chinese characters.

Another approach similar to the one they use with their typewriters, is the grid system (Photo 3), where the character is chosen by pressure on a small square with the Chinese character in it. This is a slow system. Additional characters can be generated by combining the components of several together before finishing a character.

By building Chinese characters one component at a time (Photo 4), most characters can be put together with about four key strokes. Some systems use up to seven strokes and thus are more flexible. Once an operator gets used to the system his output is about 60 characters per minute. This is nearly equivalent to 60 words per minute in English since Chinese characters can represent a word, part of a word or a group of words.

The Chinese have shown little interest in abandoning their language and seem determined to somehow adapt computers to the language rather than the reverse. Obviously the enormous keyboard approach is not compatible with microcomputer costs, so microcomputer firms are keeping an eye on the attempts at synthesizing characters with relatively simple keyboards as the only practical approach. It may work.

The Asian Tour

In the June issue of *80* I mentioned that there would be an October tour of four consumer electronic shows in Asia. The tour started with a visit to a computer show in Tokyo, then went to Seoul for their consumer electronics show. From there we returned to Tokyo for another consumer electronics show, then to Taipei and finally to Hong Kong. After visiting Hong Kong the group split up. Some went to

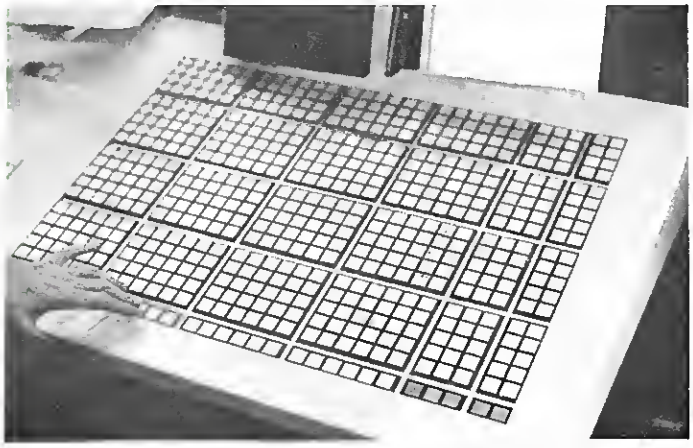

Photo 1. 580-Key Chinese Keyboard

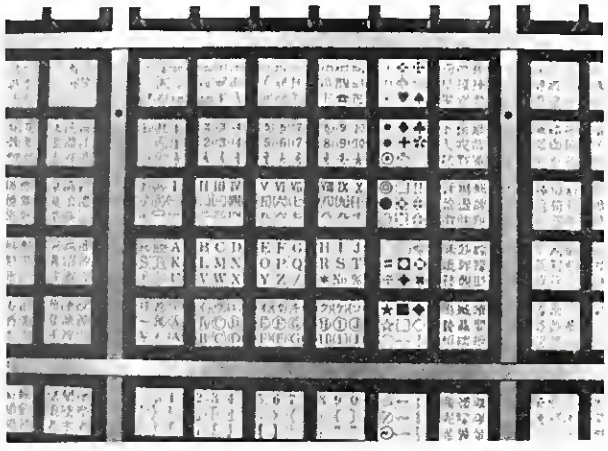

Photo 2. Close up of 580-Key Keyboard

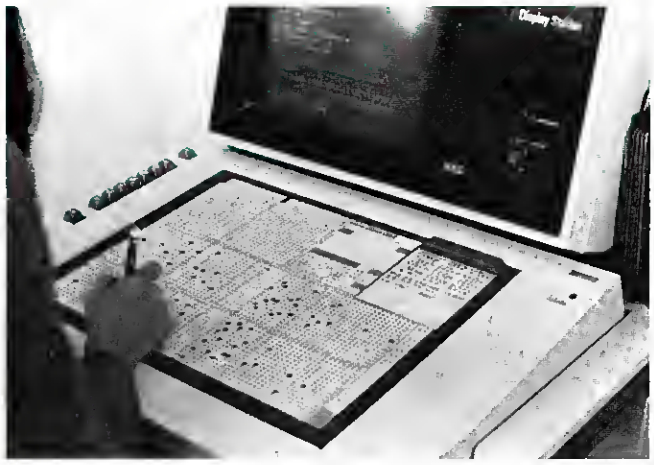

Photo 3. Grid System Keyboard

Photo 4. By building Chinese characters one component at a time, most characters can be put together with about four keystrokes.

Singapore for still another show and the rest of us went to Canton, China for a trade show there.

In addition to seeing the state of the microcomputer business in each of these countries, we also had an opportunity to get together with user groups, computer store managers and dealers. I don't know how all the others on the trip made out, but it was worth its weight in gold to me.

In Korea I managed to get together with a chap who is interested in starting a microcomputer magazine and handling Instant Software. This is just the combination I was looking for. And probably the best news I found is that a Korean ROM is being manufactured for the TRS-80, and a dealer is selling the system in Seoul.

In Tokyo I was besieged by the people wanting to work with us. Meetings went on until after midnight some evenings. The business outlook is good for a trading partnership with a large and well known electronics organization.

In Taiwan I scored two major coups. One was the discovery of a trading partner interested in distributing our programs, and the other was an opportunity to address the press and businessmen of Taiwan. I told them that if they wanted to catch up, technologically, with Japan and the U.S. they had better start interesting their teenagers in electronic careers. I suggested using amateur radio as a means. My speech made all the papers.

The trip to China was a fascinating experience. Oddly enough, there was a good deal of agreement as we were on the train back to Hong Kong that while we found the experience worthwhile, we would not be much interested in doing it again. There were a lot of negatives involved. The Chinese did all they could to make our visit enjoyable, but under *their* control.

China has gotten so used to having an abundant populace that its businessmen seldom seem to think of labor in economical terms. Even at $45 per month, this approach is not viable when dealing with the rest of the world. We toured a color TV factory in Korea, for example, and found it almost totally automated. The amount of labor required per set, complete, is under $2.50. Thus, Korea will be able to turn out those sets in competition with almost any low wage country for a long time to come.

"While we found the experience worthwhile, we would not be much interested in doing it again."

I invited you to come along on the tour, and you passed it up. You missed a real experience. There'll be another tour in October 1981, so perhaps you'll make it. I doubt if I will be able to get the time again, so you'll have to do it by yourself.

Tandy International

When you get to Europe the talk is less of the TRS-80 and you start hearing more about the Pet. A look at the Commodore balance sheet explains this to some degree when it shows their European computer sales to be almost half again those of their U.S. sales. Tandy apparently got off to a bad start in Europe, and playing catch-up is difficult.

The candid comments I got while traveling put the blame for the poor Tandy sales on the shoulders of their European manager. I gather that this situation has been fixed. The spirits seemed to be high in the Tandy Computer Center I visited in Koln and they spoke of more such centers opening in other parts of Germany.

Microcomputers are doing fairly well in Britain, where the American system can be used with the surfeit of English language programs and instruction literature. In most of the other European countries, where English is not as easy to use, microcomputer acceptance has been low. Translations of books and magazines into the other languages has been very slow, and even slower has been the translation of computer programs.

Catch-22 is at work again. Without programs it is difficult to sell computers... and without a customer base it is difficult to market programs. The end result is a stalemate, with disappointing growth for the European industry in comparison to the U.S.

In Asia both the TRS-80 and the Apple enjoyed early success. This was evident in those countries with higher disposable incomes such as Japan, Hong Kong and Singapore. Then, with the development of some more advanced Japanese systems, the American products took a nose dive. Little effort has been made by any American firm to provide programs, so no one knows what influence a reservoir of applications programs might have on these markets.

Again, with most of the magazines, books, teaching materials and programs

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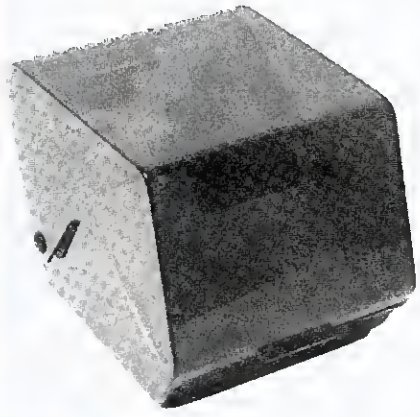

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✓ Reader Service—see page 242

In English, the Asians have not been eager to cope with American systems. In Hong Kong and Singapore, where English is the major language, the TRS-80 has sold remarkably well. But now there is a Hong Kong-made version of the TRS-80.

I saw systems at the recent Consumer Electronics Show in Tokyo, Japan by Hitachi, Toshiba, NEC, Sharp, Seiko, Casio, Matsushita, Mitsubishi, Sanyo, and a few others. Most of these firms have indicated an interest in tackling the American market. If they come over here with only hardware—even though much of it may be better than the TRS-80 and Apple systems—they will have a difficult time. None of them have simplified their entry into the U.S. by emulating the TRS-80, thus being able to work on the TRS-80 software. I'm sure this is a decision which all American manufacturers have greeted with enthusiasm.

When one system outsells the others the way the TRS-80 has, programmers do most of their writing for the more popular system. This is why we have many times as many programs for the TRS-80 as there are for the system second in sales. These programs are also far better than those for any other system.

I think the Japanese can surpass our American firms in computer technology, just as they have in virtually every other electronics field. But I don't think this is going to be enough, unless the American manufacturers remain blind to the importance of software support and accessories provided by smaller firms.

Radio Shack would do well to bend as much of their efforts toward keeping up with the Japanese technological advances, while leaving the documentation and software development to the rising number of support firms. They are trying to bite off far more than they can chew.

Unless Radio Shack re-evaluates their capability to handle every aspect of their system, they may be handing billions of dollars in sales to the Japanese.

Of course, this business of trying to predict the future is a chancy one at best. It calls for an understanding of as many facets of the situation as possible, a sense of the flow of history in a particular industry and no unforeseen developments. In this field however, we have seen a steady stream of unforeseen developments, so my crystal ball may be clouded.

Diverse Interests

One of the weaknesses of the American customer base for microcomputers lies in the diversity of interests of these customers. The large number of Tandy systems in use makes it profitable for Radio Shack to set up and maintain sales and service centers. But while users of their systems are in need of a surprisingly wide variety of peripherals and software, it quickly becomes nonproductive for them to cover every possible base. Yet this seems to be the Radio Shack approach—perhaps showing that the management has been unable to learn a very expensive lesson.

Manufacturers always think in terms of cutting down on competition. In the computer field this takes on the guise of making sure that your system has its own bus, so it will not work with any other equipment being made. This keeps as much of the accessory sale within the company as possible. The language standard must be somewhat different from others; graphics different. You can be sure that if there were a way for manufacturers to get a patent on a bus, he would, in order to prohibit any other firm from selling compatible equipment.

Several microcomputer firms have done everything possible to maintain secrecy about their bus structure and the signals on the bus—all to prevent other firms from supporting their system. I think this is shortsighted. As I have mentioned before, Heath might have become one of the largest firms in the business, if they had made two changes in their approach: compatibility with the S-100 bus and opening their sales to existing computer stores. I suspect that their decisions on these issues cost them millions of dollars.

Would The Digital Group be viable today if they had not been so arrogant about using their own bus? They had a lot going for them, but they got greedy and wanted to keep others from making accessories for their system—and succeeded.

Will Radio Shack begin to recognize the power they have as a result of the hundreds of firms producing accessories and programs for their system? Will they bring this information to their stores, where salesmen can use it to help sell systems? Tandy management seems to think that keeping word of compatible equipment from their customers is shrewd business sense.

Changes at Tandy

With the moving of Phil North upstairs and the promotion of John Roach to president, we may see some changes in Tandy policies that will benefit their computer sales. Remember that the TRS-80 is no longer just one of the Radio Shack products, it is now a major part of the income for the whole conglomerate and, thus, will require ever more attention and long-range planning. The Tandy people have one or more eyes on their stock price, and they are all too well aware that this price reflects both the realities of their marketing and the investor-perceived position of Tandy in the computer market. In practical terms this means that the corporate officers have to spend a good deal of time looking in *their* crystal balls and making moves which will result in advancing stock prices.

John has come to his new position via the computer division of Tandy, so one might assume that Tandy will be betting even more on TRS-80 growth rather than less. This will put all the more pressure on John to be right in his judgements of alternative moves by the firm. Indeed, if he makes the right decisions, the Tandy empire can head toward $10 billion and even $100 billion in sales. The business is there for someone.

"I think the Japanese can surpass our American firms in computer technology, just as they have in virtually every other electronics field. But I don't think this is going to be enough. . . ."

That Memowriter

The Sharp Memowriter looks like a nice match for the Sharp Pocket Computer —which is distributed in the U.S. as the TRS-80PC. Let's see what we can do to interface the Memowriter to the PC so we can get some printouts when desired. It would also be nice to have someone design a small unit to display the PC material on a miniature TV screen such as the Sanyo 1½-inch television unit. That ought to keep you busy for a few weeks. ■

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20

INSIDE 80

by Ed Juge, director of computer merchandising, Tandy Radio Shack

"Since the common rumor is we won't listen to you, let's talk about communications in the owner-to-Tandy direction. . ."

It seems strange to sit down at my Model II in the wee morning hours of October 23, and say that I hope you had a pleasant Christmas, and that you'll have an outstanding 1981. . . but it's true.

Authors aren't supposed to talk about the fact that their text is written months before it is read. But since I've said I'd try to keep you "up-to-date" with what is happening in Fort Worth, I think it's important for you to realize that publications work with considerable lead time.

TRS-80 Monthly Newsletter

So, let's talk a bit this month about keeping you informed and communications in general. Many TRS-80 owners are painfully aware of our newsletter delivery problems. Unfortunately, if you never get your copy, you may not know that we're starting in January to offer it on a paid subscription basis. New computer owners will get 12 issues at no charge. After that the tab will be $12 per year.

The good news is, at the same time, we'll begin mailing it first class. We've found that first class mail to the people on the list reaches owners who have never gotten the bulk-mailed newsletters.

We've checked hundreds of addresses of people who say we won't put them on the list. I've personally checked about 50, and found every one of those listed correctly.

Unfortunately, we'll have to go by the date you were put onto the list. We'll be sure everyone already on the list has been mailed more than 12 free issues. If you were placed on the list 18 or so months ago, you'll have to subscribe now. I suggest you wait and see if you get a newsletter in January. If not, contact your local store for a subscription form. If you do get the January issue, relax; we'll let you know when it's time to subscribe.

Every CPU comes with a newsletter registration card good for 12 free issues. Subscriptions are run on a very simple computer program. It *cannot* handle extensions to any subscription. If you buy a second computer and send that card too, you'll get two copies. My suggestion: If you buy a second CPU, save the card until you get notice it's time to subscribe, then send in card number two! Only CPU's contain the card—not printers, disk drives, etc.

Communicating with Radio Shack

Bet you've heard this is impossible. . . right? Our critics and competitors enjoy spreading that rumor, but it just isn't true. We're getting lots of letters asking why we don't refute that hogwash in print. I'm a bit tired hearing it too, so this month I will spend some time explaining our existing efforts and some new ones we've cranked up recently.

It must be understood up-front, though, that our response can't always be positive: What we can or can't do must be based on your needs *and* sound business judgement.

Since the common rumor is we won't listen to you, let's talk about communications in the owner-to-Tandy direction first. In my first column a few months back, I asked for your input, ideas for new products, criticism and suggestions on hardware or software. Know how many came in? Less than a dozen.

Tell us about the hardware you need, with capabilities we don't offer. (Remember to build and price it right, there has to be a wide market.) Tell us why, and how you'd use it. What features it should have, what's a reasonable selling price. Explain to us what kind of businesses/people would use it, and how big that market is. In plain language, sell us on offering it.

If one of our current hardware items looks poor to you, or if there is one you probably would have bought, had we done a couple of things differently, say so—and why.

Same is true for software. Just, please, none of the, "It's Mickey Mouse," comments. Be specific: what's done wrong or missing, or not well documented? What's needed? Let me tell you, it's v-e-r-y hard to respond to "Mickey Mouse," unless you're Minnie!

If our Inventory Management System isn't well suited to your industry or type of business, tell us what that industry needs, and how widespread is that need? We aren't opposed to having two, or even six inventory programs if there's a justification.

Of course, I'm asking a one-sided favor, since, if the mail gets really out of hand, we won't be able to reply individually to every letter.

The Tandy-to-Owner Circuit

We are intensifying our efforts to effectively communicate with you. This column is one effort. Those of you who get the TRS-80 newsletter know that our busy computer division vice president, Jon Shirley, is writing an always informative, often entertaining monthly column, "The View From the Seventh Floor."

Beginning in the December newsletter, you'll find our product news revamped with sections from each of our product line managers (PLM), directed specifically to owners of those products. You'll find pages for Model I/III owners, Model II, Color Computer, Pocket Computer, Educators.

Each PLM will be sharing ideas with you, telling you about new products, answering common questions from owners, giving you tips or hints, quirks or bugs, or maybe an in-depth description of some new item he's really excited about. You'll find out who these guys are, and hopefully "get to know" them. You can write to your PLM any time you want to go right to the horse's. . . uh. . . mouth. And please try to write rather than call whenever possible.

This week, we added a new member to the team. Bill Walters is an experienced hardware and software hobbyist, as well as having supervised a DEC PDP-11/70 installation for the Navy at one time. He has authored several articles in *Kilobaud Microcomputing*. Sorry, Wayne, there I go mentioning "competitive products."

Bill will fill the newly created position of consumer information manager. Specifically, he's here to help improve our communications with you. When you write to computer merchandising, you'll probably get your reply from him. Bill will be a bit less snagged in the details which sometimes bury our PLMs, so he'll be a much more accessible I/O port for the department.

✓Reader Service—see page 242

But, If I Heve e Question?

How do you get it answered? Your first avenue of attack should always be to phone our computer services group. They have toll-free numbers (1-800-433-1679 outside Texas, and 1-800-722-5914 if you're in Texas) with several rotating incoming lines. A large staff of trained personnel is waiting there to help you with questions on hardware, software, delivery, bugs, conversions, upgrades, or information of a general nature. They have most of the answers closer at hand than the PLMs because they answer them every day. When in doubt, call them first.

If merchandising needs to answer your question, computer services will transfer you to Bill. He will help you, or get you an almost immediate reply from your PLM.

The most effective way to communicate directly with computer merchandising, though, is by letter. We have much more time to consider your request or suggestion, and act on it more effectively. We also have a written record to follow up, or refer to later. Whenever possible, it helps us if you'll write.

In addition, we have Radio Shack bulletins on the CompuServe Information Service. When something comes up you should know about, this is where you will find it first. Bill will be updating this information as often as necessary—weekly, daily, or hourly.

If we've missed any bets, or you can suggest a better way. . . write.

TRSDOS 2.0 for the Model II

We have released a new version of Model II TRSDOS that I think you're going to like. WARNING: Although you can do an orderly XFERSYS to convert a 1.2 diskette to 2.0, do not attempt to use 2.0 and 1.2 disks in your system at the same time—you will lose data!

Do not transfer any of our Radio Shack software to 2.0. Use all of our software on the DOS version on which it was released, unless we make available a re-release of the software on the later DOS. You can get into serious trouble. (Example, moving your General Ledger to 2.0, then updating it with a 1.2 Accounts Receivable will destroy one or both disks for you.)

New library commands include: ANALYZE, which gives you disk allocation information organized by track; DUAL to duplicate output to video and line printer; HELP, which helps with TRSDOS command syntax; HOST to allow keyboard input from, and video output to, a remote terminal via RS-232; SPOOL to save printer output in a disk file for later printing and printing of the spool file while other operations are in progress; STATUS to display current top of user memory and on/off status of various TRSDOS functions. In addition, a new utility MEMTEST tests random access memory.

2.0 also allows a key-ahead of up to 80 characters. You can enter the next command while the previous ones are being executed, although the key-ahead is not displayed on video until TRSDOS is ready to interpret it.

Certain library commands now allow wild card entries in their fields.

TRSDOS now maintains an alternate directory on the disk. If for some reason the main directory becomes unreadable, the alternate is used to allow continued access to the diskette. There is an increased level of protection against an improper change of diskettes, and some new and changed SuperVisor Calls (SVCs).

Color Computer Questions

Jim Howell of San Jose, CA wrote me, asking some significant questions about our new color computer. I've written him, but would like to repeat some of the answers here, since I suspect they're of general interest.

Jim wondered why we limited screen lines to 32 characters. The answer is that the resolution of some (especially older) home color televisions simply won't produce a usable display with more than 32 characters per line or 16 lines per screen.

The question of CAPS LOCK was raised. (Lowercase characters are *not* displayed on the screen, although they are sent out via the RS-232.) The answer is, a "shift 0" goes from all caps to lowercase and back. Lowercase shows up on the screen as reverse video characters.

And finally, Jim had a question about Model III: Why didn't we put more keys on the keyboard with special symbols? Primarily because a typewriter keyboard is friendlier to the first time user. Thanks, Jim.

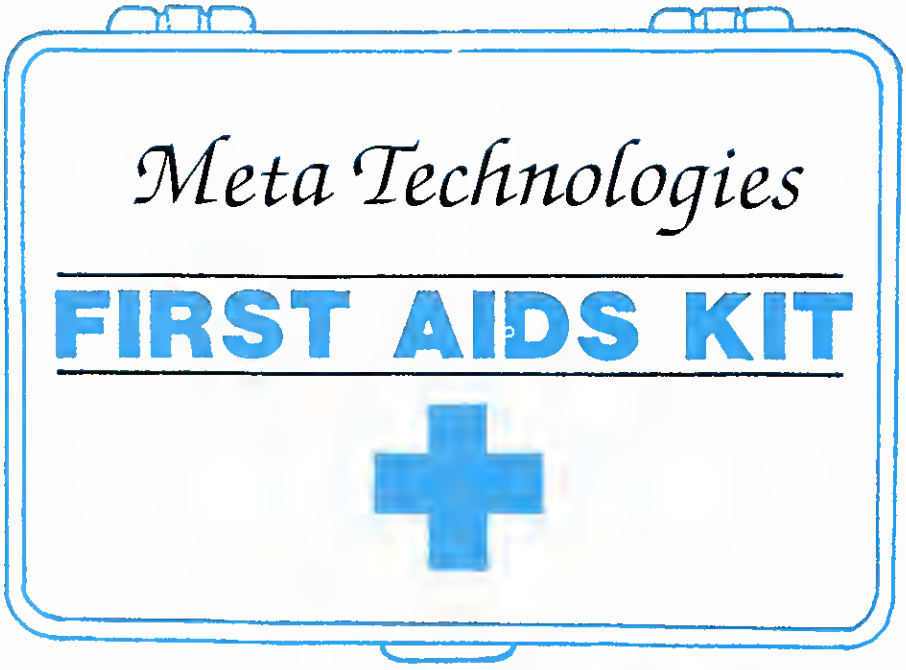
More Rumors. . . Again!

I just received an October TRS-80-related publication (which shall remain nameless), and read where we have a Model IV *and* a Model V coming! Model IV, it said will even be available by the end of this year. *WOW!* I knew there was a reason I still subscribed to that one, it's always the first place I hear about our new products.

Of course, this is the same fellow who predicted a Radio Shack eight-inch disk for Model I by March or April of 1979. (Anyone seen it yet?)

Take my advice and don't lose sleep over this one either! We'll continue to upgrade our line as technology and demand dictate. And we're constantly thinking a year or two ahead. That's not inside information—it's grade-school logic. Most rumors, and these in particular, are pure fiction, but I guess—like controversy—rumors sell subscriptions. ■

AILING INFORMATION ?



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✓Reader Service—see page 242

80 INPUT

"I also feel I was burned by your precious programmers, ... I've become very leery of purchasing anything from just about anyone."

Strings Congratulations

Congratulations on the two excellent articles on "Strings" in the last two issues of your magazine, by Mr. John D. Adams. The second article did have a listing missing. I suppose this will be corrected in the November issue?

I find the Level II Manual furnished with the TRS-80 leaves quite a lot to be learned from elsewhere. Such articles as you have offered here are most helpful to those of us who do not have a computer background but would like to learn our way around. If Mr. Adams were to take us through the manual, chapter by chapter as he is doing with "Strings," it would make my subscription to your magazine a good investment.

David. D. England
Alamagordo, NM

Likes Adams

Just wanted to compliment you on the two part series that appeared in the September and October issues under the title "Pulling Strings Together."

The articles are well written, concise and to the point. The illustrative examples are short and well chosen.

I hope that you see fit to have Mr. John D. Adams, author of these articles, write something more for future editions.

Charles B. Steele
La Jolla, CA 92037

The Armed Citizen

Well, you've done a great service to your advertisers and the industry you're so loudly trying to protect by telling us in great detail that the copyright laws don't protect software anymore (if they ever did) and how it is now apparently legal (though in poor taste) to operate a commercial software trading organization. (I'll bet they love your free advertisement for that!)

As for myself, your taking over 10 percent of the article space in your "Magazine for TRS-80 Users" explaining how poor and abused the commercial programmers of America are and what dastardly scoundrels the users of America are, is rather a bore. Who is purchasing the programs that are sold? Anyway, I think the essence could have been stated in one or two pages. Then the cover and 10 pages could have been devoted to users articles and information.

Further, I believe the value of users groups to generate interest and draw additional people into the field far outweighs the copying problem you belabor. What I would have given to get some information and help in '78 when I purchased my TRS-80!!! You see, I also feel I was burnt by your precious programmers, including such names as Radio Shack and FMG. I've become very leery of purchasing anything from just about anyone.

I believe a much greater service could have been rendered if an in-depth article had been written about the Microsoft compiler and how it is next to useless for a TRS-80 Model I because of the vast memory and disk space it eats up, instead of this 12 page (yawn) verbal tantrum.

Really, I think your article probably did more harm than good to your advertisers. Please stick to your motto of helping users and don't waste space with this "crying on each other's shoulder" routine. I'm really not interested. I purchased your magazine for the good it can do me in my craft, not to have my wrists slapped continuously for your envisioned great injustice.

Please get off your soap box and return to the great magazine you started. I'm still looking for, and will purchase, good programming for my business.

Ronald S. Kime, President
Dry Gulch & Tombstone RR, Inc.
Wytheville, VA

The editors of 80 Microcomputing *accept your criticism and hope that you and your lobotomy are healing well.*

Triple Play

In reference to the article "Triple Play" for T-BUG in the October *80*, I found what appears to be four typos, as the program will not work, at least with my T-BUG.

The locations and changes required are:

4AAC	FC 74
4688	43 74
4C69	A5
4CAA	CF

Without these changes, the required changes at 7443 and 74FC are missed. The error at 4CAA correctly increments the last line of addresses in the table. Without this change, 64K addresses are put into lower programs.

Fred W. Wise, P.E.
Windsor, PA

Just Fol-de-rol?

After the October issue of *80 Microcomputing*, I pray we can expect a respite from the Chicken Little propaganda campaign presently rampant among this and other micro-media regarding program "protection." I do agree that outright theft for the purpose of direct sale to the public should be a matter for concern, however, vendors practicing such activities are few, and affected software houses could join together to handle the matter—now!

I suggest all concerned review the thirty years development of an even larger technological industry—High Fidelity Audio—and consider its millions of tape recorders in the hands of the general public. Even the recent video recording flap has subsided to a mild whisper.

As a programmer and program purchaser, what irks me most about all this haranguing in the media is the complete indifference to the end user—your bread and butter! In the past year I alone have spent over $800 for various programs and utilities. Only a few are usable as is, some I was able to correct, the rest reside in my junk drawer, which has become substantial. With the exception of only a few software vendors, such as Computronics, rarely can one return unusable programs. *Caveat Emptor*, eh!

Criticism, without plaudits when due, is unproductive. Indeed, we do have pro-

✓ Reader Service—see page 242

grams available which are excellent and, in some cases, superb.

On another note, in return for the many tips I've received from your readers, I would like to pass on a few of my own.

In your October issue a reader, R. J. Lighton, complained that reverse indentation was not possible with Scripsit.

As a consulting engineer I write reams of technical documents requiring such structure and find it quite possible with Scripsit. I suggest interested readers read pages 1 and 5 of the Scripsit "Instruction Summary Guide."

Those using renumbering utilities who have experienced failure to renumber lines following GOTO or GOSUB inside conditional statements: check to see if you used the shorthand "," in place of "then." The "," is a delimiter and the renumbering program often ignores the balance of the statement beyond it. For example:

```
800 IF A$>2000, 880 ELSE GOSUB 950
900 IF A$>2000, THEN 880 ELSE GOSUB 950
```

Line 800 will not usually come out with 880 or 950 properly renumbered; line 900 will.

Those with 15-inch printers wishing to tab beyond the normal 64 limit can resort to any of the following.

To position B$ at tab, 95:

```
200 LPRINTSTRING$(95 – PEEK(16539),32);B$
200 LPRINTSTRING$(95," ");B$
200 LPRINTSTRING$(95,32);B$
200 LPRINTSTRING$(A,32);B$ (where A = 95)
```

Use whichever works best with your printer.

Thank you for giving us a great publication. In parting, could I ask that you research the other side of the software coin and give us some articles covering the many problems plaguing your users.

L. M. Phelps
Northfield, MN

Mod II Articles, Anyone?

I am a subscriber to your magazine, *80 Microcomputing*. I have enjoyed it immensely for the past year. I particularly like and learn from your tutorial articles. I am writing you today because I have both a complaint and a request.

I own a Radio Shack Model II computer. My problem is, most articles written for your magazine are for the Model I. That is to say, they liberally use commands which were not put into the Model II. I specifically refer to PEEK, POKE, SET and RESET.

As you may have guessed by now, my interest in the Model II is strictly business. I have installed it in my office and have hired a programmer who is presently working for us. However, that does not mean that I would not like to learn to program in BASIC. I am presently doing just that, taking a college course in data processing.

My reason for writing you today is to suggest that you add articles to your magazine which have the Model II in mind. I would hope that some of these articles would be of a tutorial nature. I would also suggest articles on ways we can avoid using the four commands I mentioned previously, which are in the Model I, but not in the Model II.

I look forward to hearing from you, for this is the first time I have made this request of anyone. Model II sales, according to the company, have gone up dramatically, and there are a significant number of businessmen who own this computer. I am sure that all of us would be interested in seeing articles adaptable to this machine.

Marvin L. Gale, M.D.
Chula Vista, CA

We are currently looking for articles and programs written for the Mod II, and hope to publish more in the future. Readers? —Eds.

Shack Woes

I am a new and proud (?) owner of a shiny TRS-80 Model III. My problems started back at the friendly Radio Shack store when I discovered that the cassette recorder and cables were out of stock and had not been shipped. I tried vainly to plug another cable into the Model III, only to discover that the jack is smaller than that on the Model I. I thought I could at least use my printer, because all the catalogs indicated that the same cable that fits the expansion interface would fit the Model III. No such luck! A 34-pin connector is necessary!

At least I could study the manual and play with the unit until my recorder and cables arrive. My amazement continued when I discovered that all the keyboard generated controls and special characters do not function as specified in the shiny new operation manual. All was not lost, however, because Radio Shack has thoughtfully included a little blue slip that indicates that I can have those missing capabilities if I will send my Model III to a service center and pay $20.00 for the addition.

The whole thing borders on false advertisement and misrepresentation!! Is Radio Shack saving on the costs of a future manual for a future machine, saving on production costs, in too much of a hurry, or all three?

I do think, however, that I will like my Model III once I am able to use it.

Arlen Richards
Devils Lake, ND

Lowercase Strings

A thousand thanks for the article, "Lowercase With Strings Attached," by Milan D. Chepko, M.D. which appeared in the August issue. I have a 48K TRS-80 system with a Centronics printer and have been wondering how to easily handle my upper and lowercase string requirements without continuously holding down the shift key to get the lowercase alphabet printed on my printer. Indeed, the change program is slow, but the time loss is made up by faster keyboard entry.

However, I did find one problem. If a string variable is entered for X$ and then a second string entry is a null string for X$, the computer will assign the first string variable to the second. This occurs because X$ has not been set to null prior to returning from the gosub routine. This is easily fixed as follows.

Change 10160 to read NEXT B:X$="": RETURN. I have used this on a large string input program and have had no problem at all.

Dennis R. Morgan
San Jose, CA

Proper Input for Lumber List

I have received a number of inquiries regarding the proper input responses to the "Rough Lumber List" program published in *80 Programs for the TRS-80*. The trick is to always answer lengthy questions in the form xxFTyyIN (FT is mandatory, IN is optional). The program has an accumulator function built in for wall lengths. When all lengths of a type have been entered, hit ENTER again and the program will advance to the next wall type. Roof pitch responses are in the form xxFTyyIN/xxFFyyIN.

I have a detailed crib sheet that I will gladly forward to anyone who sends me a SASE.

Dave Brickner
205 E. Caribbean
Phoenix, AZ 85022

Continued to p. 28

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80 AID

TAB Aid

This is in response to one of your readers requesting help with TAB statements greater than "TAB(64)", when used with "LPRINT" statements.

There are a couple of solutions to this problem. The best way is to use string statements: LPRINT STRING$ (30," ");B$ (the value you want printed), for example. There are times, however, when this statement will not print at the same location because of the variable length of the string printed before it. In this event, try a statement like LPRINT STRING$(30 – LEN(A$)," ");B$ (the value you want). This will locate each printout in the same location each time when the value printed before is A$. If there are several items on one line you could even try a statement like LPRINTSTRING$(75 – (LEN (A$) + LEN(B$) + LEN(C$) + LEN(D$)), " ";E$ (the value you want).

There are times when you will be using integers instead of strings; in this case, you LPRINT USING K$ for each value printed (for example, where you know that K$ is ###### each time). Then a simple LPRINT STRING$(30," ") ;A$ or A (the value you want) will put you in the same location each time.

This has worked for me in every application and I believe that this will fit most every need you have.

Joseph D. Saladino
Box 489
Phillipsburg, KS 67661

Line Printer Squeal

I am having a problem with my new Radio Shack Line Printer IV, and since Radio Shack has not been able to help, perhaps you or one of your readers could.

When the Line Printer IV is on, it emits a loud high-frequency whistle. Not only is this annoying, but after a half hour or so it causes almost everyone near my machine to get a headache. Incidentally, I have been advised by Radio Shack that all Line Printer IV's emit this sound. I have also been advised by Radio Shack's computer service hot line that they do not have a fix and one is not likely.

They are aware that the problem is being caused by the power transistors.

Perhaps one of your readers has the solution?

Roger Schechter
54 Park Ave.
Verona, NJ 07044

Scripsit Source Files

In the October issue of *80 Microcomputing*, page 16, R. J. Lighton said in his letter ". . . that Scripsit is an excellent means for generating source files for the disk assembler. . ."

I tried using Scripsit to generate the source file for my disk editor (RS 26-2202 by Microsoft), and found that the end-of-line block (ENTER) does not generate a proper line ending for the disk editor. My system has the stock RS upper/lower modification with my own disable switch. No combination of characters or hardware changes seemed to help get the line ending correct.

Scripsit does appear to be a delightful method of editing, but entirely useless unless I can get this problem resolved. Perhaps you might be able to provide an answer or relay my query to Mr. Lighton?

Dr. Alan D. Wilcox
PO Box 151
Archbald, PA 18403

TAB and LPRINT

Re: letter from Rolf Roethlisberger, "80 Aid," November *80 Microcomputing*.

The problem with TAB and LPRINT is not a bug in his ROM. Apparently the TAB command is limited to position 0-63 (to match the video). One way around the problem is to use the semicolon to suppress the CR/LF and send any additional LPRINTs to TAB(63). The printer will keep adding them on to the last position after any LPRINT that hits 63 or beyond. (In the example, periods are shown instead of spaces for clarity.)

```
10 LPRINT TAB(60)"TEST";TAB(63)"...TEST";
   TAB(63)"...TEST"
20 LPRINT TAB(63)"TEST";TAB(63)"..TEST";
   TAB(63)"..TEST"
```

Line 10 will put the word TEST at print positions 60, 67 and 74. Line 20 will put the word TEST at print positions 63, 69 and 75. This will work equally as well with PRINT USING statements, numeric or string variables. You only have to remember to count the actual spaces that will be used by your variables (remember numerics include a space before and after the number). A simple worksheet is invaluable in setting up video or printer formats. I use lines like the following:

```
0123456789 1 123456789 2 1234567
89 3 123456789 4 123456789 5 12345
6789 6 123456789 7 123456789
```

Do that several times on a blank sheet of paper and then run it through your friendly copier.

Albert S. Adams
10614 Norman Ave.
Fairfax, VA 22030

Justowriter, Anyone?

I have been enjoying your publication since the first issue, keep up the good work.

I have a problem that I hope you or your readers can help me with. About two or three years ago I read an article interfacing a computer (I think a TRS-80) to a Friden 'Justowriter'. About one year ago I found a Justowriter but haven't found any information about it, and cannot locate the article. I would sure appreciate any information.

Richard L. Cross
224 Marshall Dr.
Ft. Walton Beach, FL 32548

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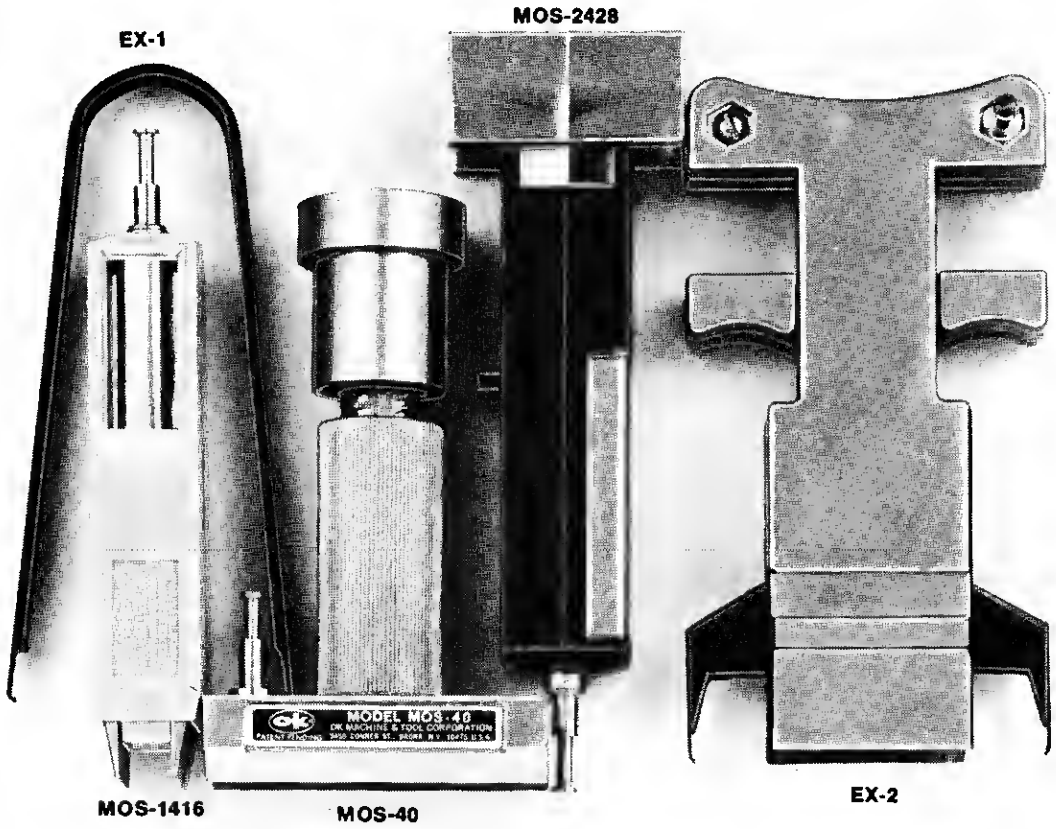

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80 ACCOUNTANT

by Michael Tannenbaum C.P.A.

"Early attempts to create an electronic file cabinet were limited by the cassette storage medium and limited memory. . . However. . . these programs have proliferated."

Consider the following familiar scenario: You are sitting at your desk desperately trying to reduce the level of your "In" box before a long weekend, when your boss announces that the finance committee has just rejected the annual budget and he (in other words, *you*) has been directed to prepare a new, *realistic* one before the next meeting. Since the next meeting is on Monday it will no doubt be a *long* weekend.

If this scene is all too familiar, you are already a candidate for a corporate microcomputer. The demand for software in this area has created a new spectrum of products that can be properly called management tools.

One promising use for the corporate microcomputer is for electronic filing. With the power of the micro, data can be filed and retrieved with multiple keys. For example, a purchasing agent can file vendors alphabetically, by type of material, by drawing number or any other key information. Then, when an inquiry is made, all that is required is the key word or phrase, and the vendor will be recalled. The time saved with this technique alone can pay for the micro.

Early attempts to create an electronic file cabinet were limited by the cassette storage medium and limited memory. However, with the increasing availability of reliable disk drives these programs have proliferated.

Electronic filing programs are distinct from most data base programs in that they access data via multiple key words. Since access is the primary purpose of the data base program, the efficiency with which this is accomplished is of primary concern.

Two Data Base Programs

For this month's column I have examined two data base programs: Tandy's Profile II and the Micro Architect's IDM-M2. Of the two, the IDM-M2 is an older package originally written for the Model I and transferred to the Model II. IDM is also written in BASIC, where Profile is written in machine language.

I created a small data base, using the documentation furnished, that allowed me to initialize the programs but only gave me a slight idea as to their access efficiency.

Profile and IDM initialize similarly. Both require a file definition. IDM requires that you specify numeric or alphanumeric attributes of a field. This is not required by Profile. Once your field is defined, both systems require specification of a maximum file size.

In the IDM system, the maximum file size has to be set at a prime number. Unfortunately, I don't have a prime number table so I just guessed. Apparently my guess was valid, because the initialization procedure continued without an error message. Initialization takes time because IDM sets up a complete file for each potential record. This is beneficial because any disk problem can be detected before a large file is created.

IDM does not size the disk before initialization. It is possible, therefore, to go through an initialization process and run out of disk space. In this case, according to the manual, the system just hangs. This should be corrected by adding an error message.

Profile supports a considerably more complicated file structure than IDM. A Profile data record can be divided into four segments. Segment one, a maximum of 85 characters in length, contains all the keys to the file. The remaining three segments are data segments and should contain information which will never be accessed, except through the keys in segment one.

A useful example of Profile data might be a magazine article index. The first segment would contain all classification keys for the article such as magazine name, data of issue, type of article and field of interest. The remaining segments can be used to store a brief article summary. Each segment holds up to 256 characters.

With a data base this complex, initialization takes some time, but this holds true for both systems.

Profile Glitters

Once the data base has been defined and intialized, IDM is ready to go. Not so with Profile. A data entry screen must be defined first. Here is where Profile positively glitters. Using the F1 and F2 keys, captions can be steered to various positions on the screen. Fields can be defined as numeric or alphanumeric to control data entry.

The screen generator program allows graphics and reverse lettering to be used to add life to a screen. With a little effort the resulting screen can look really professional. Up to five screens can be defined for a data base. Each screen is individually password-protected.

Data entry for both systems is straightforward. Despite its beautifully formatted screen, Profile lacks a data log. IDM has the advantage by offering you the option to print out each entry after an update. This can be important if the system will be used to store accounting data such as a membership billing list or an inventory.

Despite my small sample, once data is entered, the speed of Profile over IDM is clearly apparent. Both programs allow a great latitude in searching for desired data. The desired key field can be greater than, equal to or less than the key word. Profile also allows connectives to narrow the search to a specific target record or range. A search can be made for Smith AND John or Jones OR Smith.

Maintaining Profile

To maintain Profile, data can be added to or subtracted from the existing data base by defining a data entry field as a +nn or a −nn field. The nn refers to a previously defined field number in the data base.

This procedure might tempt you to turn Profile into an accounts receivable or inventory system, but this should be avoided unless you develop a data entry logging procedure. Without a log, the file could quickly become inaccurate because of posting errors.

Both systems include a report customizer. The customizer is a high point of the IDM system. Using the report-writer program you can develop specifications that indicate fields to be printed, the sequence of printing, record filter and arithmetic operations desired for numeric data. The report writer can also alter the data base

after printing to zero fields, replace the value of the field with a calculated value or blank the field entirely. Instructions to the report writer are stored as a special format file. Up to 10 formats can be stored.

The reporting program for Profile is not as elaborate. The data base cannot be altered, and there are no provisions for arithmetic operations other than totaling. Where IDM can pick up to four different fields for sequencing, Profile is limited to one. The length of this field, however, can be expanded to cover the entire first segment. Therefore it is important that the keys are placed into the first segment in a logical manner. One note of warning: The capacity of the sort program in the print reports function is 28,000 characters. If the full 85 character record is selected only 329 records can be sorted.

Prior to printing, both programs sort your data. The original IDM program used a rather time-consuming BASIC sort. The version submitted for evaluation had a machine language sort program. With my small sample size both programs worked quite fast.

Both programs print labels. Profile has greater flexibility in this area than IDM. Profile's label specification program defines label formats using any of the data record fields. IDM uses a fixed format. Line three of the label is field #1, line four is field #2 and line five is field #3.

Both programs also have extensive password protection facilities.

Both Flexible

Limitations of time and space really prevent an in-depth analysis of all the features of both systems.

Profile has an edge over IDM in its access speed. Since it was written specifically for the Model II and not adapted from a Model I package, this is not suprising. However, IDM with its essential routines in BASIC can be customized for other applications.

I must include a closing note about the documentation of both programs. Profile's is far superior to IDM's. I found getting started confusing in both systems. What is needed is a test data base, which can be used as a tutorial in both systems. Profile includes test data in the documentation which can be keyed to demonstrate the features of the system.

Profile II is available at Radio Shack for the Model II only. A version is available for the Model I, but it is quite different from the Profile system tested. IDM is available for both the Model I and Model II from the Micro Architect, Arlington, MA. Versions of IDM are available for tape-based Model I systems. ■

THE ASSEMBLY LINE

by William Barden, Jr.

Towards the beginning of each month, my wife notices subtle changes in me —my beard grows faster, my eyebrows start to get bushy, and I snarl at her in wolflike tones. Yes, it's Assembly Line column time once again... This month, I thought I would throw together a short and easy program that would compress a BASIC program by deleting blanks and REM lines. Unfortunately, I had forgotten a rudimentary programming axiom— there *are* no short and easy programs "thrown together."

Back to BASIC

The first step was researching the Level II BASIC interpreter internals, a fairly difficult task for TRS-80 users. As you may surmise, Microsoft and Radio Shack are somewhat secretive about the operation of the Level II BASIC interpreter. If I had invested thousands of man hours writing a piece of software, I would also be fairly reluctant to hand out annotated source listings at K-Mart. On the other hand, it would be nice to have "hooks" in BASIC and TRSDOS to make it easier to add new commands, I/O device drivers, disk file managers, etc.

I'm digressing. I went to my annotated source listing of BASIC; by "annotated source listing" I mean a hand-hewn composite of the work of many people. In the early days of the TRS-80 many users were disassembling BASIC to investigate the internals. (Frankly, I gave up after finding some code in which a jump was made back to the second byte of a three byte instruction! And I'm completely serious ....) Some of the methods used were dumps in ASCII or Z-80 instructions using Small Systems Software RSM-1, disassembly by various products, modification of T-BUG to dump on the line printer, and, later, disk DEBUG single stepping. Many people from different areas pooled their notes to get a picture of how BASIC operated.

(I'm still digressing.) Looking over the Level II code and digging around via disk DEBUG, I concluded that I really had forgotten some facts about BASIC program structure. Here are my rediscovered findings.

How BASIC Lines are Stored

BASIC statement lines are formatted like Fig. 1. The first two bytes are the address of the next line, in standard reverse order: least significant byte followed by most significant byte. The next two bytes are the line number in binary. The last byte of the line is a zero byte. The bytes in between are either ASCII characters or tokens. Tokens are codes in the range of 129 to 250, decimal, and are shown in the back of your Level II manual as internal codes.

Tokens save space; it is much more efficient to store a one-byte token than the characters for REM, for example.

BASIC program lines are contiguous in memory: there are no gaps between lines. In fact, the next line pointer points to the byte immediately after the zero byte of the current line. This makes it easier to search for given line numbers, as the line numbers from a linked list. The last "next line number" is zero. See Fig. 2.

Level II maintains two pointers, one to the beginning of the BASIC program, and one to the end of the BASIC program plus one, as shown in the figure.

Every time a line is inserted or deleted, this block of BASIC lines is rearranged so that there are no gaps between lines, and line numbers remain in ascending order.

A Short Program (Thrown Together)

My first attempt at a compression program was done before I realized there are no gaps between BASIC lines. I simply moved the remainder of the line down when a blank was found, leaving a gap. Naturally, this didn't work, and prompted further research. After I rediscovered the contiguous form of BASIC lines, I tried again. This time I came up with a program that eliminated blanks all right, even blanks in strings. When my menu came out "1. ADDENTRYTOFILE", I knew the program needed more work.

The answer was to search for blanks *only* if the character was not in the middle of a string. Strings start and end by quotation marks, so I could search for an odd-numbered quotation mark to set the string mode and for an even-numbered quote to reset the string mode. No blanks were deleted in the string mode.

I also added a line deletion capability,

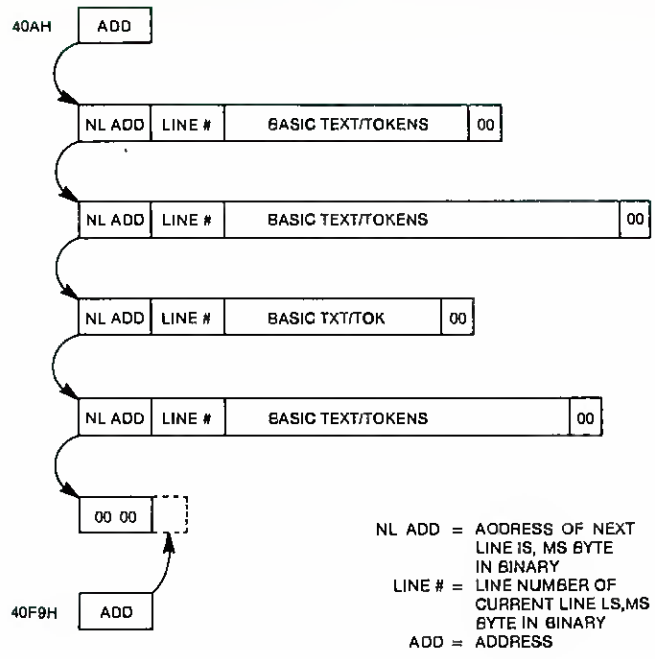

Figure 1. BASIC Line Format

which deletes the entire line if a REM token (93H) is found in character position 1 or 2. The latter covers lines starting with an apostrophe in place of the REMark, which results in a colon followed by a REM token in the line.

The point of this narrative is that hardly anything is easy, especially when not enough thought precedes the assembly-language coding. The rest of this column is largely devoted to explaining this "simple" program.

Expanding on the concepts, it would be possible to perform pre- or post-processing to consolidate lines, automatically generate a structured indentation, or change variable names. I'm sure you can throw together some neat application in short order.

The Basic Algorithm

The algorithm (procedure) for the Program Listing goes something like this:

1. COMPRS: Get starting address of the first line from location 40A4H in the BASIC interpreter working storage.
2. Set variable BIAS to zero.
3. COM10: Major loop for scanning lines and compression:
   a. Set the quote count to 0.
   b. Get the next line pointer from bytes 0 and 1 of the current line. If it is zero, the program is done. If not, go on to step c.
   c. Add BIAS to the next line pointer. BIAS is initially zero, but will be adjusted to hold a negative count of the total number of bytes deleted, from all deletions of blanks and REM lines. Store the next line pointer back in bytes 0 and 1.
   d. Test for a REM line by looking at bytes 4 and 5 of the current line. If either is 93H, delete the line by going to step e, else go to step f.
   e. Delete entire REM line: Subtract the starting address of the current line from the next line address. This gives the number of bytes in the current line, or the number of bytes to be deleted. Go to step g.
   f. COM35: Minor loop for scanning line for blanks. Set the blank count to 0, the source and destination pointers to start of current line, and go to i.
      i. Get a character. If it is a quote, increment the quote count.
      ii. COM45: Increment the blank count by one.
      iii. Test quote count by looking at the least significant bit. If it is 1, we are in the middle of a string and won't look for blanks—go to step v in this case.
      iv. Test for blank. If this character is a blank, go on to step vi.
      v. COM48: Character not a blank here. Transfer character to next character position. Bump destination pointer by one. Decrement blank count by one so that it is unchanged.
      vi. Increment source pointer by one.
      vii. Test character for 0. If it is not zero, go back to step i. If it is zero, this is the end of the current line—continue on to g.
   g. COM60: Move up remaining bytes in program area: The byte count from either deleting the entire line or deleting blanks is subtracted from the current next line pointer in bytes 0 and 1.
   h. The byte count is then added to the BIAS to adjust BIAS for the current deletions.
   i. The number of bytes from the last source byte to the end of program (in 40F9H) is computed. This is the number of bytes to be moved up into the area vacated by the line or blank deletion.
   j. A block move is performed to move the bytes up.
   k. The end of program variable in

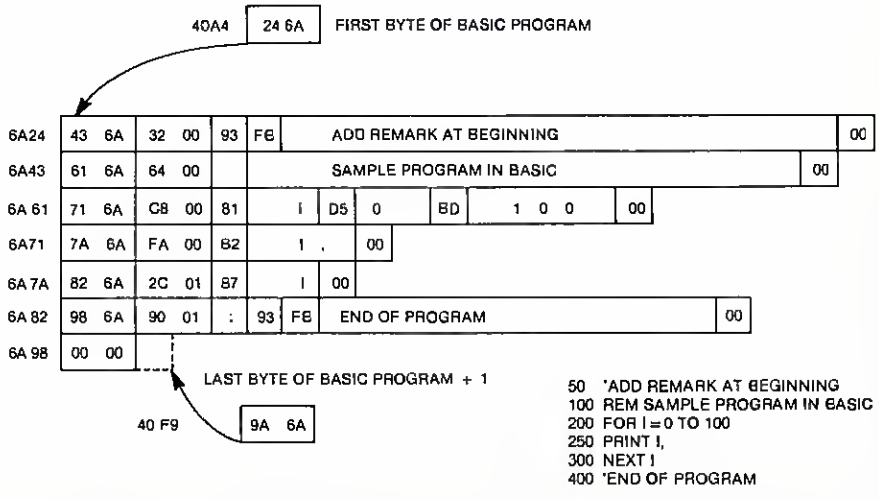

Figure 2. Sample BASIC Program Storage

The book you've been waiting for...

Ever since Radio Shack sold the first TRS-80 Model I users have been searching for detailed information about its inner workings that Tandy would not, or could not, make available. In particular the Level II BASIC from Microsoft contains dozens of subroutines that can be tremendously useful to any programmer, but Tandy Corporation is probably under contractual obligation to Microsoft not to supply information (if they even have it!).

Dedicated users, proficient in assembly language, have disassembled the Level II ROMs and made their own comments. But the majority of users are left in with virtually no information, apart from occasional articles and whatever they can decipher on their own.

ENTERPRISING USERS - Several of the more enterprising programmers realized that if they published their own comments a lot of TRS-80 users would buy them. The BOOK, Disassembled Handbook and Supermap are some of the available books giving comments on the ROM set - but they all suffer from serious drawbacks, being either incomplete, unintelligible or even worse inaccurate!

Incomplete books are usually published when the author has not finished understanding what he's writing about. Hence the "continued next book" lines in some publications, translated into english read "buy another book when I've done some more work". Unintelligible books are due to poor editing, or no editing at all! Inaccurate information is a result of not checking with anyone else.

Microsoft BASIC Decoded & Other Mysteries is both complete and understandable. Nearly 7,000 lines of comments for the Level II ROMs, with an additional 6 chapters of useful information, make this the biggest and best book available on the subject.

Written by James Farvour, the comment section took more than a year to finish - it even includes the changes for the latest ROM set in an appendix. Edited by Jim Perry, until recently managing editor of 80 Microcomputing, the text and comments are understandable.

Tested examples are given for virtually every ROM subroutine, showing you how to CALL them from BASIC or use them in an assembly language program. With more than 300 pages Microsoft BASIC Decoded & Other Mysteries is by far the largest book about Level II available.

Copyright - In order to respect Microsoft copyright the actual disassembled code is not printed, but the book is designed to come apart and fit into a standard 3 ring binder with your own disassembly (all pages are pre-drilled).

In short, Microsoft BASIC Decoded & Other Mysteries, is the most complete, understandable and accurate guide to your Level II ROMs that is available - bar none!

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40F9H is changed to show the new end of program.

I. Go to step a to process the next line.

The initial adjustment of the current next line pointer is made by adding BIAS. This means that the sum total of each deleted space or bytes of REM line is subtracted from the next line pointer at the beginning of processing for each line. This is a running count, or relocation bias. A second adjustment is made to the next line pointer *after* the line has been processed to compensate for additional bytes deleted in the line.

If a line is not a REM line, it is scanned for blanks. If a blank is found, the destination pointer is not incremented and the blank is not stored. The next character, if non-blank, will be stored at the current destination location. The buffer area used for the destination is the line itself, as the source pointer always points ahead or at the current character being investigated. The line is scanned from the fourth byte on, to avoid deletion of 20Hs for addresses or line numbers!

The Code

HL generally points to the start of the next line, or is used as a source pointer to the next character on the current line. DE points to the destination on the current line, and BC holds a count of deleted spaces or bytes. IY always contains the address of the STRING variable. IX generally points to the start of the current line.

IX is initially loaded with the start of the BASIC program in memory, a zero BIAS is stored, and IY is loaded with the address of STRING.

The COM10 code is the main loop of the program. The STRING flag is reset at each pass through the program. The next line address is loaded into HL by using the IX register, which points to the start of the current line. A check is made for HL = 0, which would indicate that the last line has been reached.

BIAS is added to HL, and the updated next line pointer is stored in the next line area at the beginning of the current line.

A check is made now for a REM line by scanning the 4th and 5th characters of the current line, using IX as the index. If either character is REM token (93H), the entire line must be deleted. This is done by subtracting DE (the start of current line) from HL (the start of the next line) to find the number of bytes to be deleted. A jump is then made to COM60, which will move the remaining code up to overwrite the entire current line.

If a REM line is not present, the current line will be scanned for blanks to be deleted. The code at COM35 bypasses the

```
F000            00100          ORG     0F000H
                00110 ;*********************************************************
                00120 ;*                  BASIC LINE COMPRESSOR                *
                00130 ;*  DELETES ALL NON-STRING BLANKS AND ALL "REM LINES     *
                00140 ;*  FROM A BASIC PROGRAM.                                *
                00150 ;*********************************************************
                00160 ;
F000 DD2AA440   00170 COMPRS  LD      IX,(40A4H)      ;GET START OF BASIC
F004 210000     00180         LD      HL,0            ;INITIALIZE BIAS
F007 2296F0     00190         LD      (BIAS),HL
F00A FD2198F0   00200         LD      IY,STRING       ;ADDRESS OF STRING FLAG
                00220 ; THIS CODE LOOKS FOR END AND ADDS LINE POINTER BIAS
F00E AF         00221 COM10   XOR     A               ;ZERO A
F00F FD7700     00222         LD      (IY),A          ;RESET STRING FLAG
F012 DDE5       00230         PUSH    IX              ;TRANSFER START TO DE
F014 D1         00240         POP     DE
F015 DD6E00     00250         LD      L,(IX)          ;GET NEXT ADD LSB
F018 DD6601     00260         LD      H,(IX+1)        ;GET NEXT ADD MSB
F01B 7D         00270         LD      A,L             ;TEST FOR 0
F01C B4         00280         OR      H               ;0 IS END OF PROGRAM
F01D C8         00290         RET     Z               ;RETURN IF ZERO
F01E ED4B96F0   00300         LD      BC,(BIAS)       ;GET BIAS FOR ADJUST
F022 09         00310         ADD     HL,BC           ;ADJUST PNTR
F023 DD7500     00320         LD      (IX),L          ;STORE LSB
F026 DD7401     00330         LD      (IX+1),H        ;STORE MSB
                00340 ; THIS CODE CHECKS FOR A REMARK LINE
F029 DD7E04     00350         LD      A,(IX+4)        ;GET FIRST CHARACTER
F02C FE93       00360         CP      93H             ;TEST FOR REMARK TOKEN
F02E 2807       00370         JR      Z,COM30         ;GO IF FOUND
F030 DD7E05     00380         LD      A,(IX+5)        ;GET SECOND CHARACTER
F033 FE93       00390         CP      93H             ;TEST FOR "'" TYPE
F035 2009       00400         JR      NZ,COM35        ;GO IF NOT REMARK
                00410 ; REMARK HERE - DELETE LINE
F037 E5         00420 COM30   PUSH    HL              ;SAVE START NEXT LINE
F038 B7         00430         OR      A               ;CLEAR CARRY
F039 ED52       00440         SBC     HL,DE           ;FIND # BYTES
F03B E5         00450         PUSH    HL              ;TRANSFER TO BC
F03C C1         00460         POP     BC
F03D E1         00470         POP     HL              ;RESTORE START NEXT LINE
F03E 1826       00480         JR      COM60           ;GO TO MOVE UP, ETC.
                00490 ; NO REMARK - COMPRESS BLANKS
F040 010400     00500 COM35   LD      BC,4            ;BYPASS PNTRS
F043 DDE5       00510         PUSH    IX              ;START OF LINE TO HL
F045 E1         00520         POP     HL
F046 09         00530         ADD     HL,BC           ;ADJUST
F047 E5         00540         PUSH    HL              ;START OF LINE TO DE
F048 D1         00550         POP     DE
F049 010000     00560         LD      BC,0            ;BYTE COUNT TO 0
F04C 7E         00570 COM40   LD      A,(HL)            ;GET CHARACTER
F04D FE22       00580         CP      '"'               ;TEST FOR QUOTE
F04F 2003       00590         JR      NZ,COM45          ;GO IF NOT QUOTE
F051 FD3400     00600         INC     (IY)              ;BUMP QUOTE TOGGLE
F054 03         00610 COM45   INC     BC              ;BUMP BLANK COUNT
F055 FDCB0046   00620         BIT     0,(IY)          ;TEST QUOTE TOGGLE
F059 2004       00630         JR      NZ,COM48        ;GO IF STRING
F05B FE20       00640         CP      ' '             ;TEST FOR BLANK
F05D 2003       00650         JR      Z,COM50         ;GO IF BLANK
F05F 12         00660 COM48   LD      (DE),A          ;TRANSFER CHARACTER
F060 13         00670         INC     DE              ;BUMP DESTINATION
F061 0B         00680         DEC     BC              ;BLANK COUNT UNCHANGED
F062 23         00690 COM50   INC     HL              ;BUMP SOURCE
F063 B7         00700         OR      A               ;TEST CHARACTER FOR 0

F064 20E6       00710         JR      NZ,COM40          ;GO IF NOT END OF LINE
                00720 ; THIS CODE MOVES UP REMAINING LINES
F066 E5         00730 COM60   PUSH    HL              ;SAVE START OF NEXT LINE
F067 DD6E00     00740         LD      L,(IX)          ;GET CURRENT PNTR LSB
F06A DD6601     00750         LD      H,(IX+1)        ;MSB
F06D B7         00760         OR      A               ;CLEAR CARRY
F06E ED42       00770         SBC     HL,BC           ;ADJUST FOR CURRENT LINE
F070 DD7500     00780         LD      (IX),L          ;STORE LSB
F073 DD7401     00790         LD      (IX+1),H        ;STORE MSB
F076 2A96F0     00800         LD      HL,(BIAS)       ;GET BIAS
F079 B7         00810         OR      A               ;CLEAR CARRY
F07A ED42       00820         SBC     HL,BC           ;SUBTRACT BYTE COUNT
F07C 2296F0     00830         LD      (BIAS),HL       ;STORE
F07F 2AF940     00840         LD      HL,(40F9H)      ;END OF PROGRAM+1

F082 B7         00850         OR      A               ;CLEAR CARRY
F083 C1         00860         POP     BC              ;START OF NEXT LINE
F084 C5         00870         PUSH    BC              ;SAVE IN STACK
F085 ED42       00880         SBC     HL,BC           ;FIND BYTE COUNT OF REST
F087 E5         00890         PUSH    HL              ;TRANSFER TO BC
F088 C1         00900         POP     BC
F089 E1         00910         POP     HL              ;RESTORE SOURCE
F08A D5         00920         PUSH    DE              ;SAVE DESTINATION
F08B EDB0       00930         LDIR                    ;MOVE
F08D ED53F940   00940         LD      (40F9H),DE      ;SAVE NEW END
F091 DDE1       00950         POP     IX              ;FOR NEXT LINE
F093 C30EF0     00960         JP      COM10           ;GO FOR NEXT LINE
F096 0000       00970 BIAS    DEFW    0
F098 00         00980 STRING  DEFB    0
0000            00990         END
00000 TOTAL ERRORS
```

Program Listing

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two pointers at the beginning of the current line, and sets HL and DE to the start of the current line. The byte count in BC is set to 0.

One character at a time is examined. A character is loaded using HL as a pointer. HL is the source pointer that always points to the next character to be examined. If the character is a blank and the blank is not in the middle of a string, the character is not transferred to the next destination (DE) position of the line. If the character is not a blank, or is a blank in a string, the character is transferred via DE. HL is always incremented by one to point to the next character. DE is incremented only if a non-blank has been transferred. BC is incremented each time a blank is deleted.

The test for string mode is made by the BIT 0,(IY) instruction. This instruction uses the IY index register to access variable STRING. The least significant bit of STRING is tested and is copied into the zero flag. If an NZ condition exists, the character is in the middle of a string. STRING is set to zero at the beginning of each line, and incremented each time a quotation mark is detected. If the least significant bit is 0, no string has been found; if the bit count is 2, 4, 6, etc., the middle of a string is indicated.

The last portion of code in the blank search tests for a byte of zero, indicating the last byte of the line. If the byte is zero, "JR NZ,COM40" falls through to COM60.

COM60 is entered from the above code or from line deletion. BC contains the number of bytes that have been deleted from the line. The first order of business here is to adjust the BIAS and next line pointer in the current line for the bytes just deleted. This is redundant in the delete line case, as the line will soon be overwritten anyway. The number of bytes from the current source is then subtracted from the end of the program pointer in 40F9H. Since the end of program pointer always points to one more than the end, the result is the true number of bytes in the remainder of the program.

At this point HL contains the source pointer, DE points to the last destination byte plus one, and BC contains the byte count. An LDIR moves up all of the remaining bytes in the program area in one block move. The last action changes the end of the program pointer in 40F9H to the value of DE from the block move; DE points to the last program byte plus one at this point.

Using the Compressor

To use this program, assemble it and output the object to cassette or disk, or key it in using T-BUG or DEBUG. Load the object by SYSTEM or the disk LOAD command (MEMORY SIZE = 61439). Load the BASIC program to be compressed. After the load, enter DEFUSR0 = &HF000:A = USR0(0) for disk BASIC, or POKE16526,0: POKE16527,240:A = USR(0) for non-disk BASIC. The program will crank away. On a 16018 byte BASIC program I used for a benchmark, the compression took 46 seconds. Watch for possible conflicts on some BASIC commands that require a blank.

Are You Ready for the 6809?

I'm the perfect Radio Shack consumer. I've got a Model I, a Model II, a Pocket Computer, and a Color Computer. I recently plunked down the cash for the Color Computer because I was excited about the 6809 microprocessor. As it turns out, my excitement is justified.

The Color Computer, far from being a games machine, is a product with a great potential for the serious programmer. It contains the 6809 with limited 16-bit processing and a hardware multiply, high-density color graphics up to 256 by 192, a six-bit digital-to-analog output for music and speech synthesis, two joystick inputs that can be used as analog-to-digital inputs, a serial port, and a ROM pack 40-pin edge connector that brings out all major system signals.

It appears that Radio Shack is committed to assembly language for the Color Computer, also. The hooks are there for USR calls, and while there isn't an assembler yet, there will be shortly.

The 6809 itself has an instruction set modeled after the 6800 microprocessor instruction set, but containing instructions to handle 16-bit operations and other nifty features. The 6800 instruction set is designed more along classical computer instruction lines, more easily understandable than the Z-80 instructions. There was much weeping and wailing and gnashing of program listings when programmers first started using the Z-80 instructions (one major aerospace contractor had three programmer suicides in the first year alone, but that's another story). There should be a lot fewer complaints with the 6809 Color Computer.

As the Color Computer grows in popularity, I'll add some material in this column on assembly language for it. Write me if you'd like to see it.

The Third Great Assembly Line Programming Contest

Sad to say, the third contest was not too successful. The problem was to write a program to draw a line between any two character positions, using the 1024 character positions rather than pixels. The programs I received were excellent, but rather too large to cover in this column. I'll be sending copies of my new Radio Shack book, *More TRS-80 Assembly-Language Programming* (soon to be released), to David R. Cecil of Texas A&I University, Bob Leech of Herndon, VA, Ed Thomas of Alexander, AR, John Whinery, of Scott City, KS, Robert Obermarck of Los Altos, CA, and Steven Roy of El Paso, TX. All of these readers did an incredible amount of work on the programs, and I wish that space permitted a full presentation.

Keep assembling, and may you always have a POP for every PUSH. ■

80 DEBUg

Continued from p. 18

EDTASM Error

I have found the following error in my article, "Customized EDTASM" in August's edition. Enclosed is the correction.

In Listing 6 and Listing 7 the patches are ORGed to 4693H, they should be ORGed to 4695H. These patches are designed to overlay the memory test from 4695 through 469F.

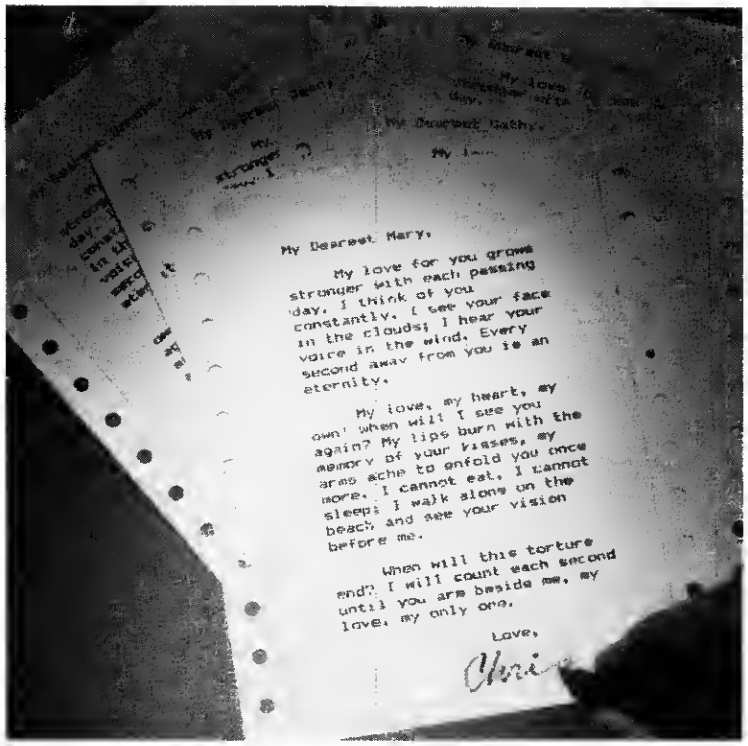
John T. Blair
122 Dumont Ave.
Norfolk, VA 23505

Super Graphics

RE: "Super Graphics", Alan R. Moyer, October 1980: There are errors in the listing included with my article appearing on page 202 of the October issue. The errors in the listing are corrected in the line listings below. The program will run with these corrections.

```
65190 PRINT@LC,A$
65230 H$ = A$:GOSUB65400:AD = T:GOSUB65350:
      GOSUB65423
65240 D = PEEK(TD):H5 = INT(D/16):H6 = D – H5 + 16
65270 IF(D>31)AND(D<192)PRINTTAB(56)CHR$(D)
      ELSE PRINT
```

Alan R. Moyer
993 San Angelo Dr.
Hamilton, OH 45013



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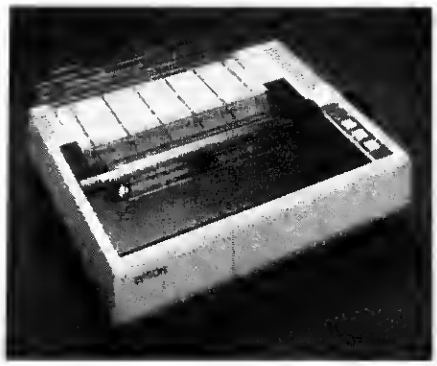

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↙Reader Service—see page 242

EDUCATION 80

by Earl R. Savage

"How can you make duplicates of system programs? And what can you do when only a 4K machine is available. . . and the program is 16K long?"

What is the first thing you do when you receive a new program? First, you try it out and then you turn it over to a student. And then, possibly, it's lost because of an accidental erasure!

One of the early lessons you learn when dealing with students and computers is: Never give a student the one-and-only copy of a program! Often this is an expensive lesson, because, sooner or later, one of them will record over a program; put a tape or disk on top of the power supply; bulk erase the wrong tape; scratch a disk or stretch/break a tape.

The moral is: If there is a new way to obliterate a program, some student is sure to find it. (A teacher can also find a way now and then!)

Down the Drain

When your one-and-only copy goes down the drain, it's back to the vendor for another which, of course, results in additional expense and loss of time. The solution is simple: Give the student a copy and keep the original in a safe place. This advice also applies in the case of both commercial and "home grown" programs.

In order to make a copy of a program, you must have the means to do so. Let's discuss tapes first, since that is the most common medium. There are several ways to copy tapes and you should be familiar with their advantages and disadvantages.

The first and probably most popular method of copying is the one built into your 80. CLOAD a program, put in a new cassette, and CSAVE that program. This is neat and simple but it makes two assumptions: (1) the program is written in BASIC—not in assembly/machine language; and (2) the program will fit into the memory size of the 80 being used.

Now that leaves you with two big problems. How can you make duplicates of system programs? And what can you do when only a 4K machine is available (students are on the others) and the program is 16K long? Let's talk about a solution to the first problem.

The second method of copying is to purchase a program designed to duplicate system programs. Mine is an old one called Syscop. It came with no documentation–just very brief instructions on the screen. No entry point was given so we ended up having to reload Syscop for each program to be duplicated.

In spite of that, it makes good copies as long as the original program is in one piece. If the program is in parts or sections, Syscop cannot handle it. I hope the Syscop I see advertised now is an improved version.

My preferred methods for duplication require a second cassette machine. If you don't have one, go down to the school audio-visual room and talk them out of one.

At first, you may think that you can play the original program on one machine and pipe it straight into the second. Don't waste your time. By the time the two machines distort the signals, they are unusable. Your ear probably can't tell the difference but your 80 surely can!

TCOPY

What you need is something between the two machines to clean up (actually reconstruct) the signal. In *80 Microcomputing* (July, 80) there's a short article and program entitled TCOPY. This is a system program which you can prepare with a monitor or an assembler; you can also POKE it in from BASIC (see the November issue). In any event, TCOPY is a little beauty. I haven't found a program, BASIC or system, that it doesn't copy flawlessly. Here's how to use it.

With TCOPY loaded into your 80, connect the black earphone plug to the player/recorder with the original program cassette. Connect the auxiliary plug to the recorder containing the blank cassette. Run both machines, playing the original and recording the blank. That's all there is to it.

What actually happens is this: TCOPY and your 80, working together, take in the program bit by bit and shoot out a corresponding stream of new bits to be recorded. This intake and output take place simultaneously–the bits are not stored in RAM and pulled out later.

The advantages of this method are significant. As mentioned, the programs can be BASIC or system (even those in parts). Regardless of whether you have two or two dozen originals on the tape, TCOPY duplicates one after the other as long as you let the tapes run.

Further, since you are reading and writing, you only have to go through each program once. That can save a lot of time. Finally, because the program is not stored in RAM, the length is irrelevant. You can copy a 48K program with a 4K 80.

There is a disadvantage which may or may not be important to you. While you are duplicating tapes, your 80 is tied up. It is unavailable for other uses. There is, however, a way you can have your cake and eat it too.

You can substitute another piece of hardware for the 80 and TCOPY. Then you can run one program while you are copying others—no wasted time. Two such devices are the Data Dubber by The Peripheral People, Mercer Island, WA and the Acu-Data by Alphanetics, Forestville, CA.

"Never give a student the one-and-only copy of a program!"

Both the Acu-Data and the Data Dubber are connected between two cassette machines with cables provided. Both reconstruct the bit stream to remove distortion. Both have an LED for visual monitoring. Both have a jack for audio monitoring (with a small amplifier/speaker). Both do an excellent job.

At this point you may be surprised to learn that there are differences.

The Data Dubber is battery operated, using a common nine-volt rectangular battery. This means that you don't add to your snakes' nest of ac cords/plugs.

The Acu-Data is ac operated and is available with a recorder motor switch. I find that switch to be very useful. When I put more than one program on a tape, I flip that switch for a few seconds after each one is dubbed and create a space between them without having to disturb any recorder settings. If you happen to be us-

ing a recorder that won't rewind or fast forward with the remote plug inserted, you'll find the switch invaluable.

There is an additional advantage to both the Data Dubber and the Acu-Data. We have all run across tapes (BASIC and system) that are hard to load. Either of these devices can be placed between your recorder and your 80. In almost every instance the signal will be "cleaned" and be readily acceptable to the 80.

I urge you to make a back-up copy of every program in your library. Remember that program tapes can be destroyed in spite of the fact the cassette record-protect tab is removed. Even if your programs are not used by students. You can make a mistake, too! Keep a back-up.

Program Exchange

It seems clear that there is a real need for exchanging the teaching programs which we develop. If we can do that, each of us does not have to re-invent the wheel when we sit down to write one.

A while back I asked you to let me know of any exchange groups which specialize in non-copyrighted instructional programs. Word has come of a couple about which I am trying to get further details. For now, you may wish to contact RETIP.

RETIP (Roanoke Exchange, TRS-80 Instructional Programs) is an informal organization of teachers in the western region of Virginia. They will exchange non-copyrighted (mostly "home-grown") programs on a one-for-one basis. I understand their list contains about 75 programs on a variety of subjects and levels. No fee is charged but be sure to send a self-addressed stamped envelope. You can get details from RETIP, c/o Craig County Public Schools, P.O. Box 245, New Castle, VA 24127.

Help For Other Readers

A number of requests have come to me for an outline of a computer literacy course. They have come from both elementary and secondary school folk. How about some help from those of you who have developed such an outline?

I am sure that even courses of long standing could use some improvement. So don't hesitate to send your outline because you feel that it may not be the best. No one knows what the best is yet! In fact, there is still disagreement about just what computer literacy means.

Send along your outline. It need not be detailed—a list of desirable topics will help. I'll put together the suggestions and we'll see how it looks.

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80 APPLICATIONS

by Dennis Kitsz

"Silicon technology has even invaded the great American bastion of heavy technology—the automobile."

If you follow this column regularly, you are probably not the timid sort. It's likely you have at least two soldering irons (one's broken, of course), a traumatic close-call story about your TRS-80, and a box full of programs for which you once had high hopes. Your computer still works, but a card you've taped to that program box reads "erase."

This month at last we turn to the software for the interrupt-driven real time clock board from October's column. But first, I would like to share with you the programs, parts suppliers, equipment, and references that make it possible for me to create software and hardware projects for this column.

I'll start by considering the nature of microcomputer applications themselves. Recently, one of the other popular computing magazines initiated a policy that hardware articles were no longer being accepted. We have all the hardware we need, they said, and now it is our business to turn to the software to create harmoniously working systems.

My reaction is strong and not likely printable (You're right—Eds.). We are just beginning to discover what kinds of traditional computer hardware (if there is such a thing) might meet our needs, and are still far away from any understanding of how to apply this technology efficiently and unobtrusively to our lives.

Science and Mechanics

Recently I received a phone call from the office of a well-known researcher in human and animal behavior, whose lab uses TRS-80s to monitor its experiments.

A major college now gives professional microcomputer interfacing courses using the TRS-80 as its model.

Even word processing, so recently a task of dedicated machines, has been comfortably and competently absorbed into the realm of the home computer.

Silicon technology has even invaded the great American bastion of heavy technology—the automobile. Cruise controls and digital dashboard clocks were only a hint of the beginning. And anyone leafing through the popular press will have seen a major manufacturer's "Computer Command Control." I excitedly brought one of these ads across the street to our village mechanic.

There was a long silence while he read the ad—and a long, distant stare after he read it, accompanied only be the sound of him drawing on his pipe. The stare finally turned my way. "Expect I'll have to learn how to fix 'em." Another long pause. "Be over to your place later."

And so this man—after two decades of wrenches and grease—plunged without a second thought into the dilemmas of electronic engine control.

There will be more to this story, but it has yet to take place. The point is this: Each month "80 Applications" attempts to bring together combinations of hardware and software that elucidate each other. The programs are kernels of potentially larger ones; the electronic projects are building blocks that allow the TRS-80 to grow outside its dull grey exterior.

Months ago I asked that you join me in this experience. My neighbor and garage mechanic is learning how it all works because he senses he must know. You may have the unique opportunity to gain such a perspective before your life's work depends on it. Once again, I ask that you join me: If your strength is in programming, then discover how the hardware works. If integrated circuits turn up under your sofa cushions, then spend time with the software.

Commercially Unsophisticated

Callers are often surprised when they discover that my own system is, commercially at least, an unsophisticated one. It was purchased in early spring of 1978 as a 4K Level II machine with expansion box, growing within weeks to a 16K version. For eighteen months, that was it. Homemade interfaces provided some control of my synthesizer, and a used monitor added visual output in the next room.

Eventually there was more memory, a Stringy Floppy, and an old Teletype. My "modem" was the cassette output, sending programs to my Radio Shack dealer 400 miles away. A real modem has replaced the makeshift one, and the Teletype sits temporarily idle while a recently borrowed Centronics helps me make my deadlines.

During its growth, my TRS-80 received three different upper/lowercase mods, higher speed, reverse video, an extra keyboard, more memory, and a plethora of little buttons and switches everywhere. A dozen homebrew circuits are snapped into place when needed. A tangle of wires goes to 16 power outlets.

There is no disk system because my home environment precludes it—dry, cold (50 degrees or less in the computer room), with wood smoke, three cats and a dog. I returned a set of disk drives because under those conditions they wouldn't even boot unless the stars were configured just right.

This system has been successful for me because of the hard work of program and book authors and parts suppliers. I would like to recommend some of these to you.

Hardware Discoveries

My criteria for choosing a parts supplier are stiff because I am fairly impatient. When I shop (and it is almost exclusively by mail from rural Vermont), I search for:

- Up-to-date parts selection
- Moderately low prices
- Prime parts
- Toll-free phone numbers
- Credit card acceptance.

The latter requirement seems to rankel some folks these days, but I'm not willing to wait for a check to clear; risk missing a COD package; or trudge through four feet of snow to get a money order.

In an emergency, Radio Shack is the first stop. I've never found a part that didn't meet or exceed specifications at the Shack. Service and selection is marginal, and knowledgeable employees are sometimes hard to find, but the company makes up for it by presenting a parts specification sheet along with the packaging. Naturally, there is a higher cost involved, but I salute Radio Shack for their continued attempt to bring small parts into their stores (You'll notice how they even sell 16K dynamic RAMs for $14.).

The bulk of my shopping is divided between two companies. The first catalog I

pick up is that of Digi-Key Corporation, P.O. Box 677, Highway 32 South, Thief River Falls, MN 56701, (800) 346-5144. If it will appear in the hobbyist marketplace, Digi-Key will likely carry it first. They are prompt, very courteous, offer a volume discount, and accept an order of any size (A $2 fee is charged under $10.).

Next stop is Electrolabs, P.O. Box 6721, Stanford, CA 94305, (800) 227-8266. This company has a motley but extensive catalog, with what looks like a selection of the owner's favorite items. The catalog is informative (a rarity) and very funny, presenting for example a chart of the "TTL Family Rules of Incest" (fan-in and fan-out of 74, 74H, 74S, 74L and 74LS circuits). They are likewise prompt and helpful.

Occasionally I turn to two other suppliers. Advanced Computer Products, P.O. Box 17329, Irvine, CA 92713, (800) 854-8230, has an exhaustive catalog of parts and boards. Their prices are very good, but their service is weak. I seldom receive requested data sheets, and twice parts which were listed and ordered as 5-volt devices were sent in +5, −12 volt versions—something I only discovered much later when the circuits were tested for proper operation. The parts could no longer be returned, and calls to the service department (That number is not toll-free!) requesting the omitted data invariably have resulted in an argument or brusque treatment.

Jameco Electronics, 1355 Shoreway Road, Belmont, CA, (415) 592-8097, would be a prime choice were it not for their resistance to service. A 3000-mile toll call for me, no credit card orders, no personal checks for CODs, and a $10 minimum order disqualify them except when I'm desperate. It's too bad, because their selection is excellent.

For bits and pieces of hardware, such as handles, cases, and heat sinks, where time and prime quality are of less concern, I turn to surplus houses like Poly Paks, Edlie, Etco, and especially BNF (formerly B&F) Enterprises. The latter firm is quite speedy and regularly updates their bulging catalog.

(Before my telephone starts ringing, I'll say that there are many excellent suppliers which seldom receive my orders, and I am making no negative inferences by omitting them.)

Soffware Discoveries

If you're out there to run programs, there's lots to buy. But if you have an application that's unusual or specific, you're on your own. You have to write a program, and you probably will want all the help you can get.

Program Listing

```
                    00100 ; MACHINE LANGUAGE CLOCK PROGRAM FOR ONE-SECOND INTERRUPT
                    00110 ; ------------------------------------------------------
7EC0                00120         ORG     7EC0H           ; CHANGE TO RELOCATE
                    00130 ; ******************************************************
                    00140 ; PATCH INTO DOS TIME$ ERROR LOCATION AND CHANGE IT
                    00150 ; ------------------------------------------------------
7EC0 F3             00160 ENTRY   DI                      ; DISABLE ACTIVE INTRPTS.
7EC1 21DE7E         00170         LD      HL,START1       ; START OF TIME$ PROGRAM
7EC4 227741         00180         LD      (4177H),HL      ; PATCH TIME$ ?L3 ERROR
7EC7 21A07F         00190         LD      HL,START2       ; START OF "CMD" PROGRAM
7ECA 227441         00200         LD      (4174H),HL      ; PATCH CMD ?L3 ERROR
7ECD 3EC3           00210         LD      A,0C3H          ; GET "JUMP" COMMAND
7ECF 321240         00220         LD      (4012H),A       ; PUT IN INT. PATCH POINT
7ED2 214C7F         00230         LD      HL,SERVE        ; INTERRUPT SERV. ROUTINE
7ED5 221340         00240         LD      (4013H),HL      ; INT. PATCH FROM 0038H
7ED8 ED56           00250         IM      1               ; SET INTERRUPT MODE #1
7EDA FB             00260         EI                      ; ENABLE INTERRUPT LINE
7EDB C3CC06         00270         JP      06CCH           ; RETURN TO BASIC "READY"
                    00280 ; ******************************************************
                    00290 ; PATCH TO INTERCEPT ?L3 ERROR AND CHECK LINE'S SYNTAX
                    00300 ; ------------------------------------------------------
7EDE D7             00310 START1  RST     10H             ; BASIC HOUSEKEEPING
7EDF E5             00320         PUSH    HL              ; SAVE BASIC LINE POINTER
7EE0 3E11           00330         LD      A,11H           ; LENGTH OF TIME$
7EE2 CD5728         00340         CALL    2857H           ; ROM STRING SPACE SETUP
7EE5 2AD440         00350         LD      HL,(40D4H)      ; LOCATION TO STORE TIME$
7EE8 114340         00360         LD      DE,SECOND+2     ; POINT DE TO HOURS POS'N
7EEB CD187F         00370         CALL    DISPLY          ; CONVERT, PLACE IN TIME$
7EEE 363A           00380         LD      (HL),3AH        ; PUT COLON INTO TIME$
7EF0 23             00390         INC     HL              ; BUMP TIME$ POINTER
7EF1 1B             00400         DEC     DE              ; BUMP DE TO MINS. POS'N
7EF2 CD187F         00410         CALL    DISPLY          ; CONVERT, PLACE IN TIME$
7EF5 363A           00420         LD      (HL),3AH        ; PUT COLON INTO TIME$
7EF7 23             00430         INC     HL              ; BUMP TIME$ POINTER
7EF8 1B             00440         DEC     DE              ; BUMP DE TO SECS. POS'N
7EF9 CD187F         00450         CALL    DISPLY          ; CONVERT, PLACE IN TIME$
7EFC 3620           00460         LD      (HL),20H        ; PUT SPACE INTO TIME$
7EFE 23             00470         INC     HL              ; BUMP TIME$ POINTER
7EFF 114540         00480         LD      DE,SECOND+4     ; POINT DE TO MON. POS'N
7F02 CD187F         00490         CALL    DISPLY          ; CONVERT, PLACE IN TIME$
7F05 362F           00500         LD      (HL),2FH        ; PUT SLASH INTO TIME$
7F07 23             00510         INC     HL              ; BUMP TIME$ POINTER
7F08 1B             00520         DEC     DE              ; BUMP DE TO DAYS POS'N
7F09 CD187F         00530         CALL    DISPLY          ; CONVERT, PLACE IN TIME$
7F0C 362F           00540         LD      (HL),2FH        ; PUT SLASH INTO TIME$
7F0E 23             00550         INC     HL              ; BUMP TIME$ POINTER
7F0F 114640         00560         LD      DE,SECOND+5     ; POINT DE TO YEARS POS'N
7F12 CD187F         00570         CALL    DISPLY          ; CONVERT, PLACE IN TIME$
7F15 C38428         00580         JP      2884H           ; FINISH DISPLAY IN ROM
                    00590 ; ******************************************************
                    00600 ; FIND VALUES IN TIME LOCATIONS AND CONVERT TO ASCII
                    00610 ; ------------------------------------------------------
7F18 1A             00620 DISPLY  LD      A,(DE)          ; GET VALUE INTO ACCUM.
7F19 CD407F         00630         CALL    NIBBLE          ; SEPARATE INTO 4 BITS
7F1C 47             00640         LD      B,A             ; VALUE INTO B FOR TEST
7F1D AF             00650         XOR     A               ; CLEAR A FOR USE IN LOOP
7F1E 04             00660         INC     B               ; DUMMY INCREMENT ...
7F1F 05             00670 LOOP    DEC     B               ; DECREMENT TO TEST FOR 0
7F20 2805           00680         JR      Z,LEAVE         ; UPPER NIBBLE NOW AT 0
7F22 C616           00690         ADD     A,16H           ; A=A+16 ...HEX-DEC CONV.
7F24 27             00700         DAA                     ; DEC.ADJ.: 16 BECOMES 10
7F25 18F8           00710         JR      LOOP            ; LOOP TILL CONV. DONE
7F27 47             00720 LEAVE   LD      B,A             ; SAVE VALUE BACK IN B
7F28 79             00730         LD      A,C             ; GET LOW NIBBLE BACK
7F29 FE0A           00740         CP      0AH             ; IS IT GREATER THAN 10?
7F2B 3804           00750         JR      C,CLEAN         ; NO WORK IF LESS THAN 10
7F2D D60A           00760         SUB     0AH             ; REDUCE IT TO 0 THRU 5
7F2F C610           00770         ADD     A,10H           ; NOW ADD CARRY BIT
7F31 80             00780 CLEAN   ADD     A,B             ; CREATE A DECIMAL RESULT
7F32 27             00790         DAA                     ; DEC. ADJ. THE TOTAL
7F33 CD407F         00800         CALL    NIBBLE          ; SEPARATE INTO 4 BITS
7F36 C630           00810         ADD     A,30H           ; CONVERT NIBBLE TO ASCII
7F38 77             00820         LD      (HL),A          ; PLACE VALUE INTO TIME$
7F39 23             00830         INC     HL              ; BUMP TIME$ PTR. BY ONE
7F3A 79             00840         LD      A,C             ; GET VALUE SAVED IN C
7F3B C630           00850         ADD     A,30H           ; CONVERT NIBBLE TO ASCII
7F3D 77             00860         LD      (HL),A          ; PLACE VALUE INTO TIME$
7F3E 23             00870         INC     HL              ; BUMP TIME$ PTR. BY ONE
7F3F C9             00880         RET                     ; BACK TO DO PUNCTUATION
                    00890 ; ******************************************************
                    00900 ; SUBROUTINE TO CONVERT A BYTE AND SAVE IT AS TWO NIBBLES
                    00910 ; ------------------------------------------------------
7F40 F5             00920 NIBBLE  PUSH    AF              ; SAVE THE BYTE BRIEFLY
7F41 E60F           00930         AND     0FH             ; MASK OUT THE HIGH BITS
7F43 4F             00940         LD      C,A             ; SAVE LOW NIBBLE IN C
7F44 F1             00950         POP     AF              ; GET THE WHOLE BYTE BACK
7F45 1F             00960         RRA                     ; MOVE THE BYTE RIGHT...
7F46 1F             00970         RRA                     ; ... SOME MORE ...
7F47 1F             00980         RRA                     ; ... SOME MORE ...
7F48 1F             00990         RRA                     ; UNTIL MSB BECOMES LSB
7F49 E60F           01000         AND     0FH             ; MASK OUT THE HIGH BITS
```

Program continues

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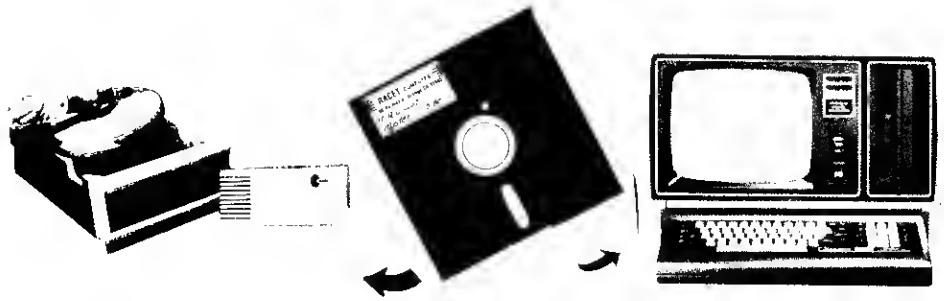

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✓Reader Service—see page 242

In creating a monthly column, I've found some programs I can't do without, many I can, and a few I wish I could. Here are the best in my collection:

Radio Shack's Editor/Assembler. You can use it in its off-the-shelf version, with the Apparat changes for disk use, the ASPTCH modification package (Micropute Software, P.O. Box 1943, Rocky Mount, NC 27801), or any of the smaller modifications published in magazines. It serves as not only a machine language assembler, but, with its TEXT command, doubles as a line-oriented text generator. EDTASM is a workhorse.

The RSM2 Monitor (P.O.Box 366, Newbury Park, CA 91320) and the Misosys Disassembler (5904 Edgehill Drive, Alexandria, VA 22303) are a good investment. RSM has a few major flaws, most notably the inability to read a system tape that is loaded into more than one portion of memory. Otherwise, it has a wealth of easily used commands.

The Misosys piece is a fast disassembler. It is not an elegant piece of writing (just ask it to disassemble itself and take a look), but it is quick. Its major flaw is its inability to read any tape into memory; its major advantage is its command to prepare an EDTASM-compatible source tape, complete with labels. Both these programs are virtually crash proof—you can accidentally exit these into your memory's never-never land, and almost always reenter them intact. I would like to see both of these programs superseded, but until a complete monitor/debugger package arrives at a reasonable price, I will continue to load the pair of these.

If you do any work that involves games, graphics, or tedious calculations, then ACCEL2 (Allen Gelder Software, Box 11721, Main Post Office, San Francisco, CA 94101) is an answer. This is a semi-compiler for BASIC. Here's how it works: You write a BASIC program, observing most normal rules of syntax as well as good programming techniques. ACCEL2 then compiles the most time-consuming parts of the program (not things like PRINT), and produces a finished program that will run faster than standard Level II BASIC. One example: I received a BASIC handball game that takes 15 seconds per shot, and is almost impossible to lose. Compiled with ACCEL2, each shot is only one-half second, making it almost impossible to win!

When you're stuck with a cassette system, you always search for an economical alternative. There is one, and it's called the B-17 Loader (ABS Suppliers, P.O. Box 8297, Ann Arbor, MI 48107). The program has a history of fits and starts, and the original version has been released to the

```
7F4B C9         01010           RET                     ; NIBBLES NOW IN A & C
                01020 ; *****************************************************
                01030 ; INTERRUPT SERVICE ROUTINE IS ENTERED AT 1-S CLOCK PULSE
                01040 ; -----------------------------------------------------
4041            01050 SECOND    EQU     4041H           ; LOCATION TO STORE TIME$
7F4C F3         01060 SERVE     DI                      ; DON'T BOTHER ME NOW!
7F4D F5         01070           PUSH    AF              ; SAVE ACCUM. & FLAGS
7F4E E5         01080           PUSH    HL              ; SAVE HL REGISTER PAIR
7F4F D5         01090           PUSH    DE              ; SAVE DE REGISTER PAIR
7F50 3A4540     01100           LD      A,(SECOND+4)    ; GET CURRENT MONTH VALUE
7F53 5F         01110           LD      E,A             ; SAVE MONTH VALUE IN E
7F54 1600       01120           LD      D,0             ; LET D=0. REASON FOLLOWS
7F56 214140     01130           LD      HL,SECOND       ; START AT SECONDS POS'N.
7F59 34         01140           INC     (HL)            ; SECONDS = SECONDS + 1
7F5A 7E         01150           LD      A,(HL)          ; GET READY TO COMPARE
7F5B FE3C       01160           CP      60D             ; IS IT 60 SECONDS?
7F5D 3824       01170           JR      C,OUT           ; DONE IF NOT 60 SECONDS
7F5F CD897F     01180           CALL    TICTOC          ; ADVANCE TIME SUBROUTINE
7F62 FE3C       01190           CP      60D             ; IS IT 60 MINUTES?
7F64 381D       01200           JR      C,OUT           ; DONE IF NOT 60 MINUTES
7F66 CD897F     01210           CALL    TICTOC          ; ADVANCE TIME SUBROUTINE
7F69 FE18       01220           CP      24D             ; IS IT 24 HOURS?
7F6B 3816       01230           JR      C,OUT           ; DONE IF NOT 24 HOURS
7F6D CD897F     01240           CALL    TICTOC          ; ADVANCE TIME SUBROUTINE
7F70 E5         01250           PUSH    HL              ; SAVE REGISTER BRIEFLY
7F71 21937F     01260           LD      HL,LOOKUP       ; DAYS-IN-MONTH TABLE
7F74 19         01270           ADD     HL,DE           ; REMEMBER DE?  SEE ABOVE
7F75 BE         01280           CP      (HL)            ; IS IT LAST DAY OF MONTH
7F76 E1         01290           POP     HL              ; GET REGISTER BACK NOW
7F77 380A       01300           JR      C,OUT           ; DONE IF NOT LAST DAY
7F79 CD8F7F     01310           CALL    TIKTOK          ; ADVANCE DATE SUBROUTINE
7F7C FE0D       01320           CP      13D             ; IS IT 12 MONTHS?
7F7E 3803       01330           JR      C,OUT           ; DONE IF NOT 12 MONTHS
7F80 CD8F7F     01340           CALL    TIKTOK          ; ADVANCE DATE SUBROUTINE
7F83 D1         01350 OUT       POP     DE              ; RESTORE DE REGISTERS
7F84 E1         01360           POP     HL              ; RESTORE HL REGISTERS
7F85 F1         01370           POP     AF              ; RESTORE ACCUM. & FLAGS
7F86 FB         01380           EI                      ; GET CLOCK TICKING AGAIN
7F87 ED4D       01390           RETI                    ; BACK FROM THE INTERRUPT
                01400 ; *****************************************************
                01410 ; ADVANCE TIME/DATE & RETRIEVE NEW VALUE SUBROUTINES
                01420 ; -----------------------------------------------------
7F89 AF         01430 TICTOC    XOR     A               ; CLEAR ACCUM. TO ZERO
7F8A 77         01440 FINISH    LD      (HL),A          ; HRS, MIN, OR SEC = 0
7F8B 23         01450           INC     HL              ; MOVE TO NEXT POSITION
7F8C 34         01460           INC     (HL)            ; TIME = TIME + 1 (CARRY)
7F8D 7E         01470           LD      A,(HL)          ; SET UP TO TEST VALUE
7F8E C9         01480           RET                     ; BACK TO COMPLETE TEST
7F8F 3E01       01490 TIKTOK    LD      A,1             ; A = 1 FOR DAY OR MONTH
7F91 18F7       01500           JR      FINISH          ; OTHER ROUTINE DOES WORK
                01510 ; *****************************************************
                01520 ; THIS IS THE DAYS-IN-A-MONTH LOOKUP TABLE - NO LEAP YEAR
                01530 ; -----------------------------------------------------
7F93 00         01540 LOOKUP    DEFB    00              ; DUMMY BYTE, BUT THEN...
7F94 20         01550           DEFB    32D             ; THIRTY DAYS HATH
7F95 1D         01560           DEFB    29D             ;       SEPTEMBER,
7F96 20         01570           DEFB    32D             ; APRIL, JUNE, AND
7F97 1F         01580           DEFB    31D             ;       NOVEMBER;
7F98 20         01590           DEFB    32D             ; ALL THE REST HAVE
7F99 1F         01600           DEFB    31D             ;       THIRTY-ONE,
7F9A 20         01610           DEFB    32D             ; 'CEPT FEBRUARY, AND
7F9B 20         01620           DEFB    32D             ;       YOU KNOW ALL
7F9C 1F         01630           DEFB    31D             ;       THE NONSENSE
7F9D 20         01640           DEFB    32D             ;       THAT'S INVOLVED
7F9E 1F         01650           DEFB    31D             ;       WITH THAT SILLY
7F9F 20         01660           DEFB    32D             ;       MONTH!
                01670 ; *****************************************************
                01680 ; "CMD" PATCH CHECKS PARAMETERS, SYNTAX, AND SETS TIME
                01690 ; -----------------------------------------------------
7FA0 114340     01700 START2    LD      DE,SECOND+2     ; POINT DE TO HOURS POS'N
7FA3 7E         01710           LD      A,(HL)          ; CHAR AT LINE POINTER
7FA4 FE22       01720           CP      22H             ; IS IT A QUOTE MARK?
7FA6 204A       01730           JR      NZ,OTHERS       ; CHECK FOR CMDT OR CMDR
7FA8 CDDB7F     01740           CALL    CONVRT          ; READ/CONV. ASCII HR.
7FAB FE3A       01750           CP      3AH             ; IS IT A COLON?
7FAD C29719     01760 SYNERR    JP      NZ,1997H        ; GO TO ?SN ERROR ROUTINE
7FB0 CDDB7F     01770           CALL    CONVRT          ; READ/CONV. ASCII MIN.
7FB3 FE3A       01780           CP      3AH             ; IS IT A COLON?
7FB5 20F6       01790           JR      NZ,SYNERR       ; SYNTAX ERROR IF NOT :
7FB7 CDDB7F     01800           CALL    CONVRT          ; READ/CONV. ASCII SEC.
7FBA FE20       01810           CP      20H             ; IS IT A SPACE?
7FBC 20EF       01820           JR      NZ,SYNERR       ; SYNTAX ERROR IF NOT
7FBE 114540     01830           LD      DE,SECOND+4     ; POINT DE TO MONTH POS'N
7FC1 CDDB7F     01840           CALL    CONVRT          ; READ/CONV. ASCII MON.
7FC4 FE2F       01850           CP      2FH             ; IS IT A SLASH?
7FC6 20E5       01860           JR      NZ,SYNERR       ; SYNTAX ERROR IF NOT /
7FC8 CDDB7F     01870           CALL    CONVRT          ; READ/CONV. ASCII DAY
7FCB FE2F       01880           CP      2FH             ; IS IT A SLASH?
7FCD 20DE       01890           JR      NZ,SYNERR       ; SYNTAX ERROR IF NOT /
7FCF 114640     01900           LD      DE,SECOND+5     ; POINT DE TO YEARS POS'N
7FD2 CDDB7F     01910           CALL    CONVRT          ; READ/CONV. ASCII YEAR
7FD5 FE22       01920           CP      22H             ; IS IT A QUOTE MARK?
7FD7 2001       01930           JR      NZ,EXIT         ; DONE IF A QUOTE MARK
7FD9 23         01940           INC     HL              ; BUMP POINTER PAST QUOTE
```

Program continues

public domain. The new B-17 is a much nicer piece of work, loading and saving BASIC programs at better than four times the normal cassette speed. It's one of the best bargains in the field at $22 postpaid.

The final program I can't do without is one of my own, called KEEPIT (The Alternate Source, 1806 Ada, Lansing, MI 48910). Many of you have written programs you never use; I do it all the time. But whenever I write in BASIC, I first load this one. It saves BASIC programs with variables intact, saves blocks of memory, and has a miniature monitor that allows you to create special machine-code features in BASIC. For details, see the review in the December *80 Microcomputing*.

As for software I wish I could do without, my primary candidate for this honor is Electric Pencil. It is an old and weak program with many flaws. The nearest reasonably priced competitor is Radio Shack's Scripsit, which seems to have been written for a computer operator (sorry, Tandy). I wait for a text-editor program at non-ripoff prices; until then, resentfully, it's Pencil.

```
7FDA C9         01950 EXIT    RET                       ; BACK TO BASIC
                01960 ; ***************************************************
                01970 ; CONVERT ASCII TO HEX AND POKE INTO CLOCK TIME$ LOCATION
                01980 ; ---------------------------------------------------
7FDB 23         01990 CONVRT  INC     HL                ; BUMP LINE PTR. BY ONE
7FDC 7E         02000         LD      A,(HL)            ; GET CHARACTER IN LINE
7FDD D630       02010         SUB     30H               ; CONVERT ASCII TO HEX
7FDF 3C         02020         INC     A                 ; MAKE A BE AT LEAST 1
7FE0 47         02030         LD      B,A               ; SAVE THAT VALUE IN B
7FE1 3EF6       02040         LD      A,0F6H            ; A= 100 HEX MINUS 10 DEC
7FE3 C60A       02050 MULT    ADD     A,0AH             ; MULTIPLY BY ADDITION
7FE5 10FC       02060         DJNZ    MULT              ; I.E., A = B TIMES 10
7FE7 47         02070         LD      B,A               ; SAVE THAT VALUE IN B
7FE8 23         02080         INC     HL                ; BUMP LINE PTR. BY ONE
7FE9 7E         02090         LD      A,(HL)            ; GET CHARACTER IN LINE
7FEA D630       02100         SUB     30H               ; CONVERT ASCII TO HEX
7FEC 80         02110         ADD     A,B               ; A = (B * 10) + A
7FED 12         02120         LD      (DE),A            ; TIME IS SET, PUT IN DE
7FEE 1B         02130         DEC     DE                ; BUMP DE TO NEXT PLACE
7FEF 23         02140         INC     HL                ; BUMP LINE PTR. BY ONE
7FF0 7E         02150         LD      A,(HL)            ; GET CHARACTER IN LINE
7FF1 C9         02160         RET                       ; RETURN FOR FURTHER TEST
7FF2 FE52       02170 OTHERS  CP      52H               ; IS IT CMDR (CLOCK OFF)?
7FF4 2003       02180         JR      NZ,NEXT           ; NOPE, TRY FOR CMDT
7FF6 F3         02190         DI                        ; TURN OFF THE CLOCK
7FF7 23         02200         INC     HL                ; BUMP LINE PTR. BY ONE
7FF8 C9         02210         RET                       ; BACK TO BASIC PROGRAM
7FF9 FE54       02220 NEXT    CP      54H               ; IS IT CMDT (CLOCK ON)?
7FFB 20B0       02230         JR      NZ,SYNERR         ; NOPE, MUST BE ERROR
7FFD FB         02240         EI                        ; TURN ON THE CLOCK
7FFE 23         02250         INC     HL                ; BUMP LINE PTR. BY ONE
7FFF C9         02260         RET                       ; BACK TO BASIC PROGRAM
                02270 ; ***************************************************
7EC0            02280         END     ENTRY
00000 TOTAL ERRORS
```

Paper Goods

I have eight shelves of books, magazines, and ephemera about computers. These I dust weekly. Next to my TRS-80 are a few well worn volumes.

If you have a TRS-80, you should already have the Level II BASIC manual and should purchase the *Technical Reference Handbook*. The latter is the most responsible piece of hardware documentation you're likely to find in the entire field of microcomputers. Even if hardware is not your strength, read this book.

Next to it on the desk is the Editor/Assembler manual. With its complete descriptions of Z-80 instructions and its cross-reference tables, it's invaluable for writing and debugging. I've rebound my own copy with a listing of all the ASCII and graphics characters, and a detailed memory map of the machine. No need to go out and buy the books advertised as "Z-80 Instruction Sets"; you get the works with the $30 invested in EDTASM.

In a fat loose-leaf notebook resides that prize and nemesis of the TRS-80 user, a disassembled listing of the Level II ROM. If you haven't made one, obtain a disassembler and a printer, set it going, close the door and come back a day later. What you'll see isn't quite accurate (There's a lot of data and ASCII in that ROM), but help is available as you plug your way through 12,000 lines of assembly listing. In the front pocket of the same notebook I've put a copy of *Supermap* (Fuller Software, 630 E. Springdale, Grand Prairie, TX 75051) and *Inside Level II* (Mumford Micro Systems, Box 435, Summerland, CA 93067). The former indexes a major portion of ROM activities, the latter details and explains their use.

By the time you read this, a new publication from IJG (569 N. Mountain Ave., Suite B, Upland, CA 91786) will be in the stores. It is *Microsoft BASIC Decoded*, by James Farvour, a line-by-line complete annotation of the Level II BASIC ROM. Farvour gets around the problem of Microsoft's copyright ownership by providing blank columns for you to paste in your own disassembled listing of the code. Your purchase of the TRS-80 gives you the license to do just that.

My hardware library is completed with a copy of the *Z-80 Technical Manual* (Zilog, Inc., 10340 Bubb Road, Cupertino, CA 95014) and the National Semiconductor TTL and memory data books (sold by Radio Shack).

Other Stuff

As I mentioned earlier, my TRS-80 has a reverse video modification that has made many hours before the screen quite a bit more relaxing. Another beauty is the "Fatigue Fighter," described as an optical band-pass filter. In other words, it fits over the screen and makes the characters look green. Much to my surprise, this device makes white-on-black characters not only more tolerable, but almost enjoyable in their other-worldly glow.

If you find your expansion interface just a bit too close to the CPU, and you've got one of the reliable interfaces (no buffered cable), you might consider a longer connection between the two. My short grey cable has been successfully replaced with a 24-inch one, available from all of the suppliers mentioned above.

How Much?

All of these programs, books, and the few pieces of hardware total less than the cost of a single disk drive—altogether under $300. In an age of increasing inflation and apparently decreasing quality, it seems to me remarkable that we can purchase, operate and document a powerful microcomputer for little more than a thousand dollars.

Let me encourage readers to drop me a card if they have found a particular book, program or attachment to be of general interest, special value, and low cost.

Any Finally . . . the Clock

At last we turn to the software which will accept signals from the one-second interrupt clock circuit published in October's *80 Microcomputing*.

The patches into the TIME$ and CMD routines are essentially the same as those used for the MSM5832 clock (as described in November "Applications"), but the format of the time and data accepted and printed is somewhat different. To set the time, enter:

```
CMD"00:00:00 01/01/81"
```

Use the spaces and punctuation exactly in the order you see them. The program checks for correct syntax but not for possible actual times. So, at least until the

clock is upoated, it will display whatever odd and impossible times you may set it to.

To print the time and date, merely enter: PRINT TIME$. You may use TIME$ in the same way you would use other strings; you can PRINT, LPRINT, use MID$, LEFT$, RIGHT$, and most other string manipulation. For details on how it works, see the software in November's Applications.

The significant part of this program is found in the interrupt service routine beginning at line 1060. Interrupts are disabled while this routine is being taken care of, and the active registers are saved on the stack. The seconds are updated, and when the number reaches 60 the minutes are updated. Hours are updated at 60 minutes, and days are updated at 24 hours.

When days are updated, a lookup table is searched for the corresponding month (lines 1540 to 1660) to check for overflow into month updating. After 12 months, the year is updated, but without checking for the turn of the century!

The routine returns to the program in progress after only a few microseconds.

Although I've had no trouble CLOADing with the clock, some time-sensitive programs may be affected by the use of the clock. Therefore, to turn off the clock's interrupt before CLOAD and whenever needed, enter: CMDR. Note that no quotation marks are used in this command (it differs from DOS and Level III BASIC). To return the clock to operation, enter: CMDT.

This program may be relocated by changing the origin (line 120); if used as written, MEMORY SIZE should be set to 32448 for 16K machines.

Notes

A note about the interrupt hardware: If you use a transformer other than the one specified, you may have to put a 100 to 1000 Ohm resistor in series from its output to the 7414 to obtain reliable counting. A small capacitor to ground at that point will also help eliminate any amplified power glitches.

Next month: Add ROM and RAM to your Model I TRS-80. All the advantages of ROM in RAM. The famous Read-Only RAM! Ready?■

80 APPLICATIONS UNSCIENTIFIC READER SURVEY

Mail to Dennis Kitsz, Roxbury, Vermont 05669

Check one:

____More hardware; how much?_____

____More hardware, less software; how much?_____

____More software; how much?_____

____More software, less hardware; how much?_____

____Everything's okay!

____Nothing's okay; do this:_____

The software I use that appeared in this column:

_____

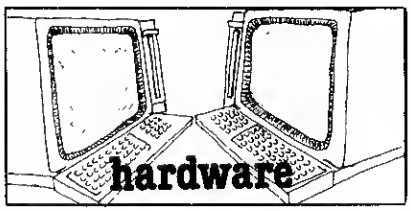
The hardware I use that appeared in this column:

_____

80 REVIEWS

Edited by Pamela Petrakos

"Simply stated, the printer is built like a Sherman tank."



Daisy Whaal II
Tandy/Radio Shack
Ft. Worth, TX
$1995

by **Bob Liddil**

In late August, 1980, Radio Shack announced a series of startling new products. One of the most promising was an inexpensive, letter quality printer. Priced by Radio Shack stores at $1995, the Daisy Wheel II represents a pricing breakthrough in word processing accessories.

Unlike some of its half-thought-out cousins in the Tandy printer line, the Daisy Wheel II is well designed and carefully constructed. Its construction is of heavy-guage cast aluminum with virtually no plastic anywhere, except for a few knobs and switches required for operation. The metal exterior is supported by a cast aluminum frame. And in between the two is a layer of foam rubber for sound insulation. Only the nylon pulley wheels, the daisy wheel, and the rubber platen are non-metallic. Simply stated, the printer is built like a Sherman tank.

The sparse, but functional front panel displays a power light, and two switches —on line/off line, and pitch control. There are three possible pitch modes, 10 characters per inch, 12 characters per inch, and proportional spacing. Optimum results with pitch are related to the font wheel that is in the printer. The Courier 10 font, which came with the printer, optimizes the 10 position, the Prestige Elite font (optional) uses the 12. The Madeleine font (also optional) requires that the switch be set on proportional spacing. Some interchanging of font and pitch may occur but the printing of a 10 font at a 12 setting jams the letters together.

The wheel and print ribbon were designed in word processing heaven. They are easy to remove and replace, a blessing to non-technical types like myself.

The interior controls are equally simple to deal with. Impression intensity of the print is controlled by a simple three-position switch inside the printer.

At the rear of the printer are two switches, power and self test. The self test reveals characters that cannot be accessed by either Electric Pencil or Scripsit, the two best known premium TRS-80 word processors. But don't let that throw you. The Daisy Wheel II seems capable of printing both the French and German alphabets, if you have the software to generate them.

With a print speed of 43 characters per second, carriage return speed of 300ms/13.6, and line faad speed of four inches per second, the Daisy Wheel II can compare with more expensive units and be counted as a better investment. This is one instance where Radio Shack has an advantage ovar the competition. With a lower price and seven thousand locations to bring it for repairs, there seems little doubt that the Daisy Wheel II is a winner.

For anyone who wants letter quality word processing, the Daisy Wheel II can provide it at a fraction of the cost of other systems. Its plug-in compatibility with both Models I and II is hassle-free. We simply powered up and started printing. ■

Lina Printar IV
Tandy/Radio Shack
Ft. Worth, TX
$999

by **William O'Brien**

Radio Shack recently announced the availabiltiy of its Line Printer IV. It is basically a Centronics 737, repackaged in the familiar Radio Shack black and silver color scheme. It is capable of printing on either formfeed, roll or single sheet paper. Taken by itself, on its own merit, it is a breakthrough in the low cost quality printer market. The printed output characteristics are:

- Ten characters per inch, monospaced. This is the primary character set, in use any time the printer is turned on. Monospaced refers to the width of the printed character (in this case, all alphanumerics have the same width).
- Proportionally spaced characters. This is the secondary character set, which must be activated by outputting CHR$(27) (decimal code for ESC) and CHR$(17) (decimal code for DC1) to the printer. Proportionally spaced printing takes advantage of the fact that different characters often have different widths. If you type an *i* you might notice that the width across the letter itself is less than of a *w*. In this print mode tha Line Printer IV takes advantage of these differences and prints each letter, number or symbol according to the actual letter width (most printers assume all characters have a width of 1). In this mode, the output is close to letter quality.
- Characters print at 16.7 per inch monospaced. Turnad on by printing CHR$(27); CHR$(20), this is a 132 character per line typeface with the same spacing characteristics as the primary character set above. It is also suitable for letter quality, but of footnote size.
- All type faces have upper and lower case, with descenders, and may be printed in elongated characters or with underlines by printing other control codes. Line feeds may be either half or full, forward or reverse (this last feature lets you use sub and superscripts).

Supplied with the IV is a paper roll holder. Paper loading, if you read the directions, is no problem, no matter the type including single label sheets. Ribbon changing is also no great problem, but a third hand would be helpful (plastic gloves are supplied in the ribbon pack).

The Bad with tha Good

There are weak points which will prove major or minor, depending on how you want to use the machine. For example, there are no sense switches for out of paper or cover removed conditions, con-

sequently printing is not halted if either of these occur. I have been using continuous form paper, and there is a tendency for the first sheet to wrap around and get dragged back into the feeder mechanism. The solution has been to simply keep alert after the first full sheet print and route it away from the feed entrance.

Front panel switches are for on/off, on line/off line and rev/fwd linefeed. The linefeed switch will only work with the printer off line. The switches themselves are the bat handle type, and I wonder if they will withstand lots of use (to feed a sheet out, you throw the line switch to off, and then either single linefeed the sheet out by toggling the LF switch or use continuous feed by holding it).

The control codes used to print elongated characters, unlike those for underlining, must be re-issued at the start of each new line. Either elongated or underlined printing may be terminated at any point by printing the correct control codes.

The Ugly

When the Line Printer IV was first advertised by Radio Shack, the ads pictured it in use with Scripsit, and if my memory serves me correctly, it was touted as being the "near perfect match" for letter quality printing.

Yet in fact, nothing could be further from the truth. From Scripsit you cannot activate the underline facility, nor the superscripts or subscripts. Unfortunately, using the proportional print, line length assignments become almost meaningless. The proportion of a letter is totally ignored by Scripsit, and it is that typeface which produces near letter quality print.

Please don't go running off howling about Radio Shack sticking it to us again. From talking to some of the people at Computer Services I think they were somewhat surprised themselves. I imagine this misdirection in Radio Shack's initial ads was due to their naivete in the field—it takes more than three years to become an expert.

Also, from the same hallowed sources, there will very likely be a new release of Scripsit sometime in the next year that will take advantage of those features.

If that seems an unendurable time to wait, you might want to contact Microtronix in Philadelphia. They have a patch for Scripsit that will allow certain control codes to be inserted in the text, thus activating some of the features of the Line Printer IV/737 (although it won't take care of the proportionality problem, unfortunately). ■

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

Proportional Normal

```
 !"#$%&'()*+,-./0123456789:;<=>
@ABCDEFGHIJKLMNOPQRSTU
`abcdefghijklmnopqrstuvwxyz{|}
```

Proportional Elongated

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

10 CPI Monospaced

```
 !"#$%&'()*+,-./012345
@ABCDEFGHIJKLMNOPQRSTU
`abcdefghijklmnopqrstu
```

10 CPI Elongated

Table 1. Character Styles and Features of Line Printer IV.

Cryptext
Cryptaxt Corporation
Seattle, WA
$500 Basic Package: Unit
Manual Power Cable
Damo Softwara
Extension Cable

by Terry Kepner

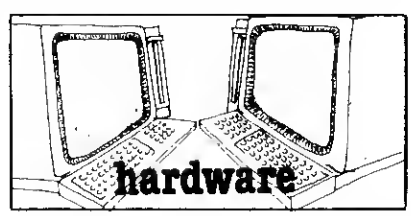
Businesses beware! Are your computer records secure? Are they safe from prying eyes? Are they protected from accidental (or deliberate) alteration by unauthorized employees or outsiders?

Cryptext is a combination of software and hardware that allows storage of almost any type of data (i.e. inventory, financial, technical, proprietary, graphics, ASCII text, programs, etc.) either on tape or diskette, in an unrecognizable, unbreakable code. The code can only be decoded by the Cryptext hardware/software combination, and only if you use the exact original encoding key.

This key is composed of a sequence of ten characters—any ASCII character that can be generated by the keyboard, including special characters such as punctuation marks, the equals sign, the arrow keys, and so forth. Because of the long length of the key, 80 bits, there are over 1.20893E + 24 (10 to the 24th power) different combinations possible, enough to defeat even the fastest computer system (it would require 380 billion years to search through all the possibilities, at a rate of ten thousand tests per second). However, to prevent someone from trying to guess the right key by rapidly typing in a series of keys, there is a built-in timer delay between keyboard input of the key and the negative response of the unit.

To use Cryptext is simple. First, plug in the hardware. Cryptext attaches to either your keyboard (it plugs directly into the expansion port) or to your expansion interface port.

This device is rather heavy (a 3 × 5 × 1 inch permanently sealed black box) and puts a noticeable strain on the edge card connector of your computer. I strongly suggest that the extension cable sold by Cryptext be used so that the weight of the hardware doesn't damage your computer.



The manufacturer concurs.

Next, the power cable is installed. Cryptext comes with a special power supply cable that is inserted between the cable from the power supply and your computer. The special cable has a small wire that connects to the encryption device to power it. It does not affect the keyboard, or violate any Radio Shack warranty.

With Cryptext attached you may begin.

Before you can start encoding your data, give Cryptext a 10-byte key. Cryptext comes with both a BASIC and an assembly language program to help you accomplish this. Once Cryptext has its key, which is not recorded in memory and cannot be found by using PEEK or any other machine language tricks, it is simple to encode data. You just send your data to the encoder, one byte at a time, retrieve the altered, encrypted byte and then save the byte to tape or disk. This is repeated as many times as needed for the data you want to store.

To decode your data, you give Cryptext your 10-byte key, feed it the encoded data, and retrieve the decoded characters.

All of this is carefully explained in a 26-page manual that is very thorough and even gives you a simple test program, command structure summary, and pin-out diagram, as well as lessons on how to use the Cryptext commands in your BASIC or machine language programs.

Cryptext is Unique

All of this is good, but what makes Cryptext different from other encoding devices for computers?

Well, Cryptext uses a special proprietary algorithm instead of the encryption standard established by the United States Bureau of Standards. This makes the code difficult to break. Also, since the algorithm is very non-linear and the key length is 80 bits, it is superior to the system suggested for use by the bureau.

In addition, the Code Branch feature allows Cryptext to modify its code sequence as it operates, giving you incredible possibilities for data protection should someone manage to obtain a plaintext translation of a specific block of code. While he might be able to decipher a few more bytes of data, the next Code Branch taken by Cryptext would leave him baffled. Only another Cryptext unit and the proper key word would allow him to decipher the rest of the code.

Cryptext is a major advance in data protection, eliminating almost any possibility of someone's stealing your vital mailing list, sensitive financial records, or even secret programs. As in most sophisticated security systems, its weakest point, however, is the human element. By carefully selecting people allowed access to the key, and by frequently changing the key, you will be able to use Cryptext to make your data virtually theft proof. ■

Pensawrite Word Processor
Pensadyne Computer Services
Vancouver, BC
$7.50

by **Louis Zeppe**

For me, programs that cost more than $30.00 are out of the realm of personal computing and require a fiscal justification. That is not an absolute line. For example, NEWDOS+, even with its poor documentation, has been worth the money.

Big name word processors that cost $100 or more do not seem to have any advantage either over my adaptation of Mitchell and Law's (CON)TEXT editor.

So, I am working on my own word processor and enjoy checking through inexpensive attempts. Caught by the idea of a $7.50 disk-based word processor, I plunked my money down and received a 21-page manual and cassette tape.

Pensawrite has five modules designed to work in a 16K single disk system. Two are printout formatters, one for letters and one for reports. One receives formats and creates upper and lowercase text. Another is used for editing. All four are invisible to the user and are called and controlled by the master menu and module.

Compared to most documentation that I've received, the manual is wonderful. Commands and processes are described in detail, without being wordy. The summary page ignores two important text-building commands. However, this is not critical. The program routines are documented with REM lines.

Had the authors been as careful with their programming as they are with this manual, I would recommend Pensawrite. Entering text is simple enough. A vertical line is printed at the 60th position on the screen and is used as a silent typewriter bell. No line may be longer than 64 characters. Text is stored to disk in 16-line chunks as a sequential file.

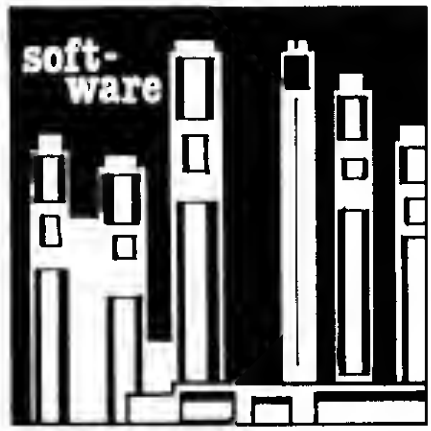
When you finish entering text, the program asks if you want the printout in normal typewriter fashion (upper and lowercase) and if you want it right justified. The first option allows a non-modified keyboard, like mine, to have lowercase. By avoiding INKEY$, this routine avoids processing delays that miss key entries.

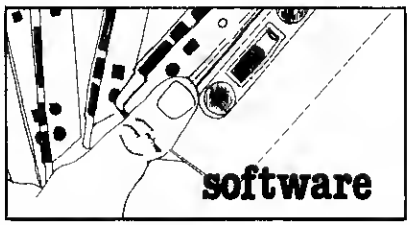
Right justification, the second option, is necessary in most books and magazines but has always seemed an unnecessary accessory.

Pensawrite also fails to live up to its potential. The 64-character input and use of hard copy is a natural limit for efficient use of memory and random access disk files. Memory is saved by keeping formatting routines at minimum. The user types most special formatting, like special indentations, though it would be nice to signal some single-space sections within double-space text. If you have special needs, Pensawrite won't do it.

The editor function is impossible because of its failure to use random access files. Every correction, no matter how insignificant, rewrites the entire text file. That is the nature of sequential files. Even for short texts, the editor takes too long. On a long text (about 80 lines), the wait is excessive, especially if you make errors and editorial changes.

The editor is so poorly designed that I do not recommend Pensawrite. It could be used for short personal letters that do not need careful editing—it does create a nicely formatted title page. It is an attempt toward inexpensive personal word processing. Pensadyne should take the TRSDOS manual and rewrite Pensawrite with random access files. ■





Compressor 1.1
Robert M. Chambers
Nepean, Ontario
$8.00

by Fred Blechman

Ever been hungry for a few more bytes of memory? If you've written any long BASIC programs for your TRS-80—or perhaps short ones that use lots of string or array space—you know how critical memory space can become.

There are various programming techniques for savings memory, but the most obvious ones eliminate unnecessary blank spaces, and remove REM statements. This can be done manually, editing each program line, or you can use Compressor 1.1.

Compressor is a TRS-80 Level II machine language program on cassette that removes all non-functional spaces and REM statements in a BASIC program. REM line numbers are retained, since some GOTOs or GOSUBs within the program may jump to those line numbers. Also, there are no combined lines, consequently no line numbers, GOTOs or GOSUBs are changed.

The program also attempts to distinguish between spaces within PRINT or LPRINT statement quotation marks. Compressor does not remove spaces between quotes because the screen and printed text would be affected.

First you load and RUN your BASIC program to make sure it's syntactically correct before compressing it. If it doesn't RUN properly before packing, it won't after packing, since Compressor preserves the logic whether it's right or wrong! Now type SYSTEM and ENTER, then type COMPRESS and ENTER to load Compressor. It only takes eleven seconds to load this program from cassette. As the program is loading, a message is displayed telling you the loading address is 32256—obviously for a 16K memory. No information is provided to change this loading address for 32K or 48K memories.

Once loaded, type / ENTER and a screen message identifies the program and tells you it's in operation. You can now LIST and RUN your compressed program to check for changes.

When I packed six different programs with Compressor 1.1, the running time was from 13 to 22 seconds. Four of them came out perfectly. All the REM statements were removed (although the line numbers remained) and spaces outside quotation marks (except after line numbers, which do not use memory) were deleted. The program ran perfectly, with text unaffected.

However, two other programs did not come out as expected. Apparently Compressor 1.1 has a bug that causes some programs to fool it! One of the two programs tested ended up with several REM statements untouched, and some text compressed, making it almost unreadable on the screen. I can't explain the malfunction, but the author has been informed.

How much memory do you gain with Compressor 1.1? Five programs saved from seven to 17 percent of original program length. The sixth one I tried was packed with individual line editing, yet Compressor squeezed out another 100 bytes somewhere, and the program ran perfectly!

There are other packing programs available but Compressor 1.1 is fast, easy to use, and priced very low. It also does not recover as much memory as a packer program that combines and renumbers lines as well as removing spaces and REMs.

Compressor 1.1 doesn't leave your BASIC program with possible syntactical traps generated by combining lines, nor are your program statements changed making your own creation a mystery to you!

The documentation for Compressor 1.1 is easy to follow and includes information on how to retain the program in high memory for repeated use. BASIC programming hints are also provided to save memory and speed execution of your programs.

Compressor 1.1 is a worthwhile program that helps fight that dreaded message—OM ERROR.■

Note: The author has recently received a corrected program, tested it and can no longer find any bugs! The bug, thus, has been corrected.

ElectreSketch
Macrotronics Inc.
Turlock, CA 95380
$14.95

by Joseph H. Cowen

You've gottasayitfast. Fandamntastic. The best things sometimes come along by accident, and that's how I came to own and love my ElectraSketch. It's an excellent and creative addition to my TRS-80's trappings, and it's inexpensive.

Macrotronics, Inc., is a California think tank which started less than two years ago as a home operation. It focused on the needs of amateur radio operators who hoped to tap their computers into radioteletype and other such mysteries.

Macrotronics has since moved into a large building and offers 30 different products, one of which is the dynamite *ElectraSketch*, designed by Tim Vaughan.

When I showed one of their brochures to a friend he immediately ordered ElectraSketch.

When it arrived, he hadn't read the fine print saying it had been designed for disks. Having no interest in buying a disk drive for his borrowed TRS-80, he offered the program to me. The price was exactly what he had paid for it himself.

Not one to pass up a good deal, I toted the cassette home, paying little attention to it and its excellent instruction manual. On a particularly boring evening I finally decided to see what it was that I had bought for less than the price of a bottle of good whiskey.

After spending five minutes with the instructions and cassette, I regretted not having looked at the program earlier. It's worth the price just to transfer it to disk and watch all its catchy gyrations in the process.

The ElectraSketch cassette contains six files, and when transferred to disk, they provide the ability to:

- Create graphics
- Store pictures on disk
- Retrieve pictures from disk
- Animate graphics
- Vary animation speed
- Obtain hardcopy printouts on a line printer
- Draw line vectors
- Fill in backgrounds
- Intersperse alphanumerics with graphics

As the manual points out, "Using ElectraSketch, it is quite simple to create elaborate pictures interspersed with standard text, print them on a line printer, animate them, and store them on a disk for

later use or modification."

Pictures are created under the program heading ESK, using control keys for cursor movement, to the extent of adding to or subtracting from a scene without disturbing the original.

You can draw lines point to point, blank out the screen, or fill it with ASCII mumbo jumbo, save it all on disk, and print it out if your system is so equipped.

When you look at the sample graphics provided in the program, which you view as you make your disk (including a spectacular animated sequence of a running internal combustion engine), you'll see what a little creativity can do for the TRS-80.

Creativity

Watching a gasoline engine running convinced me that I've been in the dark when it comes to graphics utilization on my computer. Watching the intake, compression, power and exhaust cycles, with valves opening and closing, would be a dandy lesson in itself, especially for anyone unfamiliar with the inner workings of car and lawnmower engines.

Keys 1 through 0 control the animation speed, which can be changed instantly while the program is running. The graphics are included in the package, or can be a design you create yourself.

The engine program is particularly helpful for operators learning animation tricks. It illustrates how to combine alphanumerics with the graphic designs of the piston, connecting rod and other components.

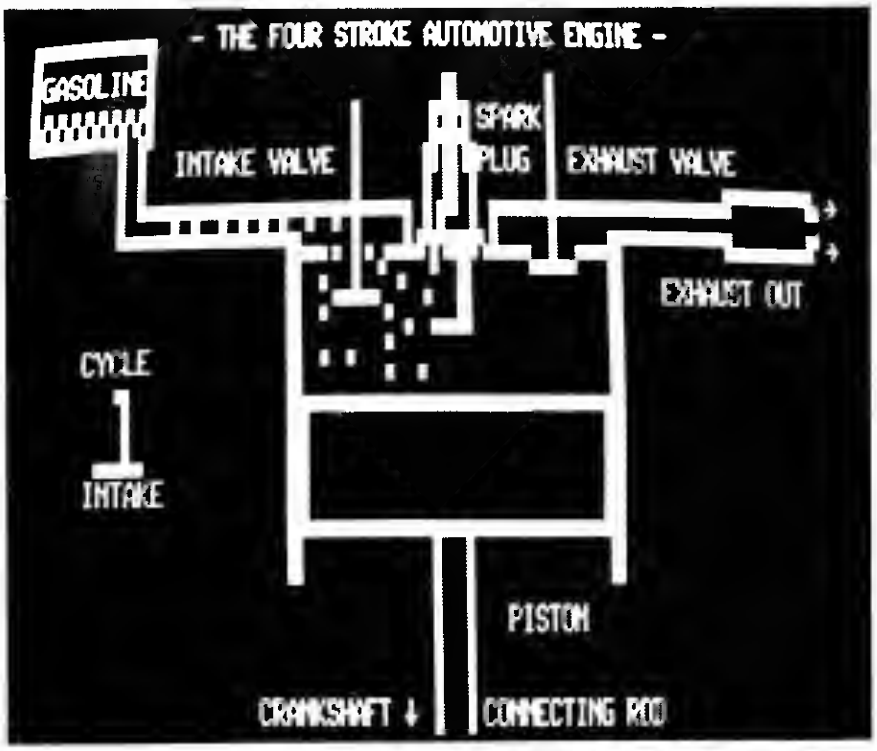
When creating your own displays, you do have to keep track of the remaining RAM, making sure that your BASIC program fits into a reserved spot.

There's some variation in the number of available animation frames, depending partially on the memory limitations of your TRS-80. About 80 frames are available with 48K, and probably half that for a 32K version.

While the program loads from cassette to disk, relax and enjoy the delightful characterizations which run across your screen. The package comes with clear, point-by-point instructions to lead you through the 17-step loading process.

You can make the animation a sequence, which has many values in computer assisted instruction, in how-to projects and the like, or you can make the action continuous.

If you are in sales and own a computer, the potential for eye-catching visual displays with Macrotronics' ElectraSketch is an inexpensive, practical approach. In fact, I recommend ElectraSketch to anyone interested in computer graphics.■



Fantastic computer graphics are easy with the program designed by Tim Vaughan.

Programmer
Rational Software
Pasadana, CA
Cassette $25.00

by Dennis Thurlow

Programmer is a machine language utility that fits into the top 1.4K of memory and adds commands to BASIC. Pressing SHIFT/BREAK brings up the PRO* prompt and allows the user to (D)elete, (M)ove a block, (R)enumber from any line to any line, (P)ack a program into less space, or (A)ppend from tape.

The renumbering routine lets the user pick where the renumbering should start, what that line should be, what the increment should be, and what old line number to stop at. It works like a charm.

An excellent use for the append routine is to keep a library of BASIC routines on tape and add them to programs as needed. These two routines would make a super package by themselves! The rest of the utility is, unfortunately, flawed.

(P)ack is supposed to remove all spaces not in a string, delete all remarks, and if a reference is made to a deleted line, update the reference. The problem occurs when two or more lines of remarks are in sequence. Only the first is deleted. A simple fix would be to have the routine repeat until no changes are made. Of course, the user *could* do it but that's what programs are for.

(M)ove inserts a block of BASIC text designated by a starting and ending line number into another location, again designated by line number. It deletes the moved text and renumbers it in its new location. It will not renumber the program to make room for the lines to be inserted. If there isn't room, the documentation says an error message is generated. The version I received would either freeze up, do the insert but renumber in crazy ways, or fill the screen with kaleidoscopic patterns.

Since the delete function is already provided in BASIC, perhaps the author would have room to fix the bugs by dumping the delete function, but he or she should keep one other thing in mind. Once memory has been protected for a program, utility or routine, no more overhead should be necessary for its operation. The protected space should include a buffer, or the stack can be used. Programmer doesn't presently work this way.

I hope Rational can repair the shortcomings of this package, as it contains much merit and, with a little work, promises to be extremely useful.■

The Alternate Source
The magazine of advanced applications and software for the TRS-80
Lansing, MI
$9 per year (6 issues)

by **Dennis Bathory Kitsz**

Not long ago there was rarely a source to turn to for reliable information on the TRS-80. If any was to be found, it was either of the novice-oriented "I love my computer" variety, or in the form of arcane treatises on the advantages of memory-mapping restarts to ROM.

Since then, we have witnessed the birth of *80 Microcomputing* with its glossy, eclectic approach. Less heralded was the simultaneous appearance of *The Alternate Source* (TAS). It is the balancing end of the major publications, favoring the modest journal approach rather than a popular one. It belongs to that class of publications dedicated to the personal perfectionist, such as *The Audio Amateur* and *Photophile*.

TAS is not a pretty publication. It is dutifully prepared on an IBM Selectric with a TRS-80 based text editor, resulting in a plain, neatly typed document.

TAS makes no apologies for being oriented toward disk owners. According to publishers Charley Butler and Joni Kosloski, the majority of their subscribers are disk users, and they feel *TAS* is filling the needs of TRS owners who complain that most TRS-80 publications have been reluctant to include disk applications. With that in mind, nearly all of the first issue and fully half of the latest issue (#4) offered disk information exclusively.

Machine or assembly language programs, particularly utilities, are another *TAS* emphasis. In the first four issues, 18 utility programs or tutorials were published, including sound generation routines, auto-executing programs, disk patches, uses for disabling BREAK, description of power-up sequences, a disk file killer, and so on. Issue #5, which will be published by the time you read this review, will be distinguished by the publication of PENRAM, a lengthy article and program enabling screen editing of all sorts of programs and information.

Technical questions from readers are answered by Jesse Bob Overholt from the Circle J Software Ranch on "180,000 microacres," and regular letters from readers are also published. Surprisingly, the magazine's studious formality has not obscured the personalities of publishers Butler and Kosloski, who address readers' comments directly.

Of particular interest to those using the TRS-80 as a major vehicle in their lives is the availability of each issue of *The Alternate Source* on tape or disk as an "Electric Pencil" file. Unlike *CLOAD* magazine, which consists exclusively of programs, and unlike the balance of printed TRS publications, which demand that the reader enter all programs by hand, *TAS* can either be read or run . . . which means no typos in long programs. The tape/disk versions of *TAS* is sold individually at $5 per issue.

Finally, *TAS* contains a bulletin board for new information, includes software reviews, covers information on the TRS-80 Model II, and has no advertising except for its own software library. Even that advertising is modest, unlike some mags that exist exclusively as promotions for their own products. It also publishes a special update sheet called "Between the Issues," intended to serve as a free-form newsletter/editorial page with a shorter lead time than the magazine itself.

From the above description, it would seem that *The Alternate Source* is an ideal publication. Not quite. Its approach is somewhat "old school," in that it views the TRS not as a departure, but rather as a logical new member of the historical data processing family.

Data processing is considered "professional" rather than a hobbyist or industrial concept, and so in *The Alternate Source* you will not find: hardware articles other than reviews; games or pastimes; photographs or diagrams; programming as it relates to electronics or process control; mechanical or electronic fixes, additions, or improvements. The "advanced applications and software" in the magazine's subtitle should perhaps read "advanced software applications".

The Alternate Source succeeds in presenting literate and detailed applications articles, particularly in areas of TRS-80 programming where gaps in general knowledge exist. Its subscription rate is easily paid back in the high quality of the programs it publishes. ■

TRS-80 Level II Basic,
A Self-Teaching Guide
Albrecht, Inmen, Zamora
Tandy/Radio Shack
Ft. Worth, TX
Softcover, 348 pp.
$9.95

by **Dan Keen & Dave Dischart**

Radio Shack has a new book out, one we wish had been available several years ago as we struggled to learn BASIC programming on a Level II.

The book takes you from scratch, assuming you know nothing about the Level II machine or programming. It even tells you how to turn the computer on!

The book is clearly written and illustrated with plenty of examples. And to help you through the somewhat dry, technical process of learning computer programming, it has frequent cartoon drawings that add humor and provide a break in the text.

Periodic quizzes check how much you learn. Even these are funny. For example, when drilled on writing a simple program line, one question asks: "At a certain time during his legendary life, Firedrake the Dragon measured 1,000 centimeters from the tip of his firebreathing nostril to the longest point of his multiforked tail. Write a print statement to compute Firedrake's length in inches." We are told he has grown since the book was published.

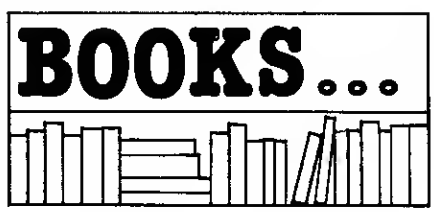
And then there's the problem involving interest rates at "Erosion Savings & Loan" where, due to inflation, your money loses 4 percent a year.

The chapter on graphics in this book is very comprehensive and the appendices cover a range of subjects from setting up the TRS-80 to ASCII codes.

A lot of material is covered. However, machine language and such techniques as string packing are not dealt with, but we think they should have been mentioned.

This book is designed for the guy who just bought a Level II machine and has never seen a Level I owner's manual. Unless you know programming, you'll need the computer in front of you to get the most out of the material. If you are upgrading your system from Level I to II, get it. It's a necessary supplement to the owner's manual.

The authors are to be credited for putting together this nice piece of work. Maybe they'll tackle another book using this writing style for say, TRSDOS. ■




Taranto
The Total System Store

I started by selling programs, and a year later they said I was "the standard of the industry."

Now I'm selling the whole computer.

I'm Irwin Taranto, the one who changed the TRS-80* into a serious business computer.

Thousands of businesses tried my programs in the last year and a half, and sometimes it seems like every one of them has called me on the phone. With every call, I get another idea. I polish, alter, upgrade and correct these programs constantly.

By now I know how they work best, and exactly what they need in the way of peripherals. It's only logical that I should sell the whole computer system, not just the program diskettes.

So if you look at the computer in the picture, you'll see it says "Taranto" on it, not "TRS-80." The keyboard and CRT unit are a Tandy II* (that's what the manufacturer calls TRS-80 Model II when it's not sold through the Radio Shack). If it fits your needs better, though, we'll get the disk drive or the line printer somewhere else.

When you buy one of these Taranto computers, you get some serious advantages.

Some serious advantages.

You get hardware that's absolutely tailored to my programs. This means you'll be able to use every bit of the capability that's built into these systems.

You get my backup, down the line. And the manufacturer's repair and service guarantee on all the hardware. If something goes wrong, we tell you how to fix it over the phone. If the problem's tough enough, I get on the phone myself. If we find out it's a hardware problem, any Radio Shack Service Center will fix it under Tandy's guarantee, even though it says "Taranto" on the machine.

In a lot of cases, we can help you set it up, too. I'm putting a group of authorized dealers together. Before long, they'll be all over the country, able to bring the equipment and programs right to your business. They'll spend a day or so with you helping you shake it down. It'll cost a little more, but it's good insurance.

The programs.

When you buy a Taranto computer, you're also buying these systems — any or all — each custom-tailored to your own needs, all interacting with each other, all integrated with the General Ledger.

General Ledger/Cash Journal
Accounts Payable/Purchase Order
Open Items Accounts Receivable/Invoicing
Balance Forward Accounts Receivable (new)
Payroll/Job Costing
Inventory Control (new)

Of course, if you already own a TRS-80 (any model), all our programs are available without the hardware.

Put it all together, and you have a truly serious, truly supported computer, software and hardware included — for as little as $8000.

I think they just might decide I've moved that "standard of the industry" up a notch or two.

✓45 **Taranto**
& ASSOCIATES, INC.

The Total System Store.™

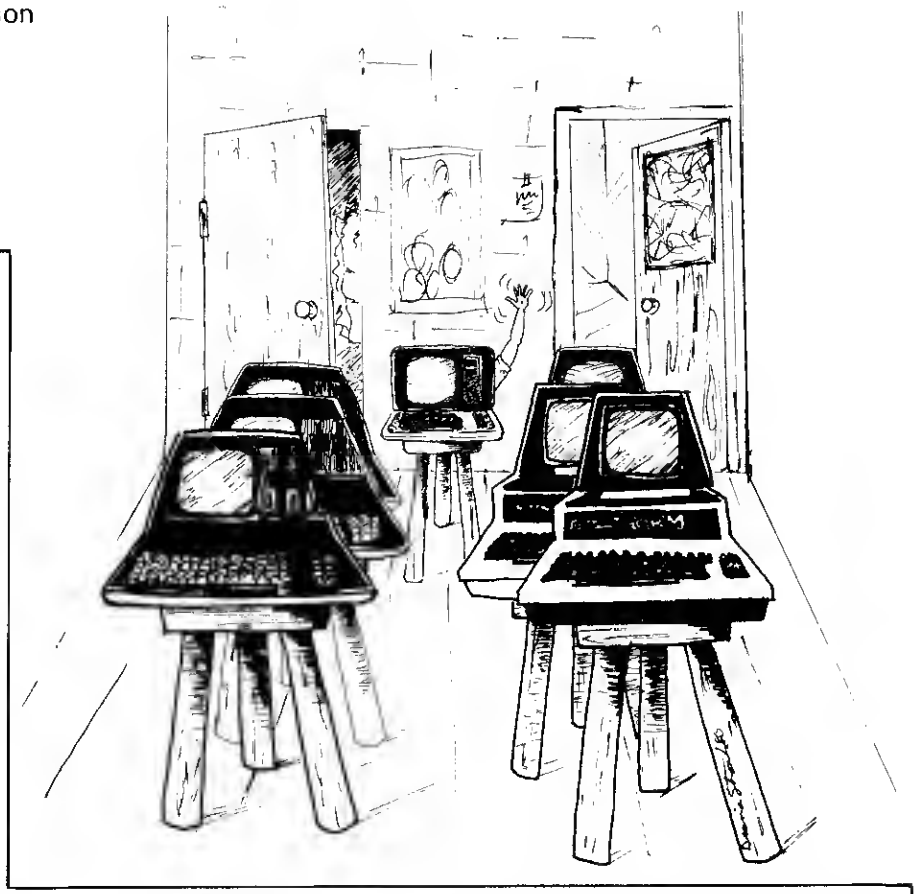
121 Paul Drive, San Rafael CA 94903.
Outside California, phone toll free (800) 227-2868.
In California (415) 472-2670.
Authorized dealers throughout America.

*Trademarks of the Tandy Corporation

✓Reader Service—see page 242

80 NEWS

edited by Nancy Robertson



Education Market Attracts RS

Tandy is applying for admission to school: not in search of education, but rather, in search of profits. This new marketing direction may have come about as a result of the general decline in economy and all that it implies for slumping retail sales, but regardless of the reasons, Tandy is making concerted efforts to establish a toehold in the educational applications marketplace.

In both hardware and software divisions, Tandy has lately undertaken projects designed to enhance their standing in the educational community—a community that has long been courted by other microcomputer manufacturers including Apple and Atari.

The development of the Color Computer, the Network I loading system and extensive "courseware" (programmed learning modules on math, history, and computer education) exemplify Tandy's commitment to educational sales. In addition to hardware and software development, Tandy has begun publishing booklets aimed at the educator. The most recent is entitled, *Radio Shack's Federal Funding Guide and Proposal Development Handbook For Educators* (Cat No. 26-2108). This compendium of grant information is aimed at professional educators who would like to use federal funds to establish a computer program in their school system.

Market Support

To support these marketing efforts the Radio Shack division has set up five regional sales districts around the country which are looked after by educational sales coordinators. These sales coordinators usually bring a professional education background to their sales job, and are charged with developing sales of TRS-80 systems to educational institutions.

Tandy is offering sales incentives to potential customers including discounts based on quantity and direct factory quotes on bids. A national bid department, staffed by people familiar with the intricacies of bid writing, has been set up by Tandy in Fort Worth for this purpose. Other sales incentives include free computer training for educators at Radio Shack computer centers and maintenance contracts on equipment that offer regional or on-site repair options (depending on size of the contract).

Chris Bowman, Tandy's Boston-based educational sales coordinator for the New England region, told *80 Microcomputing* that another aspect of his job is attending educational conferences, usually on the national level. At these conferences he attempts to illustrate the advantages of the TRS-80 system and provide educators with background information on using computers in the classroom. The high profile the Shack is maintaining in the educational community is designed to enhance their image among educators who want to get into computers but don't quite know how to go about it.

Dallas Affiliation

Tandy's effort at identification with the educational community are not limited to the conference circuit. In addition, they have affiliated with six school districts around the country. These six districts act as field test sites for hardware and software of Tandy manufacture.

One of the most ambitious, and mutually beneficial affiliations, is in Dallas, TX. Tandy has placed 350 TRS-80s with the Dallas Independent School District and, under a mutual marketing agreement, has supplied discounted hardware on a drop-shipped basis to other school systems using the Dallas district's software. The program has been so successful that Dallas is acquiring 450 additional 80s by January. A total of 800 machines will be in use in the district in 1981 in both inner city and suburban classrooms.

Federal Funding

Dr. Frank Jackson, director of marketing for the Dallas Independent School District, is a specialist in obtaining federal funds in the form of educational grants. He recently authored Tandy's *Federal Funding Guide* for educators who want to fund computers-in-the-classroom programs with federal money. His funding guide includes sections on available fund-

Continues to p. 56

MITA: Two Steps Forward and One Back

The Microcomputer Industry Trade Assoc. (MITA) is undergoing some changes following several years of inactivity. After meetings and membership drives at industry trade shows, MITA seemed to be getting on its feet in August. Recent developments, however, might indicate a break in MITA's upward swing.

The association was founded in 1977 to represent and serve all facets of the microcomputer industry. There are approximately 90 member organizations, ranging from such major manufacturers as Apple and Atari to one-man microcomputer consulting firms. Despite their membership, MITA has shown little direction and few accomplishments in the past three years.

At the Personal Computing '80 show held in Philadelphia in August, Executive Director Wes Thomas submitted his resignation, admitting that other commitments kept him from devoting more time to the association. President Dennis Barnhart announced the appointment of Richard Linn, a former insurance agent and financial planner, as the new director.

MITA's growth, according to Linn, hinges on successful membership drives and organizational meetings at shows such as the November COMDEX 80 show in Las Vegas. However, Linn and associates were surprised to find that the MITA booth at COMDEX was canceled, and the association was forbidden by COMDEX planners to hold any organizational meetings at the show.

Linn believes that the cancellation was a form of protest about a proposed MITA-sponsored trade show in Atlantic City. "The people at COMDEX took the position that MITA is a competitor," he said. "The position that COMDEX took will not help MITA today, but it may promote more visibility for MITA and help us in the future."

Since Linn's appointment in August, the development of a group insurance package available to all MITA member organizations has been encouraging. Along with David Chen of Mid Peninsula Agencies, Inc., San Mateo, CA, Linn has developed what he believes to be "one of the most comprehensive and competitive group plans available today."

The insurance program will include group health, dental, and life. General liability will cover products liability, contractual liability, malpractice, property in transmit, workmen's compensation, umbrella, commercial auto, and excess liability. Retirement plans are also included. Chen will be the administrator of the program, which is primarily underwritten by Aetna Life and Casualty, Hartford, CT.

The law firm of Wewer and Mahn assists MITA in Washington lobbying efforts. Two booklets are now available from them to MITA members: one on software copyrights; and the other on FCC regulation of electronic devices.

MITA has also made some arrangements with Ralph Ianuzzi, planner of the New York Personal Computing and Small Business Show for a jointly-sponsored show in Atlantic City this year.

More immediate MITA goals, according to Linn, focus on assessing the needs of the industry and developing a working budget to satisfy some of these needs.■

Chris Crocker
80 Staff

Two Companies Label Same Program

When Larry Clements of West Palm Beach, FL bought a copy of the Radio Shack game program Space Warp this winter, he didn't suspect that he might be purchasing a program that he already owned.

In 1978 Clements bought a game from Personal Software called Time Trek, written by Joshua Lavinsky. It was a fast real-time space game that cost $19.95.

He bought Radio Shack's Space Warp for $14.95 this winter, but found that with a few minor modifications, the program was identical to Personal's Time Trek. Though the Radio Shack package was clearly marked with Personal Software's trademark, nowhere did the label indicate that the program was already sold as Time Trek.

It is not unusual for one company to market a program written by another company. Six out of every ten programs sold by Radio Shack are written outside of the company, according to Ed Juge, director of computer merchandising at Tandy.

"Normally," said Juge, "Tandy will buy all TRS-80 rights for a program." The exception would be if the program were already on market for the TRS-80, as was this one.

The private labeling of these programs raises a larger question about private labeling, a practice that is fast becoming the rule rather than the exception in software marketing. Large software firms are buying rights to market programs which are already being marketed by smaller firms.

Tandy markets other programs written for Personal Software, such as Microchess and Visicalc, a business application program. But these programs do not have different names.

Cautious of Copyright

According to Juge, when Tandy decided to obtain marketing license for this program, they were cautious of original Star Trek copyrighted material, and therefore requested that the original author, Joshua Lavinsky, change parts of the program which might fall under copyright.

Lavinsky changed some wording in the program. The ship Enterprise became the Endever, phasers became masers, and Klingons became Jovians. At that point, the title was changed.

Clements returned to his local Radio Shack dealer, who refused to take back the program. Since then he has written to Tandy, but has received no response.

According to Juge at Tandy, "It seems inconceivable that a store manager wouldn't want to take care of his customers." Neither Tandy nor Personal Software has any definite plans to remedy the issue.

Bill Walters, Tandy's consumer information manager, said that complaints "will be dealt with on an individual basis." Customers should first go to Radio Shack franchises. If they are still dissatisfied, they should direct their complaint to customer service at Tandy/Radio Shack in Fort Worth.

Walters called the incident "unfortunate," and added, "What has happened here will not happen again."■

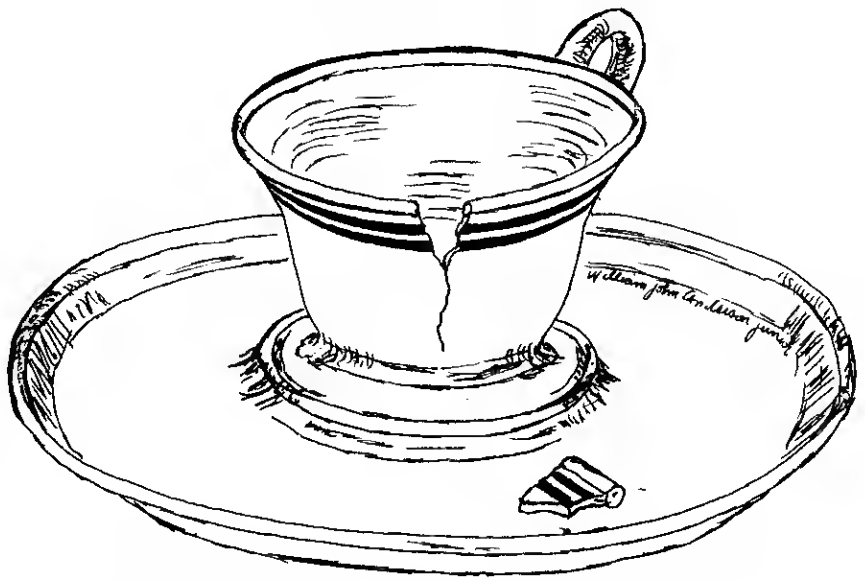
by Chris Crocker
80 Staff

Time Trek/Space Warp Screen Display

Motorola Color Chip Comes to Tandy

Radio Shack's TRS-80 Color Computer represents a significant change from the precedent set with the TRS-80 Models I, II and III. Not so much from the color per se, nor the high-resolution graphics option—not even the availability of pre-programmed ROMpaks.

The most important difference lies in the heart of the machine; the microprocessor itself. Unlike previous Radio Shack microcomputers which used Zilog's Z-80 chip, the Color Computer uses a Motorola 6809 as its MPU.



Long History

The 6809 has a family tree which stretches back almost to the dark ages of microprocessors. 1974 was the year in which its grandfather, the 6800 appeared. This chip was revolutionary at the time and has appeared in many useful microcomputer designs. The fledgling 6809 then evolved by way of the 6801 and 6802, which could be described more as cousins than father and son.

Finally, in December 1978, the 6809 was born, and has apparently been under-utilized since then. This situation was probably brought about by the immense success of the Z-80, which appeared to trample a lot of competitive chips into the dust. The TRS-80 has done a lot towards promoting the Z-80 as the powerful chip that it is. The TRS-80 Color Computer is now likely to do the same with the 6809.

The 6809 Difference

Motorola's 6809 chip differs in a number of ways from the Z-80, and offers advantages oriented towards fast-video graphics. Not only that, but the chip has a powerful instruction set which places it in the top of the league of eight-bit processors; it has a repertoire of instructions at least as extensive as the Z-80, and in some cases, more so.

The Z-80 is biased towards manipulation of a large number of internal registers, whereas the 6809 has few registers and tends more towards manipulation of external RAM. Some spectacular indexed addressing modes are available, which give the programmer some mainframe capabilities. This is one of the features which makes it so suitable for video output.

The 6809 has two independent accumulators which can be combined as one 16-bit register and even multiplied together with a single byte opcode. Also available are two stacks, and operations which can push or pull any or all registers with a single instruction. Two index registers are available, which can be used in so many combinations that it's impossible to describe them without rewriting the Instruction Set Summary.

Choosing the 6809

According to Radio Shack's Steve Leininger, the chief designer of the Color Computer, another reason for choosing the 6809 over the Z-80 was the fact that it can more easily share an address bus. This means that if the processor needs to access video memory, it can do so without interrupting the video scanning circuitry. This is achieved by timing the processor and the video so that they never need to access memory at the same time. Without this feature, quick-changing video graphics can be marred by streaks on the screen as the video is denied access to the video RAM by the higher priority demands of the microprocessor.

In this specialized use of the 6809, other external chips perform peripheral operations to achieve optimum video output. This explains why the inside of the keyboard unit contains only Motorola chips, all specially designed to interface with each other.

Few Hints about the Future

At Motorola, applications engineer Tim Ahrens indicates that plenty of support for the 6809 will be forthcoming in the form of new peripheral chips and memory management hardware which will support up to two megabytes of RAM. Ahrens says there are no immediate plans for any 6809 offspring. A solid future for the 6809 seems assured since the Color Computer is certain to be successful in its own right. But Radio Shack's Leininger was tight-lipped about any new plans his company might have for the chip. ■

by Jake Commander
80 Staff

Stockholders' Meeting: Kornfeld Retires, Stock Split Approved

At the annual stockholders' meeting, Nov. 13, 1980, Tandy Corp. shareholders approved an amendment to the certificate of incorporation increasing the number of authorized shares of common stock from 40,000,000 shares to 110,000,000 shares.

The action permits a previously approved two-for-one stock split in the form of a dividend. Distribution of the shares will be made Dec. 31, 1980, to stockholders of record on Nov. 30, 1980.

Stockholders were also informed of changes in the company's management structure. At the Tokyo Board of Directors meeting held in October, John V. Roach was elected president and chief operating officer of Tandy. Roach, who has been with Tandy since 1967, replaces Lewis F. Kornfeld, who has chosen to retire when he becomes 65 years old June 30, 1981. Kornfeld will remain on the board of directors. ■

Bank on the Color Computer in Knoxville

Switch on your brand new TRS-80 Color Computer, hook it up to Ma Bell, and check your bank account balance, pay your bills, apply for a loan, then prepare your income tax statement. When you're done with your financial business, read the news and check up on your stocks. Finally, leave a message for a friend in the next town, and read your own mail. Business over, play a game or get down to some serious programming.

If you live in Tennessee and do your banking through the United American Bank (UAB) in Knoxville, all this will be possible shortly after Christmas. Four hundred volunteer UAB customers will be outfitted with new Color Computers from Radio Shack by the holidays. The computers use an intelligent keyboard which plugs into their own tv and telephone. Each keyboard will be equipped with a specially installed security ROM pack to ensure secure banking facilities. The computer is otherwise no different from any other computer sold by Radio Shack.

For a monthly service charge, UAB's customers will be able to use the computer-banking, bookkeeping and tax services provided by UAB, and electronic mail and news services provided by CompuServe.

UAB was the first bank chosen to implement this new service by Radio Shack, CompuServe, and the United American Service Corporation (UASC)—the three companies joined in the venture. (UASC is a corporation founded by the UAB and 11 other banks in the southeast, to perform marketing and future trends research, etc. None of the member banks owns more than 19 percent of the corporation. The UASC currently holds contracts with approximately 30 other banks in the southeast for marketing research services.)

The UASC foresees another 20,000 bank customers nationwide becoming involved in this service by the end of 1981. That's a lot of bucks for the investors—no matter how you count them.

Security ROM Pack

Customers may acquire their new Color Computers in various ways, each bank branch offering its own terms and conditions. Outright purchase and an installment plan will be most widely used, with some key customers leasing the equipment. In any event, clearance from the bank is necessary in order to receive equipment with the security ROM pack.

For the time being, only the specially designed Color Computers, with the security ROM pack, will be used. USAC is concerned about security of its banking services, and is effectively eliminating current micro owners who do not wish to buy the special Color Computer. Sudman has suggested that this decision may be reassessed and modified sometime in the future, but not soon. The security problem must be dealt with first.

The UAB is introducing its project in three phases of increasing services, in order to allow customers to become acquainted with a home computer system and gain skills in BASIC. Tom Sudman, executive vice president of UAB and vice president of UASC, believes that most of the 400 customers beginning this service have no prior contact with personal computers.

When the announcement was made that the UAB was instituting its home banking service in January, customer demand for micros greatly exceeded the number Radio Shack could immediately produce.

There have recently been several trial runs of computer banking services conducted by various banks and other corporations. These are primarily short-run projects designed to determine the public's interest in this sort of service. Tests of this kind are currently being conducted in California, New York, Ohio, Florida and elsewhere, and generally attempt to involve a statistical cross-section of the consumer public. The service instituted by UAB in Tennesse is not a trial run. It's the real thing—the 21st century has arrived early in Tennessee. ■

by Debra Marshall
80 Staff

Will Electronic News Reshape the News Business?

Rich Baker, publicity director for CompuServe, Columbus, OH says that the customer feedback through the CompuServe Information Network indicates that electronic news and mail are the most popular features of their micro network. By and large, electronic news seems to be the rage of the electronic communications networks. Noel Tyl at The Source, McLean, VA says that subscriber response to their UPI wire capsulized stories is "phenomenal" and beats interest in anything else on their net. Knight-Ridder Newspapers, Coral Gables, FL is experimenting with consumer response to electronic news in a joint venture with AT&T. They haven't begun to tally the viewer response of the six-month project yet, but it looks positive, according to John Woolley. Qube, Columbus, OH, and other two-way cable TV stations are also getting into the act.

While micro hobbyists may consider electronic news a pleasant diversion, members of The Newspaper Guild and many newspaper publishers are taking a more serious look at its implications.

As Associated Press President Keith Fuller has said, there are two views on electronic news: "One, that electronic delivery is the future knocking at the door, and the other that electronic delivery to the home is a disaster hunting a victim."

Evidently the Twin Cities Newspaper Guild No. 2 leans toward "a disaster hunting a victim" in its appraisal. Sept. 13, 1980 they began a 26 day strike against the *Minneapolis Star* and *Tribune*, which are scheduled to begin electonic publication through the CompuServe network in the spring. It was the first strike in the nation related to electronic news.

Carriers sought gurantees that they will not lose their positions as a result of electronic delivery. Editors and writers sought to maintain editorial control over the material transmitted electronically and to receive residuals for its distribution.

The executive committee of The Newspaper Guild met in Washington, D.C. in October, following the Minneapolis strike, to discuss electronic news. Dick Ramsey, executive secretary, explained the Guild's need to assess their "bargaining power to meet the challenges" of job protection, editorial jurisdiction and compensation. In a policy statement The Guild recognized the importance of electronic publication "to industry employers" and hoped the industry would recognize the "justifiable and legitimate concerns of its employees." The policy statement recommended that protective clauses be included in all local Guild contracts.

Not for Profit

At CompuServe, Baker contends that newspapers are not experimenting with electronic news for profit—yet. Donald Dwight, publisher of the *Minneapolis Star* and *Tribune*, explains that his news-

Continues to p. 56

KING OF THE HILL!

We've taken artistic license with our illustration in order to make a point: MYCHESS is the most powerful microcomputer chess program on the market, bar none.

Proof? All you want and then some. For example, MYCHESS was the winner of the "Fifth West Coast Computer Fair". At the "Third World Computer Chess Championship" in Linz, Austria, it was the highest finishing micro... in addition to winning the special Blitz Tournament (5 to 1) against six top players. Add to this its USCF rating of 1565, and you know you're dealing with the King of the Hill.

You'll find MYCHESS is the perfect companion or opponent whether you're an advanced player, or starting your first game. For it lets you set the difficulty of the game from level 1 to 9. And, you can change levels of play as you go ... or even change sides. Want to set time limits for moves? MYCHESS can do it. Want to save a game for later? MYCHESS will store up to 6 games. And, for added interest, it will even predict the upcoming line of play.

If you're a player, you'll appreciate the MYCHESS challenge. If you're a beginner, you'll enjoy learning from a master. Either way, when it comes to superior chess, make your move ... to MYCHESS. Available for the TRS-80* with 32K, for $34.95 including disk, documentation and backing by Programma International. Apple** version coming soon.

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Model I—Keyboard Only—Discontinued

When Radio Shack's president Lewis Kornfeld returned from his October business trip to Japan, *80* had one point blank question for him: Has the Model I been discontinued?

The rumor was already in the press and running all through the industry. Franchisers called the magazine to say they couldn't get stock, while the managers of the regional warehouses assured us that Model I was still rolling off the delivery trucks. In Fort Worth, the company executives unanimously deferred the question to Kornfeld, who was happily in the Orient.

"The truth is simple," Lewis Kornfeld said, then listed three points: 1) The Model I CPU-keyboard unit, and that unit only, is going out of production in this country whenever the parts in stock run out. The timing is likely to coincide with the new year. 2) The company will continue to produce other Model I items, such as the expansion interfaces, disk drives, etc. 3) "And the company will support those items ad infinitum."

Kornfeld explains that, "Warehouse and marketing space for the Model I will be taken up by the Model III and the Color Computer."

Model III, the Successor

The Model III, of course, has been hailed as an enhanced Model I, and marketed in part as its sequel. The $699 price tag for the bare bones Model III is $200 more than the tag for its predecessor. Dennis Kitsz, a frequent contributor and columnist in *80*, points out that Radio Shack has "corrected virtually every flaw" of the original machine. Considering inflation, he feels the price is right.

However, there are some problems apparent with software compatibility between the two machines. Problems have resulted from redistribution of RAM, the addition of more I/O ports to handle peripherals, and the inclusion of double-density drives.

While these changes are basically upgrades, the additional I/O ports bollix programs which use assembly language routines to access peripherals. Difficulties with the double-density drives have arisen because the older drives cannot accommodate data written with the new equipment. Memory redistribution has also resulted in 256 fewer bytes for programming.

No News

Kornfeld says that there really isn't any news in the fact that the Model I CPU-keyboard unit is going out of production. He feels the move was "pretty obvious" considering the recent Federal Communications Commission restrictions on computer radio frequency emissions, the age of the Model I (which has been on the market for three years), and the introduction of the Model III. "It's also pretty obvious that it will continue in use just like a typewriter would."

"Stopping production is not a surprise and not an insult. We haven't issued a statement on this whole thing because we haven't stopped anything at this point," he said in November.

Nonetheless, it's nice to get a definite answer. We can stop speculating on the inevitable and move on to closer consideration of the Model III. ■

by Nancy Robertson
80 Staff

Education Market

Continued from p. 50

ing sources (Title I, Title IV, etc.), proposal writing and follow-up activity after a grant has been awarded. An appendix of state education agencies is also included.

He is currently at work on another, more specific, funding guide for Tandy, the emphasis of which will be step-by-step procedures required of small and medium-size institutions to win grants. His new booklet will also discuss the requirements of such competitive funding structures as Title VII.

He told *80 Microcomputing*, "The money will be there no matter what the national political climate, all you have to do is know how to go about getting it." In Jackson's opinion, grant writing is an unknown art in much of the education community. He hopes his funding guides will remove some of the mystery which surrounds the process.

Marketing Strategy

Bill Gattis, educational products manager for Tandy, sums up Tandy's current involvement with the education market by saying, "We have undertaken a massive courseware development effort and we're working with lots of authors on a contract basis." He added, "For the present, we have no plans to develop any major new hardware." He indicated that the Model III and the Color Computer will be the keystones of Tandy's educational marketing efforts for the next few years.

It appears that Tandy has interpreted the needs of the education market to be essentially soft. Having at last developed hardware capable of competing with Apple in terms of graphics and Atari in terms of unitized construction, Tandy is determined to avoid the pitfall that has entrapped both these manufacturers: Tandy intends to have educational software, and lots of it, available to back up their hardware.

The move toward the education marketplace may signal a new self image in Fort Worth. The TRS-80, no longer viewed as just another retail consumer appliance in the eyes of its creators, may finally have come of age. And, as part of its maturation process, it is destined to spend some time in school. ■

by Chris Brown
80 Staff

Electronic News

Continued from p. 54

papers are contracting with CompuServe because of "interest in the future. It seems to me, it (electronic publication) presents an extraordinary challenge with lots of opportunity for both success and failure."

Dwight explains that as a publisher, he faces "high fixed costs" for the labor of delivery and for paper, among other things. It's possible that with electronic publication some of these costs can be eliminated, in his opinion. "People seem to think it's all going to happen tomorrow," he said. But he believes the change will be a long time coming.

Dwight does not believe that computerized delivery of news and other information will completely eclipse newspapers for quite a long time, if at all.

"It's a question of assimilation. The great advantage of electronic networks and computers is that they can sort and make available almost infinite amounts of information—but people can't assimilate it all. I believe people will still be willing to pay for editors and publishers to sort through it all and present them with the news."

But what do you foresee? You're wired. Do you still subscribe to your local paper? Would you like to subscribe to *80* through your favorite computer net someday? ■

A Message from the President

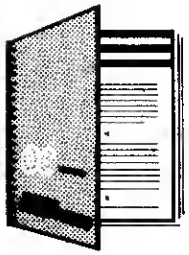
We are pleased to introduce you to PROGRAMS UNLIMITED, the Software Source, offering home computer hobbyists a gallery of games, utility programs, business software and micro-computer hardware for today's leading systems.

PROGRAMS UNLIMITED's **free** catalog contains our initial selection of today's most popular software and peripherals, as well as exclusive offerings available only through "The Software Source."

Our electronic-ordering system, using a 24-hour computer bulletin board service, gives you access to PROGRAMS UNLIMITED day or night. Whether you take advantage of this rapid order process or choose the standard mail-order method, our full line of top quality programs comes to you with our guarantee!

PROGRAMS UNLIMITED stores will soon be serving you coast to coast. At last, TRS-80 enthusiasts will be able to see, hear and test hundreds of programs from the nation's widest selection of software.

Richard Taylor, President, Programs Unlimited



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NEW PRODUCTS

Edited by Chris Crocker

Androids Fight In Game Program

Duel-n-Droids is a new sound and graphics game program for the Model I Level II TRS-80 from Acorn Software Products, Inc. The program features two androids that square off against each other with swords in both practice and tournament duels.

Duel-n-Droids is priced at $14.95 on cassette or $20.95 on disk. For more information, contact Acorn Software Products, Inc., 634 North Carolina Ave. SE, Washington, DC 20003.

Reader Service ✓332

Narrow and Wide-form Printers

The Microline 82 from Okidata is an 80-column, 80 character per second matrix printer. The printer is a bidirectional short line seeking unit. Also from Okidata is the 136-column Microline 83, which accommodates wider forms and prints at 120 characters per second.

Prices are available from Okidata Corp., 111 Gaither Dr., Mt. Laurel, NJ 08054.

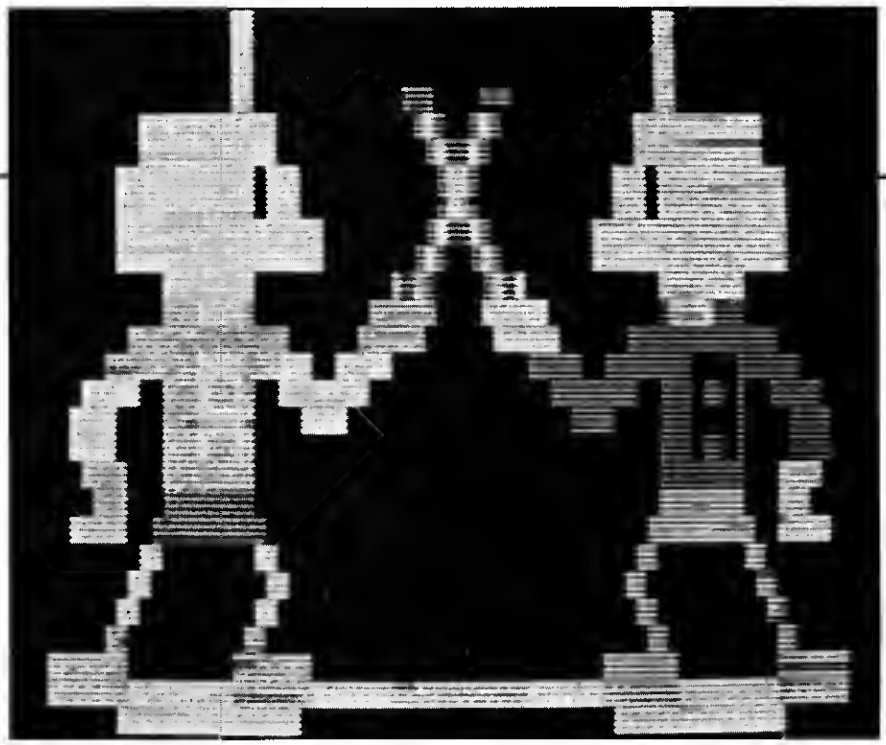
Reader Service ✓163

Produce Mailing Lists with Cassette

Deluxe Addresser provides business mailing list capability for users with a single cassette drive. The program handles the standard four-line address with phone and up to eight user-defined address flags. It is also adapted to handle the proposed nine-digit zip code as well as foreign codes.

The cassette costs $40 and comes with instructions from Harry H. Briley, P.O. Box 2913, Livermore, CA 94550.

Reader Service ✓342



Acorn Software's Duel-n-Droids

Model II Word Processing

Wordbank is a word processing program for the TRS-80 Model II that allows one time or repetitive letter, report, or manual writing. Features include 7500 available document lines, automatic page and line numbering, and page control.

The program requires 64K, one disk file and a line printer. Wordbank is available for $149.95 from Taranto and Assoc., P.O. Box 6073, 121 B Paul Dr., San Rafael, CA 94903.

Reader Service ✓341

Program Tutors in Spelling

Words for the Wise is a spelling tutor system for elementary school students. The program features five spelling activities: Missing Letters, Scrambled Words, Match the Letters, Alphabetizing and Hangman. Teachers may choose the words to be studied, and students are rewarded with graphics and sound.

The Words for the Wise package comes with two programs: an activity program/word list generator, and a word list tape of 1000 words. The package is available for TRS-80 Level II, 16K at $14.95 from TYC Software, 40 Stuyvesant Manor, Geneseo, NY 14454.

Reader Service ✓349

Index Lists Micro Magazine Info

A computerized index from Hexagon Systems lists technical tips, programs, reviews and advertising from *Kilobaud Microcomputing*, *80 Microcomputing*, and *80 US*. The index package includes SCAN, a program that searches through the index to locate a keyword.

The package requires a 48K TRS-80 Model I with two disk drives. The programs, index and manual are available for $29 from Hexagon Systems, P.O. Box 397 Stn. A, Vancouver, B.C. Canada V6C 2N2.

Reader Service ✓344

The New Products section is intended to inform our readers of new products on the market. All information in the section is taken from product releases sent by manufacturers. Because of the volume of product releases, we cannot attest to the quality of the products listed.

Radio Shack Printer and Educational Funding Guide

Radio Shack's Line Printer IV is a proportionally spaced high-density dot matrix printer for word processing. The printer produces either 80 or 132 fixed-space characters per eight inch line for right-justification or tabular information. Upper and lowercase letters are available in all three printing modes. Subscripts, superscripts, boldface and enlarged characters are also provided. Print speed is 50 characters per second and 22 lines per minute.

Also from Radio Shack is the *Federal Funding Guide and Proposal Handbook for Educators*. The handbook, written by Dr. Frank Jackson, is a resource guide for educators explaining how to locate external funding and how to write proposals. The guide costs $2.50. Line printer IV costs $999. Both are from Tandy/Radio Shack, 1800 One Tandy Ctr., Ft. Worth, TX 76102.

Reader Service ↙327

Radio Shack Line Printer IV

Computer Opponent Programs

Monty Plays Monopoly and Monty Plays Scrabble are computer opponent programs designed for use with traditional game boards and equipment. Monty is the computerized opponent that plays to win according to the official rules. The programs have music and animated graphics.

Both programs are available for TRS-80 Level II. Monty Plays Scrabble is also available for CP/M systems. The Monopoly version on cassette (16K) costs $24.95 and on disk costs $27.95 (32K). The Scrabble version is on disk only at $29.95 (16K). For more information contact Ritam Corp., P.O. Box 921, Fairfield, IA 52556.

Reader Service ↙346

Printer Modification Kits

The Lowercase Kit is a hardware kit that converts Radio Shack Model I Line Printers to upper/lowercase. The kit consists of a replacement for the character generator chip. Another hardware kit is Motor Control, which turns the printer motor on just prior to printing and off after printing. Motor Control consists of a PC board which mounts on top of a chip.

Both kits are available from Service Technologies, 32 Nightingale Rd., Nashua, NH 03062 for $199. The Lowercase Kit alone costs $125, and the Motor Control Kit costs $95.

Reader Service ↙340

Machine Language Enhancements for Level II

Bionic BASIC is a library of machine language enhancements to TRS-80 Level II Disk BASIC from Micro Consultants. The Bionic Surgeon, a BASIC program in the first volume implants Bionic BASIC modules in the BASIC/CMD file. Volumes 2 and 3 introduce a BASIC SORT command and a SEARCH and REPLACE command.

Bionic BASIC is available for $24.95 per volume from Micro Consultants, 671 N. D Street, San Bernardino, CA 92401.

Reader Service ↙347

Real Estate Matching System

Big Match is a real estate client-matching system from Arizona Computer Systems, Inc. The system allows information to be input from the multiple listing books, and matches listings with customer requests. As new listings become available, Big Match matches them to previous requests and generates a letter to customers.

No prices were released. For further information, contact Arizona Computer Systems, Inc., P.O. Box 805, Jerome, AZ 86331.

Reader Service ↙348.

Game Paddles and Sound

A game package from Electronic Systems includes: two game paddles, interface, software, speaker, power supply and two games on disk (Pong and Starship War). Also included are schematics, a user's guide and theory of operation.

The package (part #7922C) is designed for TRS-80 Level II or Disk and costs $79.95. It is available from Electronic Systems, P.O. Box 21638, San Jose, CA 95151.

Reader Service ↙350

Construction Industry Package

The Management Information System is a six program package for home builders and general contractors. The complete system contains programs for cost estimating, job costing, general ledger, accounts payable and receivable, payroll, and word processing.

The programs may be purchased separately and will operate as a system or on a stand-alone basis. They are designed for a Model II with 64K and require an addi-

tional disk unit and printer. Prices were not released. For a demonstration disk ($10 refundable), contact Construction Data Control, Inc., 1330 Healey Bldg., Atlanta, GA 30303.

Reader Service ✓336

Manage Church Donations

Church Donations is a nine program package designed to facilitate counting, storing, recording and reporting of offerings made to a church. The package will handle accounts of a church with a congregation of up to 1,000.

Church Donations requires a TRS-80 Model I Level II with 48K and two disk drives. NEWDOS+ is the recommended operating system. No prices were released from Custom Data, P.O. Box 1066, Alamogordo, NM 88310.

Reader Service ✓335

Drawing and Multiplication Programs

Sketch-A-Sound lets the user draw pictures while making music. The program allows noncontinuous lines and error-correction, and pictures can be stored and retrieved on cassette or disk. Mul-Ti-Sound is a multiplication drill program designed for fourth to eighth grade students that includes games and sound.

Both programs are for Model I and require 16K Level II or 32K DOS. Each program is available on cassette for $14.95. Both are available on disk for $24.95 from The Innovative Penguin, 2320 Hampton Dr., Harvey, LA 70058.

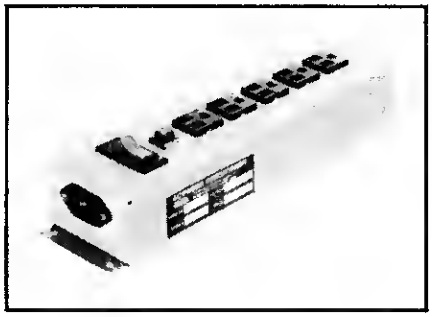
Reader Service ✓161

Stock Management Aid

Stockpak, a four-diskette package from Standard and Poor's Corp., allows a user to manage a stock portfolio of up to 100 securities with as many as 30 transactions on each issue. The package will also analyze 900 New York and American exchange and over-the-counter common stocks, and generate reports to guide investment decisions.

Stockpak costs $49.95 at Radio Shack outlets. An annual subscription rate to the monthly update service is $200. For more information, contact Tandy/Radio Shack, 1800 One Tandy Ctr., Ft. Worth, TX 76102.

Reader Service ✓337



Voltector Multibus Strip

Safeguard Against Powerline Transients

The Voltector Mulitbus Strip from Pilgrim Electric Co. is designed to eliminate such interference problems as power on-off transients and disk drive errors from printer solenoids.

The Voltector strips are rated at 15 Amps, 125 V ac, 60 Hz and are available with six, eight, ten or twelve receptacles. Prices range from $79.50 to $122. For more information, contact Pilgrim Electric Co., 29 Cain Dr., Plainview, NY 11803.

Reader Service ✓325

Language-free Data Management

A data management system from Lifeboat Assoc. provides customized accounting systems including payables, receivables, inventory control and order entry. The Configurable Business System (CBS Version 1.1) may be set up without using any programming language, according to Lifeboat.

CBS requires a 48K CP/M compatible system. A disk system with at least 200K of mass storage is recommended, and no support languages are required. CBS version 1.1 is available on most disk formats for $395 with $25 for updates. Documentation alone costs $40 from Lifeboat Assoc., 1651 Third Ave., New York, NY 10028.

Reader Service ✓162

Retaining Wall Design Program

RETWALL-1 is a retaining wall design program for structural engineers using the TRS-80 Model I. The program aids in the design of either block walls or concrete walls with parallel or tapered sides. RETWALL also computes masonry stresses for concrete block walls.

RETWALL-1 costs $125. For more information, contact Disco Tech, Morton Technologies, Inc., P.O. Box 11129, Santa Rosa, CA 95406.

Reader Service ✓164

Cash Register Software

TRS-POS is a program allowing a TRS-80 Level II to operate as a point of sale terminal. The package features English operator prompts and error messages, an electronic memo pad and a tracking system for sales commissions and inventory.

The 16K TRS-POS system allows 50 user-definable departments. The 32K system allows 110 departments. Prices are available from Computer Consultants, POS Software Dept., 310-312 Hoyt St., Dunkirk, NY 14048.

Reader Service ✓168

Stand-alone Machine Language Utility

Super Utility is a stand-alone machine language program occupying 24K of memory. It has its own I/O routines and does not use ROM or DOS calls. The program includes utilities such as Zap, which allows the user to read or modify data, whether or not the disk is protected. The screen readout displays normally in hex or ASCII.

Also included are the Purge, Format, Disk Copy, Tape Copy, Disk Repair, and Memory Utilities. Super Utility is available for $52.45 from A.M. Electonics, Inc., 3366 Washtenaw Ave., Ann Arbor, MI 48104.

Reader Service ✓329

System Updates Inventory

The Mayflower TRS-80 Point of Sale System acts as an electonic cash register that updates inventory with each sale. It is designed for small retail stores, and has a built-in report generator that sorts and sums inventory data. The user can design reports to fit individual needs.

The TRS-80 Point of Sale System runs on a 48K Model I with one disk drive and a Model II printer. The system costs $398 and is available from Mayflower Computer Co., P.O. Box 496, Naperville, IL 60566.

Reader Service ✓328

VR DATA'S DATA BASE MANAGEMENT SYSTEM

for TRS-80™

WALOS II

Industry proven applications:

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- Mailing Lists
- Sales Records
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WALOS II is in use today by major businesses throughout the United States.

WALOS II is a complete data base management system designed exclusively for the TRS-80 Model I and II.

It includes the most widely requested features formatted for easy and maximum use.

Model I, III $149.95 Model II $299.95

WALOS II is easily customized for specific needs and applications by even the most unsophisticated user, while still maintaining the capabilities of more complex data base systems.

VR DATA'S Data Base is fully self prompting and requires no knowledge of computer language or programming. Files and options are created using ordinary English.

WALOS II is forgiving. Numerous error-correcting and recovery procedures make it virtually impossible to "mess things up."

Self teaching. A special program provides on-screen instruction that supplements the written documentation.

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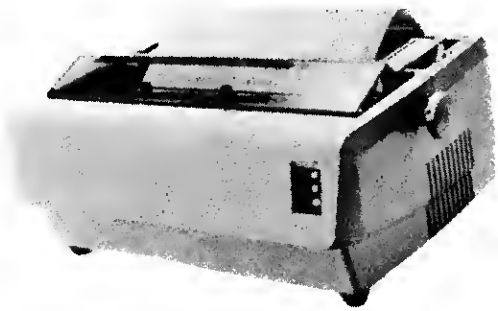
EPA 250 features:

- DIABLO® wheels and supplies
- Letter Quality
- 25 cps, Rapid Seeking, Bi-Directional
- 45 cps optional
- Parallel Interface, Serial optional
- Tractors available
- RS-232 optional



VR DATA'S EPA 250* Daisy Wheel Printer is designed to fill a distinct gap in the peripheral marketplace. A speed of 25 characters per second and it's low price make it the ideal choice for todays system designer interested in achieving superior price/performance ratios.

The EPA 250 produces letter quality printing on 3 sharp copies and will accept up to 14½" paper.

The easy plug-in compatibility of the EPA 250 and its outstanding print performance continue VR DATA'S tradition of providing reliable peripheral equipment to systems users the world over.

VR DATA'S EPA 250 sells for $2195. and includes a one year limited warranty.

*Electronic Printing Ability up to 250 word per minute.

VR Data

For more information, call toll free
(1) 800-345-8102, in Pennsylvania (215) 461-5300
or write VR DATA, 777 Henderson Boulevard, Folcroft, PA 19032

NEW PRODUCTS

Epson MX-80 Printer

MX-80 Has Disposable Print Head

The MX-80 is an 80-column dot matrix printer with a disposable print head. The printer operates in up to 12 print modes, and uses multi-strike and multi-pass techniques. The MX-80 prints bidirectionally at 80 characters per second.

The printer costs $645. Replacement print heads cost $28. The MX-80 is available from Epson America, Inc., 23844 Hawthorne Blvd., Torrance, CA 90505.

Reader Service ⌐333

Disk Drive Repair

All Systems Go is a repair service for TRS-80 compatible disk drives, including Parasitic Maxidisk eight-inch drives.

The cost for repair of drives is $35 plus parts. Shipping costs two dollars. For more information, contact All Systems Go, 8266 Tansy Dr., Orlando, FL 32811.

Reader Service ⌐167

Communicate With Mainframes

The Remote Batch Terminal Emulator (RBTE) is a program enabling Z80 microcomputers to transfer data files to and from mainframe computers or other remote batch terminals, using bisynchronous protocol. According to Winterhalter and Assoc., data rates of up to 19.2K baud may be achieved with this product. The RBTE operates under CP/M and several other operating systems.

The price is $500 for a single-use license. The Operator Manual is $25 and the Programmer Manual costs $15. RBTE is available from Winterhalter and Assoc., Inc., 3825 Zeeb Rd., Dexter, MI 48130.

Reader Service ⌐331

Sort Utility Uses Assembler Routines

SORTFILE is a BASIC sort utility for the TRS-80 Model I or III that uses assembler routines. It sorts random disk files under TRSDOS 2.2, 2.3 or other operating systems compatible with Radio Shack's Disk BASIC. According to Software Efficiency, a file of 250 records of 64 bytes each can be sorted in 10 to 12 seconds.

SORTFILE requires a minimum of 16K and one drive and will sort a file with up to 32,767 logical records. A separate utility, SEEFILE, is included for dumping of data files to screen or printer. SORTFILE costs $23.95 on disk or $19.95 on cassette. For more information, contact Software Efficiency, 7800 Stanford Ave., St. Louis, MO 63130.

Reader Service ⌐334

Load Machine Language in BASIC

SYSTEM to BASIC is a utility package designed to convert machine language code into code that can be loaded and stored from BASIC. The program is designed to bridge the gap between editor/assembler and BASIC.

Included with SYSTEM to BASIC is FASTLOADER, a machine language program placed in memory from BASIC. This program takes machine code out of the data item list and rapidly places the machine code into the proper memory location for execution.

The program is available for Model I, Level II BASIC or disk users with 16K. SYSTEM to BASIC costs $19.95 for cassette and $24.95 for disk and is available from J.F. Consulting, 74-355 Buttonwood, Palm Desert, CA 92260.

Reader Service ⌐326

Level II Word Processor

The GB Assoc. Word Processor operates specifically on the TRS-80 Level II (16K) and Centronics 730 series (Radio Shack Line Printer II) printers. The program can be adapted with some BASIC programming for other printers. The Word Processor has the same editing capability as the Level II, as well as uppercase/lowercase printout, and adjustable line length.

The program is on cassette for $35 and does not require disk. For more information, contact GB Assoc., P.O. Box 3322, Granada Hills, CA 91344.

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Disk Editor Assembler

EDAS 3.4 is a text editor/assembler for TRS-80 Models I and III. The editor provides text editing facilities for the modification of alphanumeric files in RAM. Command syntax is identical to the BASIC editor. The assembler portion of EDAS facilitates the translation of Z-80 symbolic language from RAM or disk into machine executable code.

EDAS 3.4 is available for $82 from MISOSYS, 5904 Edgehill Drive, Alexandria, VA 22303.

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✓ Reader Service—see page 242

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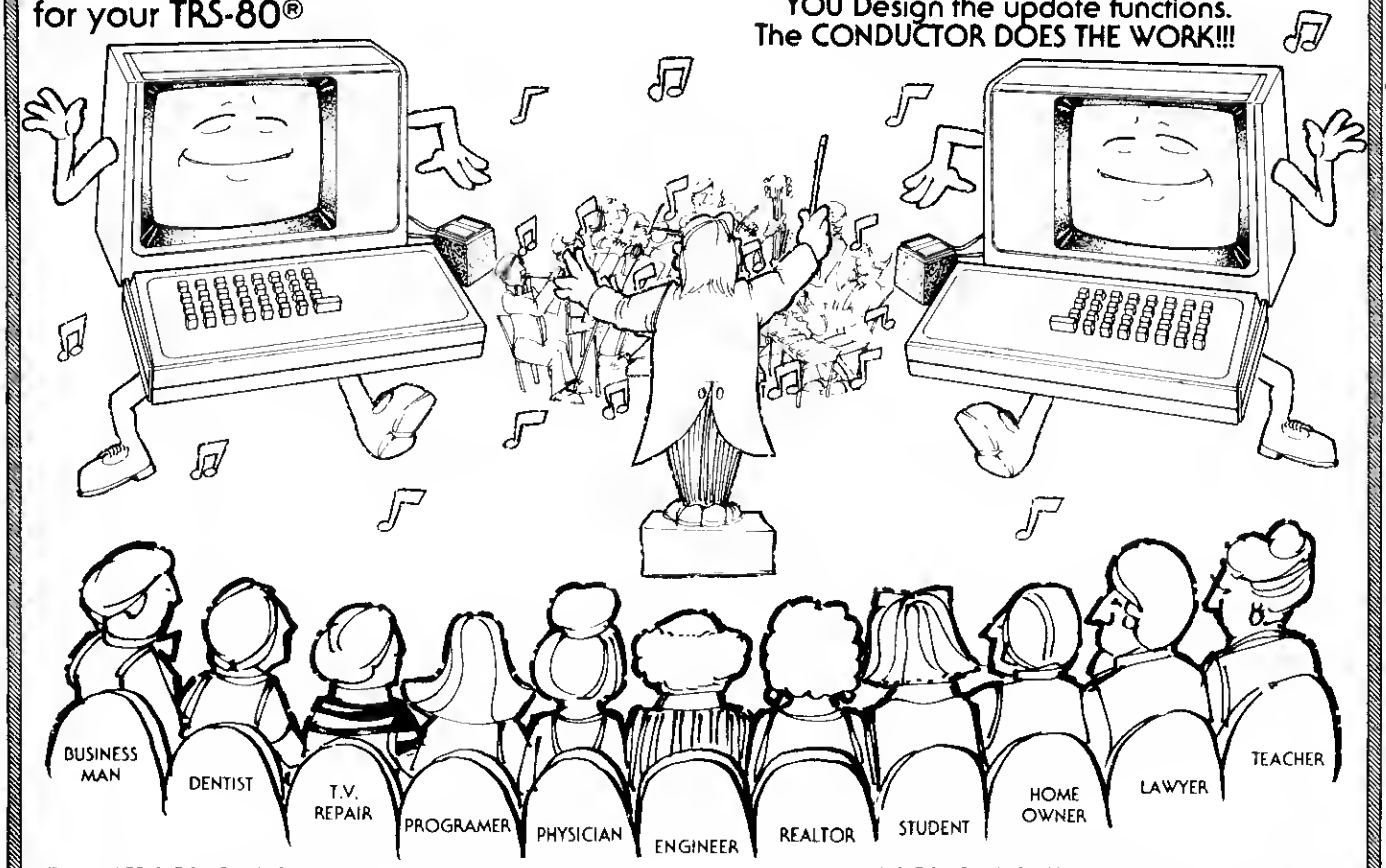

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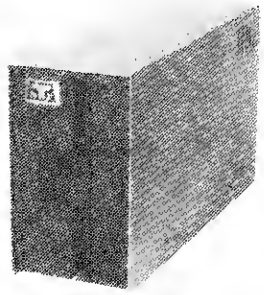

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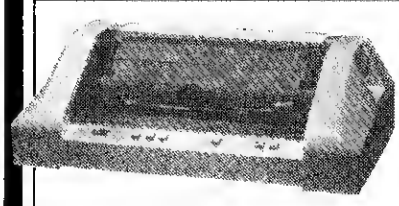

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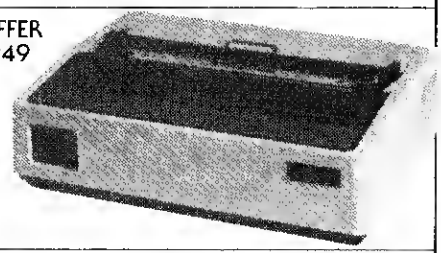

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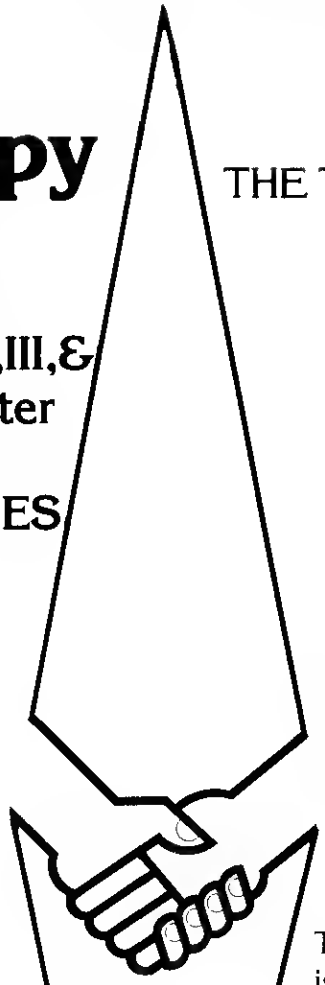

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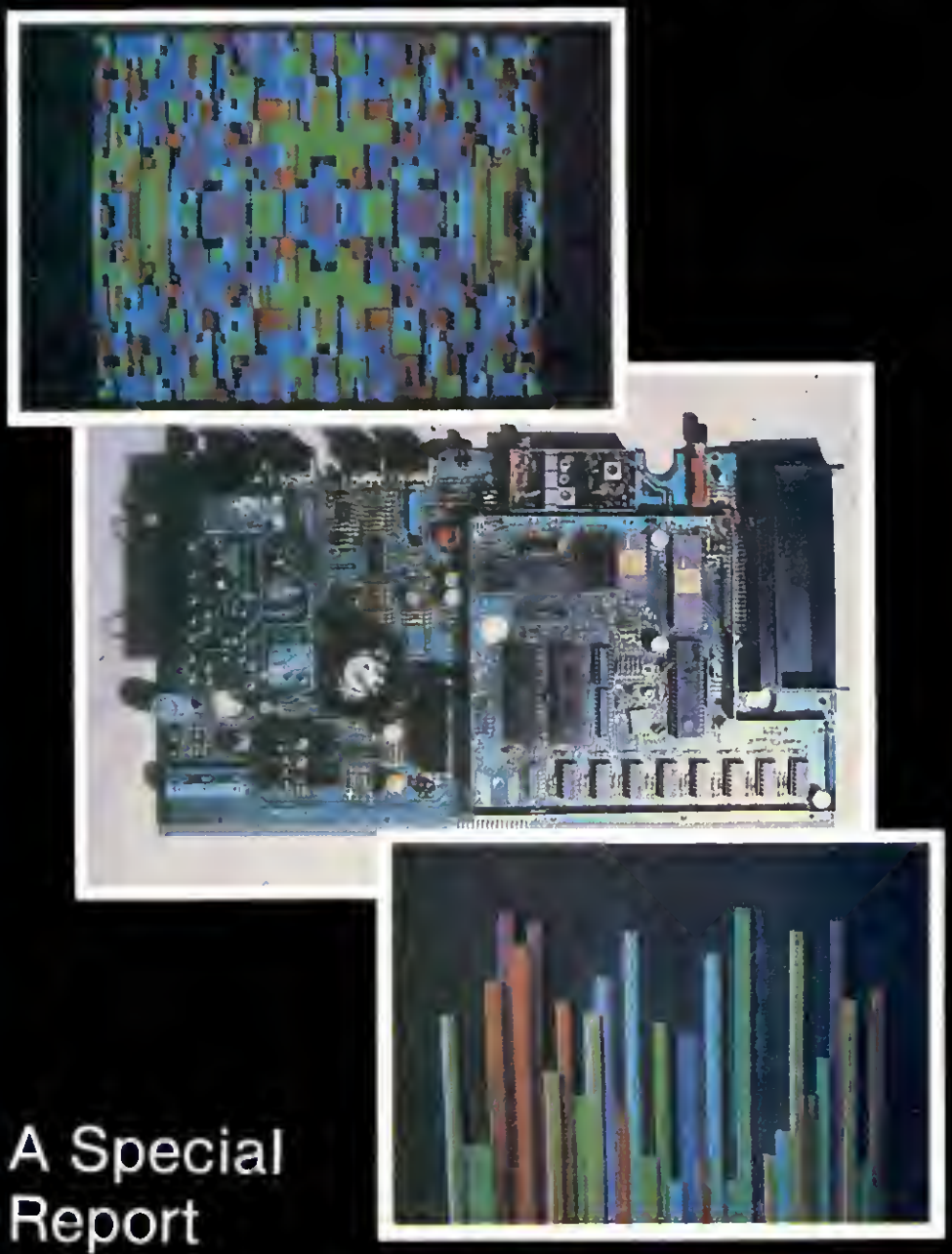
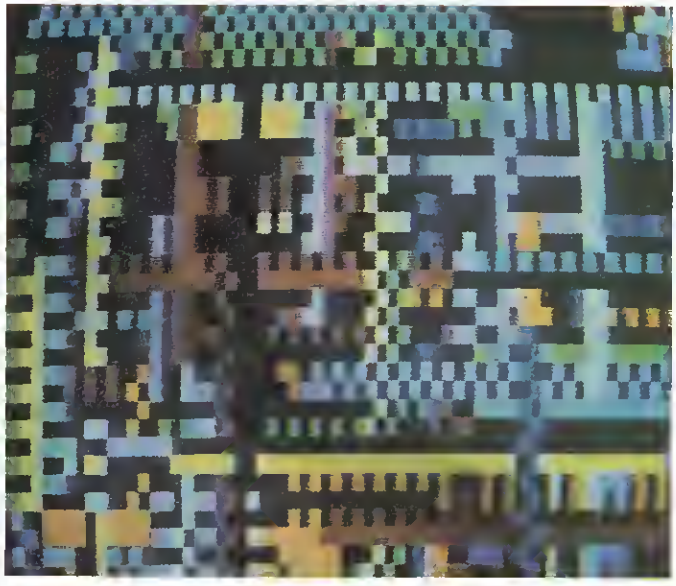


A Special Report

Model I owners, don't be blue
when you can be cyan, magenta and buff with the Electric Crayon.

Color by Percom



Francis S. Kalinowski
16 N. Alder Drive
Orlando, FL 32807

Once upon a time I faced a dilemma. Shall I keep my trusty TRS-80? Will I always be satisfied with black and white displays? Can I save enough cash to trade for a color machine? I began to scrimp and save my pennies for trade-in day.

Then, along came Percom's Electric Crayon, riding the shiny inne cover of *80 Microcomputing*. The Crayon said: 'Hook me up between a color TV and your TRS-80, and I'll give you color graphics.' With more than enough pennies already in my piggy bank, I ordered one.

Now I key BASIC commands into my TRS-80, it translates and sends them to the Electric Crayon, and action graphics appear on a color TV screen. Quite a change from the black and white monitor.

Hookup Requirements

A TRS-80 must have a Centronics-type parallel printer port through which it can send commands to the Electric Crayon. The printer port may be on a Radio Shack expansion Interface 26-1140, a printer interface cable 26-1411, or a Microtek Printer/Memory Expansion Module MT-32. Percom has two optional cables for interconnecting the Electric Crayon with a printer port.

The Electric Crayon outputs a composite video signal. This signal may be applied through a 75-ohm RG591/U coaxial cable directly to a color monitor. The video signal may also be applied through an rf modulator and an impedance-matching transformer to a color TV set's antenna terminals.

Operating Modes

Table 1 lists the operating characteristics of Electric Crayon semigraphics and graphics modes. Semigraphics blocks and graphics pixels (rectangular groups of dots) are shown in their relative shapes and sizes. A TRS-80 semigraphics block is included for comparison.

With minimum (1K) refresh memory, the Electric Crayon is operable in four modes. With 6K refresh RAM installed, it can operate in any one of 10 modes.

Dual-purpose mode 0 provides alphanumeric characters, coarse semigraphics patterns, or a mixture of both. Mode 1 provides a wider range of finer semigraphics patterns. Sorry, no alphanumerics, unless you make them up using the mode's patterns. Pure graphics modes 2 through 9 provide gradually finer resolution displays with individually mappable pixels and dots.

Table 1 block and pixel matrices are defined by TV dot clocks horizontally and TV field scan lines vertically. Although one field has 262.5 scan lines, only 192 of them can be mapped in BASIC programs. The remaining 70.5 lines are either blanked (black) or displayed in a mode's inherent background color.

Mappable TV screen divisions range from 512 semigraphics blocks (modes 0 and 1) to 49,152 dots (mode 9). The mode 9 dots may be only green or buff on black, but the resolution is eight times finer than that of the TRS-80. A simple Sx y command defines the dot to be lit. One Hx y n command can light up to 256 dots on a scan line.

In contrast, the Level II SET (x,y) command defines one of 6144 distinct video screen points where a 2 x 4-dot pixel may be lit. That's one sixth of a TRS-80 semigraphics block.

"The Crayon said: "Hook me up between a color TV and your TRS-80, and I'll give you color graphics."

MODE (DENSITY)	BLOCK/PIXEL MATRIX	MIN RAM	AVAILABLE COLORS NORMAL	No.	INVERTED	REMARKS
0 Block (X32xY16) Part (X64xY32)		1K	Green Yellow Blue Red Buff Cyan Magenta Orange (with black border)	C0 C1 C2 C3 C4 C5 C6 C7	N/A	This semigraphic mode uses 8x12-dot blocks divided into four 4x6-dot parts. The parts can be selectively lit to provide 16 patterns ranging from all parts extinguished to all parts lit in any one of eight colors. (See Fig. 1 for patterns.)
1 Block (X32xY16) Part (X64xY48)		1K	Green Yellow Blue Red (with black border)	C0 C1 C2 C3	Buff Cyan Magenta Orange	This semigraphic mode is like mode 0, except blocks are divided into six 4x4-dot parts. Also, the parts can be selectively lit to form 64 patterns (Fig. 1). Each pattern can be lit in any one of four normal or four inverted colors.
2 (X64xY64)		1K	Green Yellow Blue Red C0* is border and background color.	C0* C1 C2 C3	Buff Cyan Magenta Orange	This graphic mode uses 4x3-dot elements (or pixels). Individual pixels can be displayed in any one of four normal or inverted colors.
3 (128x64)		1K	Green on black C1* is border color.	C1* C0	Buff on black	These graphic modes use 2x3-dot pixels. Displayable colors depend on available refresh memory (MIN RAM).
4 (128x64)		2K	Same as mode 2.		Same as mode 2.	
5 (128x96)		2K	Same as mode 3.		Same as mode 3.	These graphic modes use 2x2-dot pixels. Displayable colors depend on available refresh memory.
6 (128x96)		3K	Same as mode 2.		Same as mode 2.	
7 (128x192)		3K	Same as mode 3.		Same as mode 3.	These graphic modes use 2x1-dot pixels. Displayable colors depend on available refresh memory.
8 (128x192)		6K	Same as mode 2.		Same as mode 2.	
9 (256x192)		6K	Same as mode 3.		Same as mode 3.	This graphic mode provides one dot clock by one TV field scan line resolution. Dots may be green or buff.
TRS-80 graphic block size ref. Block (X64xY16) Part (128x48)		N/A	White (set) Black (reset)		N/A	Block matrix is shown for size comparison with the available Electric Crayon semigraphic mode blocks and graphic mode pixels.

Table 1. Color Graphics Operating Characteristics

Grephics Commends

Table 2 details the eight Electric Crayon commands used in BASIC programs for semigraphics and graphics. All commands but one are single-letter statements with up to three arguments. How much simpler can a set of command statements get?

I consider ERS and Mn system initialization commands. They normally appear once at the beginning of a program. Cn is used as needed to change color throughout a program. The I command may or may not be used more than once.

Pn works only in semigraphics modes 0 and 1. A semicolon and at least one of three mapping commands must follow each Pn. Statement 12 in Program Listing 1 shows a typical semigraphics command string, displaying a 3 × 3 pattern solid yellow rectangle at the center of the display screen.

You can color the entire TV display screen using mapping commands Sx y, Hx y n, and Vx y n, by stringing them, occasionally inserting a Cn command, and packing them into numbered statements.

Deducting seven bytes for LPRINT", you may pack up to 248 graphics command characters into one statement. A few such statements can display a lot of color graphics.

That's not just simplicity, it's RAM-miserly compactness. After all, the TRS-80's RAM can't gulp characters forever; if you try stuffing it too much, it burps: "OM ERROR."

Compare Electric Crayon's programming simplicity and compactness with the programming required by currently available color microcomputers. The more I do that, the tighter I hug my Electric Crayon.

Three Electric Crayon commands not listed in Table 2 are A (ALPHA) and R (REVERSE), used only in programming mode 0 alphanumerics, and LD* (LOAD), used for entering assembly language Motorola S1 and S9 data records into the Electric Crayon's RAM.

Semigraphics Patterns

Fig. 1 shows the Electric Crayon's 16 mode 0 and 64 mode 1 semigraphics patterns. You can assemble them to form or draw various shapes in the same manner as TRS-80 graphic characters. You can also make the shapes move.

Program Listings 1 and 2 demonstrate all available semigraphics patterns. Listing 1 sequentially displays 16 mode 0 patterns on the TV display screen. Corresponding pattern (P) numbers appear on the TRS-80's monitor. Each pattern remains displayed about one sec-

BASIC COMMAND	LETTER(s) DEFINITION	ARGUMENT(s)	PURPOSE
ERS	ERASE	None	Clear refresh RAM and erase color video screen.
Mn	MODE	n=mode No. 0 thru 9	Select one of 10 operating modes. (See Table 1.)
Cn	COLOR	n=color No. 0 thru 7	Select one of eight colors. (See Table 1.)
I	INVERT	None	Complement all the displayed colors; that is, switch from normal to inverted or back to normal.
Pn	PATTERN	n=pattern No. 0 thru 63	Select one of 16 mode 0 or 64 mode 1 semigraphics patterns. (See Fig. 1.)
Sx y	SET	x=horizontal ordinate y=vertical ordinate	Light one pattern, pixel, or dot at x-y coordinates. Note: Using this command with the background color overprints and erases any contrasting color displayed at the x-y coordinates.
Hx y n	HORIZONTAL	x=horizontal ordinate y=vertical ordinate n=number of elements	Starting at x-y coordinates, display (n) patterns, dots, or pixels in the right-hand direction.
Vx y n	VERTICAL	Same as x y n above.	Starting at x-y coordinates, display (n) patterns, dots, or pixels downward.

Table 2. Color Graphics Commands

"Excluding statement 8 and the 36 delays, the program executes in about 18 seconds with DEFINT X,Y; 26 seconds without it."

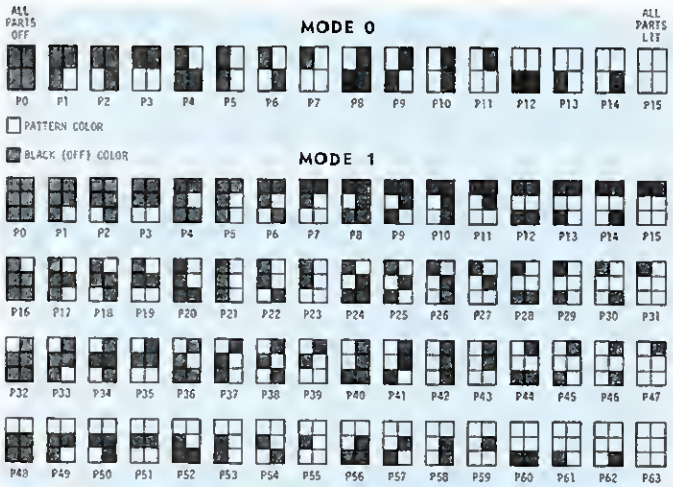


Fig. 1. Semigraphics Patterns

ond. Listing 2 similarly displays 64 mode 1 patterns. Press the TRS-80 BREAK key to stop any pattern. Type and enter CONT to resume pattern sequencing.

Semigraphics Action

Mode 2 missile launcher program (Listing 3) demonstrates how pattern-formed shapes may be moved using action sequences. Even-numbered statements make up the operating program. Odd-numbered REMs describe the sequential actions. The program shows five missiles being launched at two-second intervals.

Fig. 2 shows and identifies the mode 1 patterns used in the demonstration. Statement numbers under pattern groups identify the statements which display them. X and Y ordinate numbers along the edges of Fig. 2 pinpoint the display screen locations where actions occur.

Statements 6 and 8 initially display a launcher and a missile. C3 in statement 4 specifies orange as the launcher color. C1, used once in statement 8, specifies cyan (a light blue color) for all missiles displayed during program execution.

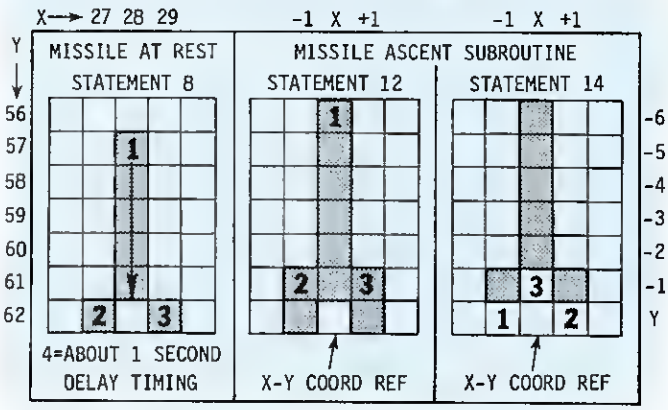


Fig. 3. Mode 2 Graphics Action

Statements 12, 14, and 16 make up a missile ascent subroutine. This subroutine raises the missile one vertical (Y) division in three climb increments. Fourteen successive loops through the subroutine raise the missile to the TV screen's top edge. From that point, six pattern group changes progressively move the missile off the display screen.

Throughout the missile ascent subroutine, pattern X,Y location points are defined with respect to coordinate reference block X = 15 Y = 13 (Fig. 2). The climb increment command segments in Statement 12, for example, are derived as follows:

Pattern P24, located in column X = 15 but two positions below line Y = 13, requires "P24;S";X;Y + 2;. The TRS-80 translates this command segment to P24;S 15 15 for the Electric Crayon.

Pattern P8, located one position to the right of column X = 15 and two positions below line Y = 13, requires "P8;S";X + 1;Y + 2;. This segment goes out as P8;S 16 15.

Pattern P21, located in column X = 15 but one position below line Y = 13, requires "P21;S";X;Y + 1;. This segment goes

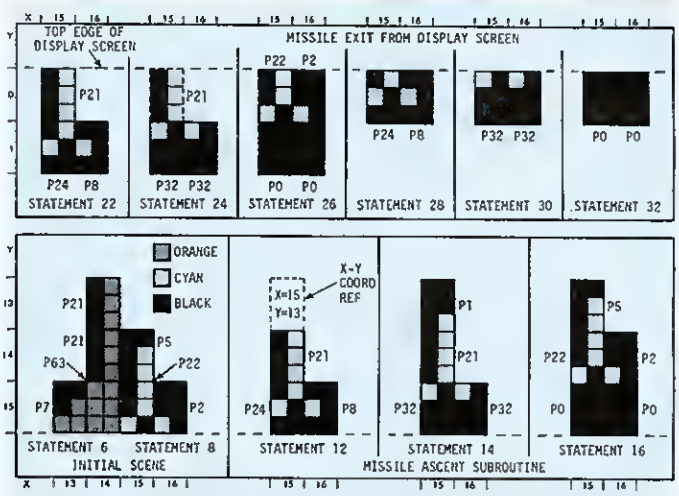


Fig. 2. Mode 1 Semigraphics Action

out as P21;S 15 14.

Statement 18 decrements Y to Y = 12, raising the coordinates reference block one line. Statement 20 keeps returning display control to the missile ascent subroutine until the missile reaches the TV screen's top edge.

Statement 34 keeps track of the missiles fired. About one second after a count increment, statement 38 checks whether or not five missiles have been fired. If not, GOTO8 sends display control to statement 8. That jump starts another missile display and launch routine.

In statement 2, MC = 0 returns the missile count to zero upon program start. DEFINT X,Y speeds up the TRS-80's X,Y coordinate calculations during missile ascent. Excluding statement 8 and the 36 delays, the program executes in about 18 seconds with DEFINT X,Y; 26 seconds without it. DEFINT (with all integers used) should be included in every action graphics program.

"Oops! Did I just stick the missile's nose two pixels through the ceiling? Nope, not really."

Semi Versus Pure Graphics

The mode 1 missile launcher program (Program Listing 3) shows action by changing semigraphics patterns. Sequential pattern groups advance (raise) a missile and erase (replace background color) behind it at the same time. The advance and erase functions must be programmed separately in a pure graphics mode.

A comparable pure graphics program (Listing 4) shows how command requirements and display results differ. Corresponding number statements in both listings do similar things (see REM's). Fig. 3 identifies missile display, advance, and erase actions. Numbers within pixel divisions identify sequential command segments in program statements 8, 12, and 14.

First, one Vx y n and two Sx y commands display a cyan missile at rest. The fourth segment holds the missile in place about one second. H1 9 61 merely overprints the buff background with 61 buff pixels. That's easier and thriftier than using a TRS-80 FOR T=0T0440:NEXT command to insert a delay.

Then, three Sx y commands add cyan pixels above the missile nose and two tall fins.

Finally, three Sx y commands erase the unmoving cyan pixels below the advanced missile. Each command overprints a cyan pixel with buff.

Fifty-nine loops through the two-statement ascent subroutine place the X,Y coordinates at line Y=3.

Oops! Did I just stick the missile's nose two pixels through the ceiling? Nope, not really. In this case, decrementing the X,Y point below five starts folding the missile down onto itself. Y=3 folds the missile nose two pixels below the TV screen's top edge. That leaves less missile to move off the screen. (To see the fold-down action, change statement 20 to IF Y>Y-3 GOTO 12. The change sends the first missile crashing down to the baseline. It also puts the program in an endless loop, trying to reach Y-3. Press the BREAK key to exit the loop.)

Statement 22 gets the missile off the display screen in four moves (Y-line decrements). These moves are aligned vertically in Listing 4 to show successive advance and erase actions in each X column.

I used Vx y n instead of Sx y commands in each increment's last segment. Additional overprint pixels in the Vx y n commands provide slight delays. Without these delays, the missile would move off the display screen too fast.

Removing all REMs and timing delays, byte counts and execution times of the semigraphics and pure graphics are:

MODE 1	MODE 2
527 bytes	518 bytes
17 seconds	40 seconds

Speedy mode 1 is the winner, and no wonder: It gets a missile up without color changes with only 14 loops through the ascent subroutine. In contrast, mode 2 switches color twice during each of its loops through the ascent subroutine. All these recurring operations sandbag a missile and slow its ascent.

Pure Graphics

Modes 2 through 9 let you map individual pixels or pixel strings. Since mappable TV screen divisions and command requirements increase with each higher mode, action speed decreases. With more screen divisions, more subroutine loops are needed to move a shape an equal distance. Given eight choices, you may go from simple (mode 2, Program Listing 4) to fancy (mode 9). In any mode, a program needs only system initiate, color (C), mapping (S,H,V), and a few common TRS-80 commands.

I like mode 6. It provides moderate resolution and fair speed within a reasonable program length. Chase (Program Listing 5) demonstrates mode 6 action graphics. Chase has typical routines for:

- Repeatable shapes
- Horizontal action
- Double action
- Diagonal action

```
1 'THIS PROGRAM SEQUENTIALLY
   DISPLAYS YELLOW MODE 0 PO
   THRU P15 PATTERNS  WITHIN
   A  GREEN  FRAME.  IT ALSO
   DISPLAYS  PATTERN NUMBERS
   ON THE TRS-80 MONITOR.
3 '
8  CLS: Z=0
10 LPRINT"ERS;M0;ERS;C0
12 LPRINT"P15;H14 6 3;H14 7
   3;H14 8 3
14 PRINT CHR$(23): GOTO20
16 LPRINT"C1;P";Z;"S15 7
18 PRINT@472,"P";Z: Z=Z+1
20 FOR T=0TO499: NEXT
22 IF Z<15 GOTO16
24 LPRINT"C0;P15;S15 7
26 PRINT@472,"DONE
28 END
```

Listing 1. Mode 0 Patterns Demonstration

```
1 'THIS PROGRAM SEQUENTIALLY
   DISPLAYS YELLOW MODE 1 PO
   THRU P63 PATTERNS  WITHIN
   A  GREEN  FRAME.  IT ALSO
   DISPLAYS  PATTERN NUMBERS
   ON THE TRS-80  MONITOR.
3 '
8  CLS: Z=0
10 LPRINT"ERS;M1;C0
12 LPRINT"P63;H14 6 3;H14 7
   3;H14 8 3
14 PRINT CHR$(23): GOTO20
16 LPRINT"C1;P";Z;"S15 7
18 PRINT@472,"P";Z: Z=Z+1
20 FOR T=0TO499: NEXT
22 IF Z<64 GOTO16
24 LPRINT"C0;P63;S15 7
26 PRINT@472,"DONE
28 END
```

Listing 2. Mode 1 Patterns Demonstration

```
1 'ELECTRIC CRAYON MODE 1  MISSILE LAUNCHER PROGRAM
2  CLS: DEFINT X,Y: MC=0
3 'ERASE SCREEN; GO MODE 1 INVERTED; SPECIFY ORANGE
4  LPRINT"ERS;M1;I;C3
5 'DISPLAY MISSILE LAUNCHER
6  LPRINT"P63;S14 15;P21;V14 13 2;P7;S13 15":GOTO36
7 'SWITCH TO CYAN COLOR; DISPLAY MISSILE AT REST
8  LPRINT"C1;P22;S15 15;P2;S16 15;P5;S15 14":
   FOR T=0TO440:NEXT
9 'DEFINE X-Y COORD REF POINT FOR MISSILE ASCENT
10 X=15: Y=13
11 'ASCENT SUBROUTINE --- 1ST CLIMB INCREMENT
12 LPRINT"P24;S";X;Y+2;"P8;S";X+1;Y+2;"P21;S";X;Y+1
13 '2ND CLIMB INCREMENT
14 LPRINT"P32;H";X;Y+2;2;"P1;S";X;Y
15 '3RD CLIMB INCREMENT
16 LPRINT"P22;S";X;Y+1;"P2;S";X+1;Y+1;"P0;H";X;Y+2;
   2;"P5;S";X;Y
17 'RAISE X-Y COORDINATES REFERENCE POINT  ONE LINE
18 Y=Y-1
19 'CHECK IF MISSILE AT SCREEN TOP; IF NOT, DO LOOP
20 IF Y>-1 GOTO12
21 'START MOVING-OFF-SCREEN SEQUENCE
22 LPRINT"P24;S15 1;P8;S16 1;P21;S15 0
23 '1ST MOVE --- NOSE GONE
24 LPRINT"P32;H15 1 2
25 '2ND MOVE --- MISSILE GOING
26 LPRINT"P22;S15 0;P2;S16 0;P0;H15 1 2
27 '3RD MOVE --- GOING
28 LPRINT"P24;S15 0;P8;S16 0
29 '4TH MOVE --- GOING
30 LPRINT"P32;H15 0 2
31 '5TH MOVE --- GONE
32 LPRINT"P0;H15 0 2
33 'INCREMENT MISSILE COUNT (MC)
34 MC=MC+1
35 'WAIT ABOUT 1 SECOND
36 FOR T=0TO440:NEXT
37 'IF LESS THAN 5 MISSILES FIRED, GO FIRE ONE MORE
38 IF MC<5 GOTO8
40 CLS: END
```

Listing 3. Mode 1 Missile Launcher

S, H, and V mapping commands for all these routines have their X and Y arguments expressed relative to a prespecified X,Y coordinate point. Relocating the reference point repeats a shape at another location on the TV. Incrementing or decrementing the X value of the reference point moves a shape right or left across the TV screen. Doing the same with Y moves the shape up or down. Incrementing X and Y at the same time moves a shape diagonally. Vertical action, already described and shown, (Program Listing 4 and Fig. 3), is not included in Program Listing 5.

In chase, even-numbered statements make up the active program. When keyed in continuous strings (no indents), these statements occupy 2893 bytes of TRS-80 RAM. All odd-numbered REMs can be safely omitted without affecting the program. Statements 2 and 68 display CHASE and DONE on the TRS-80 monitor at program start and end, respectively.

Statement 4 initializes the system. Using two M6 commands ensures a clean mode 6 display whether or not the Electric Crayon has been erased in the previous mode. Without the extra M6, mode 6

comes up with vertical magenta stripes after the Electric Crayon is turned on. Manually key and enter LPRINT"ERS" after each system turn-on or include that extra M6 in the program.

Statements 6, 10, and 12 paint the initial static scene. Each statement has several GOSUB8 commands preceded by X and Y ordinates. The ordinate pairs specify locations for displaying trees. The nine command segments in statement 8 display a tree, as shown in Fig. 4. Numerals and arrow lines identify sequential V commands which light the vertical pixel strings. GOSUB66 in statement 12 displays number 55 on a billboard, completing the static scene.

Statement 14 provides a short delay, defines action start (X,Y) and stop (Z) points, and then jumps to a speeding car action subroutine.

Statements 30, 32, and 34 bring a speeder on the scene. H commands impart brief delays to ensure its gradual appearance. The first two delays (H7 62 9 and H7 62 8) overprint pixels on the leftmost magenta tree, the nearest available area in the active color. The seven command segments in statement 34 advance the speeder into full view (Fig. 5, top frame).

Fig. 5, center and bottom frames, show how statement 36 sequentially lights and erases pixels. Each loop through the statement moves the speeder one X position. X = X + 1 increments the X,Y coordinate's reference point to keep the speeder moving horizontally.

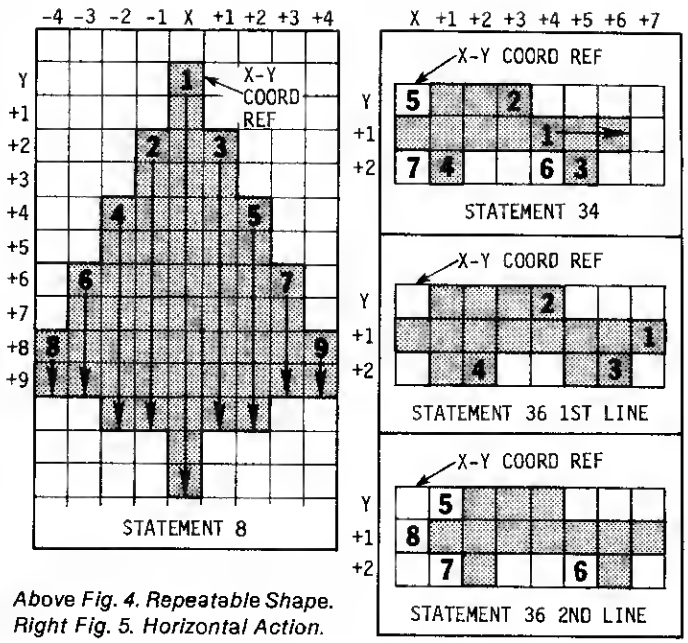
Statement 38 monitors the speeder's movement. It drops display control upon detecting an X = Z condition.

Statement 40 picks up the action; it starts moving the speeder behind a billboard. Statements 42 and 44 complete the move. Again, H

```
1 'ELECTRIC CRAYON MODE 2  MISSILE LAUNCHER PROGRAM
2  CLS: DEFINT X,Y: MC=0
3 'ERASE SCREEN; GO MODE 2 INVERTED; SPECIFY ORANGE
4  LPRINT"M2;ERS;M2;I;C3
5 'DISPLAY MISSILE LAUNCHER AND MAGENTA BASELINE
6  LPRINT"V26 53 10;V25 59 4;V24 61 2;S23 62;C2;
   NO 63 64":GOTO36
7 'SWITCH TO CYAN COLOR; DISPLAY MISSILE AT REST
8  LPRINT"C1;V28 57 5;S27 62;S29 62;C0;H1 9 61
9 'DEFINE X-Y COORD REF POINT FOR MISSILE ASCENT
10 X=28: Y=62
11 'ASCENT SUBROUTINE --- RAISE MISSILE  ONE Y LINE
12 LPRINT"C1;S";X;Y-6;"S";X-1;Y-1;"S";X+1;Y-1
13 'ERASE BELOW MISSILE.
14 LPRINT"C0;S";X-1;Y;"S";X+1;Y;"S";X;Y-1
17 'RAISE X-Y COORDINATES REFERENCE POINT  ONE LINE
18 Y=Y-1
19 'CHECK IF MISSILE AT SCREEN TOP; IF NOT, DO LOOP
20 IF Y>3 GOTO12
21 'MOVE OFF SCREEN (MISSILE GOING - GOING - GOING)
22 LPRINT"C1;S27 2;S29 2;C0;S27 3;S29 3;V28 2 3;
          C1;S27 1;S29 1;C0;S27 2;S29 2;V28 1 2;
          C1;S27 0;S29 0;C0;S27 1;S29 1;V28 0 9;
                          S27 0;S29 0":   '(GONE)
33 'INCREMENT MISSILE COUNT (MC)
34 MC=MC+1
35 'WAIT ABOUT 1 SECOND
36 LPRINT"C0;H1 9 61
37 'IF LESS THAN 5 MISSILES FIRED, GO FIRE ONE MORE
38 IF MC<5 GOTO8
40 CLS: END
```

Listing 4. Mode 2 Missile Launcher

✓ Reader Service—see page 242



Above Fig. 4. Repeatable Shape.
Right Fig. 5. Horizontal Action.

commands in the latter statement add timing delays to ensure gradual movement.

Display control returns to statement 16 which compensates for speeder passage time behind the billboard. Statement commands make a trooper (smoky) start his motorcycle and then peek around the billboard. With three added H command delays, statement execution time makes the speeder's reappearance look more realistic.

Statement 18 defines new start and end points for the speeder's remaining run. Again, GOSUB30 sends display control to the speeder action subroutine (statements 30 through 44). The speeder's final move behind the rightmost tree returns display control to statement 20.

Nine advance and erase moves in statement 20 swing the trooper from his hiding place to the road. Three of the moves use orange overprints to restore billboard structural parts. Packed as this statement appears, it still has five character spaces to spare. Remember, up to 248 standard graphics command characters may be packed into one statement.

X = 91 in statement 22 defines the trooper's horizontal move start point. Twenty-eight loops through statement 24 advance the trooper to X = 120. This horizontal action subroutine is similar to the one already described for the speeder. Each loop lights four leading pixels and erases four trailing pixels.

When X = 120, statement 26 passes display control to statement 28 which moves the trooper behind the rightmost tree. Since statement 28 is used only once, its commands have actual number X and Y arguments.

A jump to 46 starts a helicopter flyby routine. Statement 46 abruptly displays the copter's fuselage with two H commands (Fig. 6 top frame). There's no advantage in gradually bringing the copter into view while user attention is focused at the TV screen's opposite edge. The statement also defines start and end points for initial level flight.

Continues to page 78

```
1 '**** MODE 6 ACTION COLOR GRAPHICS DEMONSTRATION ****
2  CLS:PRINT CHR$(23):PRINT@472,"CHASE
3 'INITIALIZE; GO MODE 6 INVERTED; PRESTATE ORANGE
4  DEFINT X-Z:LPRINT"M6;ERS;M6;I;C3
5 'DO ORANGE PARTS OF INITIAL SCENE
6  X=4:Y=61:GOSUB8:X=111:Y=51:GOSUB8:X=59:Y=43:GOSUB8:
   X=29:Y=53:GOSUB8:X=123:Y=63:GOSUB8:LPRINT"H66 62 20;
   H67 72 17;V85 63 10;V66 63 11;S8 68;S120 68":GOTO10
7 'DISPLAY ONE TREE WITH TIP AT GIVEN X-Y COORDINATES
8  LPRINT"V";X;Y;13;"V";X-1;Y+2;9;"V";X+1;Y+2;9;"V";X-2;
   Y+4;7;"V";X+2;Y+4;7;"V";X-3;Y+6;4;"V"X+3;Y+6;4;"V";
   X-4;Y+8;2;"V";X+4;Y+8;2:RETURN
9 'DO MAGENTA PARTS OF SCENE
10 LPRINT"C2;S83 73;S83 71;S84 72;S85 73":X=11:Y=54:
   GOSUB8:X=54:Y=45:GOSUB8:X=100:Y=43:GOSUB8
11 'DO CYAN PARTS OF SCENE
12 LPRINT"C1;H0 71 2;H7 71 59;H86 71 33":X=19:Y=52:
   GOSUB8:X=106:GOSUB8:X=56:Y=32:GOSUB8:X=70:Y=64:
   GOSUB66:X=77:GOSUB66
13 'WAIT 1 SECOND AND START ACTION WITH SPEEDER
14 LPRINT"H7 71 59":X=9:Y=68:Z=59:GOSUB30
15 'SMOKY START MOTORCYCLE
16 LPRINT"S83 71;C2;V84 70 2;C0:V84 67 4;C2;S84 73;C0;
   H67 63 18;C2;V84 70 2;C0;S84 73;H80 71 5;C2;S85 71;
   C0;S84 70;H60 61;40
17 'SPEEDER CONTINUE DOWN ROAD
18 X=86:Z=113:GOSUB30
19 'SMOKY MOVE UP ON ROAD
20 LPRINT"C2;S85 72;C3;S85 71;S84 72;S85 73;C2;S86 73;
   S84 73;C0;S83 73;C2;S86 70;S86 72;S87 73;S85 73;C0;
   S86 73;S84 73;C3;S85 72;C0;S86 70;C2;S87 70;S88 72;
   C0;S87 73;C3;S85 73;C0;S87 70;C2;S88 70;S88 72;S89
   69;C0;H86 72 6;C2;S90 68;S90 70
21 'SMOKY GO AFTER SPEEDER
22 X=91
24 LPRINT"C2;S";X;Y;"S";X-1;Y+1;"S";X;Y+2;"S";X-2;Y+2;
   "C0;S";X-1;Y;"S";X-2;Y+1;"S";X-1;Y+2;"S";X-3;Y+2:
   X=X+1
25 'CHECK IF SMOKY AT TREE; IF NOT, LOOP AGAIN
26 IF X<120 GOTO24
27 'SMOKY DISAPPEAR BEHIND TREE
28 LPRINT"C0;S118 68;C2;S119 68:S119 69;S118 70;C0;
   S118 69;S119 70;S117 70;S119 68;H116 72 3;C2;S119
   70;C0;S119 69;H116 70 4":GOTO46
29 'SPEEDER APPEAR FROM BEHIND TREE OR BILLBOARD
30 LPRINT"C2;S";X;Y+1;"H7 62 9;S";X+1;Y+1;"S";X;Y+2;
   "H7 62 8;S";X+2;Y+1;"S";X+1;Y+2;"C0;S";X;Y+2;"C2;H";
   X;Y+1;4;"S";X;Y;"S";X+2;Y+2;"C0;S"X+1;Y+2
32 LPRINT"C2;H";X+1;Y+1;4;"S";X+3;Y+2;"S";X+1;Y;"S";
   X+2;Y;"C0;S";X+2;Y+2;"C2;H";X+3;Y+1;3;"S";X;Y+2;"S";
   X+4;Y+2;"C0;S";X+3;Y+2
34 LPRINT"C2;H";X+4;Y+1;3;"S";X+3;Y;"S";X+5;Y+2;"S";
   X+1;Y+2;"C0;S";X;Y;"S";X+4;Y+2;"S";X;Y+2
35 'SPEEDER MOVE DOWN ROAD
36 LPRINT"C2;S";X+7;Y+1;"S";X+4;Y;"S";X+6;Y+2;"S";X+2;
   Y+2;"C0;S";X+1;Y;"S";X+5;Y+2;"S";X+1;Y+2;"S";X;Y+1:
   X=X+1
37 'CHECK IF SPEEDER AT END OF RUN; IF NOT, LOOP AGAIN
38 IF X<Z GOTO36
39 'SPEEDER DISAPPEAR BEHIND BILLBOARD OR TREE
40 LPRINT"C2;S";X+4;Y;"S";X+6;Y+2;"S";X+2;Y+2;"C0;S";
   X+1;Y;"S";X+5;Y+2;"S";X+1;Y+2;"S";X;Y+1;"C2;S";X+5;
   Y;"S";X+3;Y+2
42 LPRINT"C0;S";X+2;Y;"S";X+6;Y+2;"S";X+2;Y+2;"S";X+1;
```

Program continues

✓Reader Service—see page 242

"Nine advance and erase moves in statement 20 swing the trooper from his hiding place to the road"

```
   Y+1;"C2;S";X+6;Y;"S";X+4;Y+2;"CO;S";X+3;Y;"S";X+3;
   Y+2;"S";X+2;Y+1;"C2;S";X+5;Y+2;"CO;S";X+4;Y
44 LPRINT"S";X+4;Y+2;"S";X+3;Y+1;"C2;H";X+4;Y+1;3;"V";
   X+6;Y;3;"CO;S";X+5;Y;"S";X+5;Y+2;"S";X+4;Y+1;"H";X;
   Y;7;"S";X+6;Y+2;"S";X+5;Y+1;"H";X+1;Y+1;6:RETURN
45 'HELICOPTER APPEAR ON SCENE
46 LPRINT"C2;H0 29 5;H3 30 3":X=3:Y=27:
   Z=95:GOSUB48:GOTO54
47 'HELICOPTER FLY OVER TREE TOPS
48 LPRINT"C2;S";X;Y;"S";X+2;Y;"S";X-1;Y;"S";X+3;Y;"S";
   X+2;Y+2;"S";X+3;Y+3;"CO;S";X-3;Y+2;"S";X;Y+3
50 LPRINT"S";X-1;Y;"S";X+3;Y;"S";X;Y;"S";X+2;Y;"C2;S";
   X+3;Y+2;"S";X+4;Y+3;"CO;S";X-2;Y+2;"S";X+1;Y+3:X=X+2
51 'CHECK IF COPTER PASSED HIGH TREE, LOOP UNTIL IT HAS
52 IF X<Z GOTO48 ELSE RETURN
53 'HELICOPTER DROP BELOW TREE TOPS
54 Y=Y+1
56 LPRINT"C2;S";X;Y;"S";X+2;Y;"H";X-2;Y+2;2;"CO;H";X-3;
   Y+1;5;"C2;H";X+1;Y+3;3;"S";X-1;Y;"S";X+3;Y
58 LPRINT"CO;S";X-1;Y;"S";X+3;Y;"S";X;Y;"S";X+2;Y;"H";
   X-2;Y+2;5;"C2;H";X-1;Y+3;2;"H";X+2;Y+4;3:X=X+2:Y=Y+2
59 'CHECK IF COPTER LOW ENOUGH; LOOP UNTIL IT IS
60 IF Y<50 GOTO56
61 'HELICOPTER START LEVEL FLIGHT
62 Y=49:Z=124:GOSUB48
63 'HELICOPTER GRADUALLY DISAPPEAR OFF SCREEN
64 LPRINT"C2;S125 49;S127 49;S124 49;S127 51;CO;S122 51;
   S125 52;H122 49 3;S127 49;H123 49 3;H117 51 7;S126
   52;C2;S127 49;H125 51 2;S126 49;CO;H118 51 7;S127 52;
   H123 49 4;H124 49 4;H119 51 7;H113 51 14;H114 51 14":
   GOTO68
65 'DISPLAY ONE NUMERAL 5
66 LPRINT"V";X;Y;3;"H";X+1;Y+2;3;"V";X+4;Y+3;3;"H";X+1;
   Y+6;3;"S";X;Y+5;"H";X+1;Y;4:RETURN
67 'DISPLAY SIGN-OFF MESSAGE ON TRS-80 SCREEN
68 PRINT@472,"OONE ":END
```

Listing 5. Chase (mode 6) Demonstration

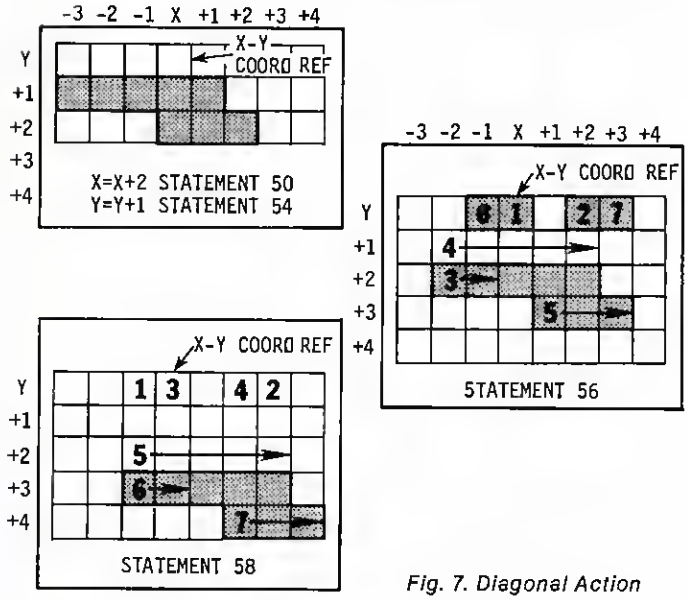


Fig. 7. Diagonal Action

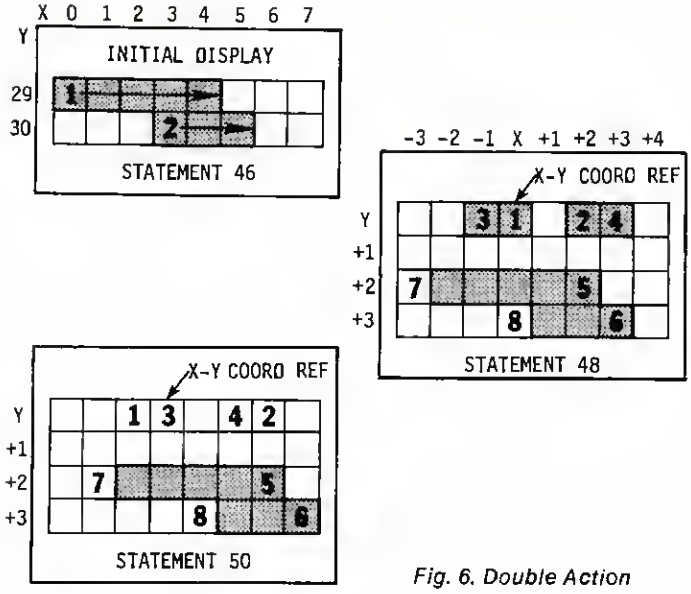


Fig. 6. Double Action

"You too can have alphanumerics in the higher-resolution graphics modes, the Easy-Does-It way."

Dual-action statements 48 and 50 spin the copter's rotor and advance its fuselage. Each loop through these statements turns the rotor once and moves the fuselage two X positions. Fig. 6, center and bottom frames, identifies sequential light and erase actions. The first statement lights four rotor pixels in an outward direction. The second statement erases the pixels inward. This scheme creates a rotational illusion. Both statements also light fuselage leading pixel pairs and erase trailing pixel pairs.

Forty-two loops through the two-statement subroutine advance the copter's X,Y coordinate reference point to X=Z. At that point, statement 54 increments Y one line (Fig. 7 top frame). This action allows use of Y instead of Y−1 arguments in eight subsequent rotor pixel light and erase commands. Using Y in these commands saves 16 bytes.

Fig. 7, center and bottom frames, identifies sequential actions performed by a two-statement copter descent subroutine. Rotor

Alphanumeric Resolution: A Solution

The Percom Electric Crayon color graphics generator/controller has a good alphanumerics character generator, but it can be used only in alphanumerics-semigraphics mode 0. In that mode, A (ALPHA) and R (REVERSE) commands let you mix the generator's characters with coarse semigraphics patterns. Beyond mode 0, you are on your own.

Don't despair! You too can have alphanumerics in the higher-resolution graphics modes, the Easy-Does-It way. This program simulates a character generator for graphics modes 2 through 9.

That's right folks. You can sit right down and write yourself some letters—even words and phrases—for all your Electric Crayon color graphics programs.

Display Comparisons

The Electric Crayon's character generator provides excellent 5×7 dot matrix characters within 8×12 dot blocks. This format yields three-dot separation between characters and five-dot separation between lines.

Using the A or R command in mode 0, you can place up to 32 of the generator's characters on each of 16 display lines. Character display positions are limited to 32 specific locations on a line.

Characters may be green or orange on black (A command) or black on green or orange (R command). The displayed characters appear in 12 dot high background-color windows. An I (INVERT) command lets you select character or background color.

The Easy-Does-It program is written in TRS-80 Level II BASIC. Except for I, 1, and certain punctuation marks, the program plots characters on 5×7 element matrixes. Matrix elements may be mode 9 dots or mode 2 through 8 pixels (rectangular groups of dots). You decide your own character, word, and line separations. Simply define the X (horizontal) and Y (vertical) coordinates for character and line placement.

This scheme lets you put characters anywhere on the TV and arrange them tightly or loosely. Also, you can use any available color to display the characters on any contrasting background color. To erase, just overprint the characters with the background color.

Table 1 lists character densities that can be achieved with the programmed characters. Except for mode 9, densities are based on three-pixel line separation and one-pixel character separation. The mode 9 density is based on two-dot character separation.

Character X,Y Plots

Fig. 1 shows the program's graphics mode characters. The upper left-hand pixel of each character's matrix is the X,Y coordinate reference point for the character. In mode 2, for example, X=29 and Y=25 center a character on the TV display screen. You determine and provide the coordinates in your Electric Crayon graphics programs.

Even-numbered statements 10 through 98 (Listing 1) contain character X,Y plot information. Each statement specifies the pixels and pixel strings which must be lit to form a character. Pixel positions are specified with respect to the character's X,Y coordinate reference point.

Fig. 2 shows how statement 28 ultimately illuminates the letter J. In this example (X=29 and Y=25), the TRS-80 translates the statements's four command segments into the following Electric Crayon commands:

1. V32 26 5 (light 5 down)
2. H30 31 2 (light 2 across)
3. S29 30 (light 1 pixel)
4. H31 25 3 (light 3 across)

Translated commands go out the TRS-80's printer port to the Electric Crayon's refresh RAM. They stay there until replaced or erased. Electric Crayon converts the stored commands to video signals and repeatedly sends them out its video port. These signals illuminate a J on the video screen, and then refresh it at a 60-Hz rate.

Program Mechanics

Program Listing 1 contains three principal sections. The first plots characters, the second displays them sequentially, the third uses them to form words. The latter two sections are included to demonstrate the available characters and their use.

Even-numbered statements 10 through 98 contain the X,Y plot information for characters shown in Fig. 1. Odd-numbered REM statements 9 through 97 identify the characters plotted by statements directly below them. The 45 X,Y plot statements occupy 3040 bytes of RAM; accompanying REM statements occupy 616 bytes.

Statement 7 speeds up X,Y plot calculations. Minus the time delays of statements 108 and 114, the program executes in 21.5 seconds with DEFINT X−Z; 27.5 seconds without it. Include statement 7 (or its equivalent) in your Electric Crayon graphics program for faster alphanumeric displays.

"You can use any available color to display the characters on any contrasting background color."

spin commands are similar to those in the level flight subroutine. Fuselage move commands differ since they must advance and lower the fuselage. H commands in statements 56 and 58 light and erase pixel strings to advance and lower the fuselage. The latter statement also increments X and Y two positions to steer movement diagonally.

Finally, statement 62 defines new start and end points, and jumps to the level-flight subroutine. When the copter reaches Z = 124, statement 64 moves it off the TV. That ends all programmed action.

If you like to live dangerously, change Z = 95 to Z = 89 in statement 46. That change makes the copter clip tree tops during its descent. Using Z = 61 makes the copter a real chopper as it hacks through a few trees on its exit flight. These changes illustrate how an action sequence may be relocated on the screen.

These are just some of the many ways to get action color graphics with a TRS-80/Electric Crayon system. ■

Statements 100 through 116 sequentially display yellow characters on a green background in graphics mode 6. For cyan (light blue) characters on buff (off white) add ;1 to statement 100. (Spaces may be used instead of semicolons in that statement. I use semicolons to ensure required separation between the statement's command segments.) For blue/magenta or red/orange characters, change C1 of statement 104 to C2 or C3. Display color depends on the operating state (normal/inverted) during program execution.

Change M6 in statement 100 to any other graphics mode (M2-M9) in which you want to see the characters. When trying other modes, note the shape proportions of the displayed characters. Modes 7 and 8 foreshorten the characters; modes 3 and 4 slenderize them.

Statement 104 must have C1 as the character display color in modes 3, 5, 7, and 9. Also, statement 110 must have C0 as the erase (overprint) color.

Statements 118 through 122 display the phrase: EASY DOES IT! X,Y coordinates in these statements center the three words vertically.

Here's how each statement positions and spaces the letter characters of its assigned word:

Y = 16 in statement 118 defines the uppermost pixel of four character matrixes. X = 20 defines the upper left-hand corner pixel (Fig. 1) for plotting letter E. GOSUB18 gets plot parameters for E from statement 18. The TRS-80 translates them, and the Electric Crayon lights the required pixels to illuminate an E. Next, X = 27 defines the plot point for letter A. GOSUB10 gets plot parameters for A from statement 10, and an A appears on the display screen. X = 34:GOSUB46 and X = 41:GOSUB58 display S and Y in the same manner. That completes the word EASY.

The statement's successive X ordinates are increased by seven positions. This increment provides two-pixel separation between letters.

Statements 120 and 122 similarly display their assigned words. Y = 26 and Y = 36 in these statements provide three-pixel separation between lines. The X ordinates in statement 120 match those in statement 118, placing DOES directly under EASY. Since statement 122 handles

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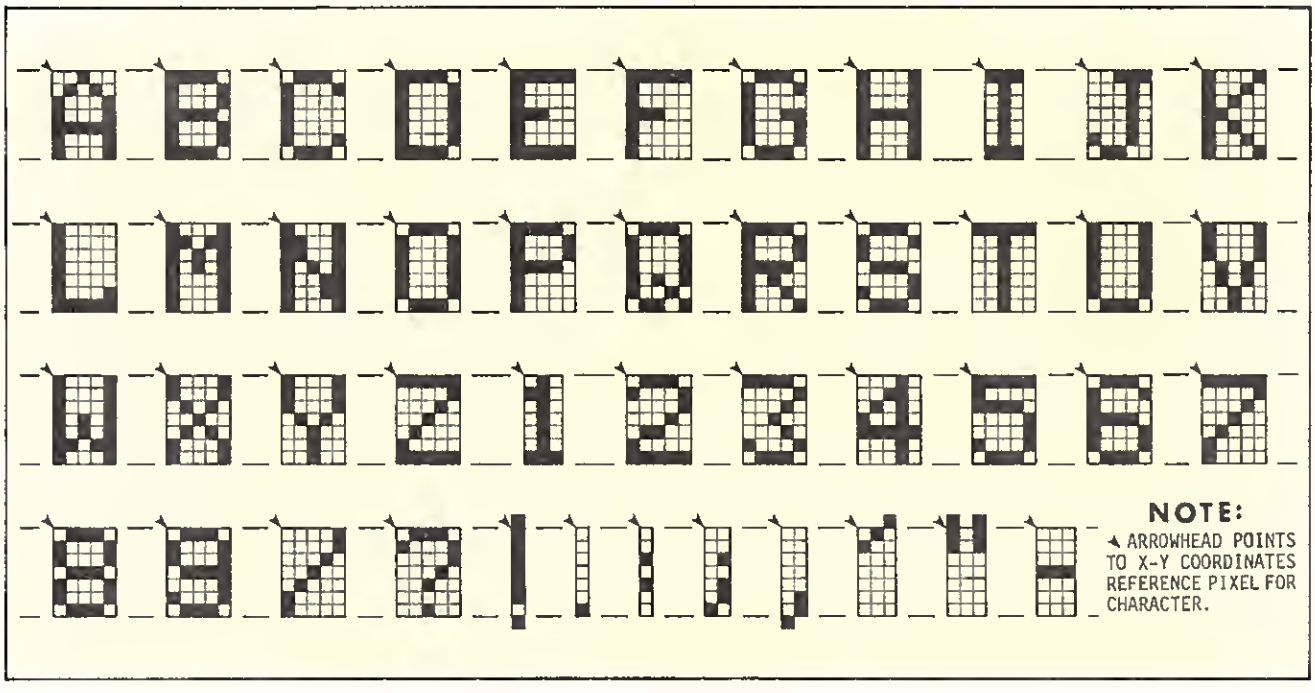

Fig. 1. Programmed Character Matrix Plots

```
1 CLS:PRINT@207,"ALPHANUMERIC CHARACTERS BASIC PROGRAM
2 PRINT@404,"FOR PERCOM  ELECTRIC CRAYON
3 PRINT@597,"GRAPHIC MODES 2 THROUGH 9
4 ' A HOW-TO BY: * * * * * * * * * * * * * * * * * * *
5 '               *          F.S. KALINOWSKI          *
6 LPRINT"ERS;M6' *         16 N. ALDER DRIVE         *
7 DEFINT X-Z'    *       ORLANDO, FLORIDA  32807      *
8 GOTO100'       * * * * * * * * * * * * * * * * * * *
9 ' CHARACTER DOT-MATRIX PLOTS  ----  A
10 LPRINT"V";X;Y+2;5;"S";X+1;Y+1;"S";X+2;Y;"S";X+3;Y+1;
   "V";X+4;Y+2;5;"H";X+1;Y+4;3:RETURN
11 ' B
12 LPRINT"V";X;Y;7;"H";X+1;Y;3;"H";X+1;Y+3;3;"H";X+1;
   Y+6;3;"V";X+4;Y+1;2;"V";X+4;Y+4;2:RETURN
13 ' C
14 LPRINT"V";X;Y+1;5;"H";X+1;Y;3;"H";X+1;Y+6;3;"S";X+4;
   Y+1;"S";X+4;Y+5:RETURN
15 ' D
16 LPRINT"V";X;Y;7;"H";X+1;Y;2;"H";X+1;Y+6;2;"S";X+3;
   Y+1;"S";X+3;Y+5;"V";X+4;Y+2;3:RETURN
17 ' E
18 LPRINT"V";X;Y;7;"H";X+1;Y;4;"H";X+1;Y+6;4;"H";X+1;
   Y+3;2:RETURN
19 ' F
20 LPRINT"V";X;Y;7;"H";X+1;Y;4;"H";X+1;Y+3;2:RETURN
21 ' G
22 LPRINT"V";X;Y+1;5;"H";X+1;Y;3;"H";X+1;Y+6;3;"V";X+4;
   Y+3;3;"S";X+4;Y+1;"S";X+3;Y+3:RETURN
23 ' H
24 LPRINT"V";X;Y;7;"H";X+1;Y+3;3;"V";X+4;Y;7:RETURN
25 ' I
26 LPRINT"V";X+1;Y+1;5;"H";X;Y;3;"H";X;Y+6;3:RETURN
27 ' J
28 LPRINT"V";X+3;Y+1;5;"H";X+1;Y+6;2;"S";X;Y+5;"H";
   X+2;Y;3:RETURN
29 ' K
30 LPRINT"V";X;Y;7;"S";X+1;Y+3;"S";X+4;Y;"S";X+3;Y+1;
   "S";X+2;Y+2;"S";X+2;Y+4;"S";X+3;Y+5;"S";X+4;Y+6:
   RETURN
31 ' L
32 LPRINT"V";X;Y;6;"H";X;Y+6;5;"S";X+4;Y+5:RETURN
33 ' M
34 LPRINT"V";X;Y;7;"S";X+1;Y+1;"V";X+2;Y+2;2;"S";X+3;
   Y+1;"V";X+4;Y;7:RETURN
35 ' N
36 LPRINT"V";X;Y;7;"V";X+1;Y+1;2;"S";X+2;Y+3;"V";X+3;
   Y+4;2;"V";X+4;Y;7:RETURN
37 ' O
38 LPRINT"V";X;Y+1;5;"H";X+1;Y;3;"H";X+1;Y+6;3;"V";
   X+4;Y+1;5:RETURN
39 ' P
40 LPRINT"V";X;Y;7;"H";X+1;Y;3;"V";X+4;Y+1;2;"H";X+1;
   Y+3;3:RETURN
41 ' Q
42 LPRINT"V";X;Y+1;5;"H";X+1;Y;3;"H";X+1;Y+6;2;"V";X+4;
```

Program continues

I'M A BELIEVER !!

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11) User definable keys, all 26 letters
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13) Dated files. - All files are accompanied by the date of their last modification. (creation or write)
14) Marked files. - All files are accompanied by a 'mark' is they have been modified since they were last backed up. This permits the BACKUP utility to copy only those files which have actually been updated since a previous backup.
15) File transfer by class. Allows transferring of all files of a similar directory classification such as /CMD, /BAS, /PCL, etc.
16) Built in SYSTEM command contains lower case display driver, screen print, break key disable, blink-cursor, disk drive stepping rate and motor-on delay modifications, and more.
17) Users may SYSGEN a custom VTOS system configuration containing special I/O drivers, device LINKing and ROUTEing, SPOOLing and DEBUG tasks, etc. which will be automatically loaded during the BOOT process without requiring a more lengthy AUTO and CHAIN procedure.
18) Non-BREAKable AUTO and CHAIN commands.
19) Wild-Card DIRectory. Permits you to locate all files of a certain classification such as '/BAS'. Uniformly file size in K (1024 bytes) regardless of drive type. "DIR D" would give you all of your files that start with D.
20) Dynamic file name defaults in APPEND, COPY, and RENAME commands allow you to specify only minimal information about file names.
21) COPY and APPEND commands execute up to 300% faster.
22) ALLOCate command for pre-allocation and non-releasibility of file space. File space will never shrink if this option is used.
23) MEMORY command for directly setting upper memory limit.
24) Variable length file support is incorporated which automatically blocks short user data records both within a sector and across sector boundries thereby taking maximum advantage of disk file space.
25) No security disk needed to make backups or to run the system.
26) Though many O/S bear his design and code, VTOS 4.0 is the ONLY FULLY APPROVED OPERATING SYSTEM by Randy Cook! And it's FANTASTIC!
27) Endorsed by SCOTT ADAMS & LANCE MICKLUS.

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Master Reference Manual
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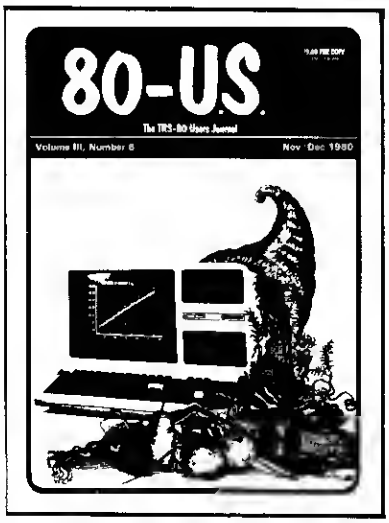

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```
   Y+1;4;"S";X+2;Y+4;"S";X+3;Y+5;"S";X+4;Y+6:RETURN
43 ' R
44 LPRINT"V";X;Y;7;"H";X+1;Y;3;"V";X+4;Y+1;2;"H";X+1;
   Y+3;3;"S";X+2;Y+4;"S";X+3;Y+5;"S";X+4;Y+6:RETURN
45 ' S
46 LPRINT"S";X+4;Y+1;"H";X+1;Y;3;"V";X;Y+1;2;"H";X+1;
   Y+3;3;"V";X+4;Y+4;2;"H";X+1;Y+6;3;"S";X;Y+5:RETURN
47 ' T
48 LPRINT"V";X+2;Y+1;6;"H";X;Y;5:RETURN
49 ' U
50 LPRINT"V";X;Y;6;"H";X+1;Y+6;3;"V";X+4;Y;6:RETURN
51 ' V
52 LPRINT"V";X;Y;3;"V";X+1;Y+3;2;"V";X+2;Y+5;2;"V";X+3;
   Y+3;2;"V";X+4;Y;3:RETURN
53 ' W
54 LPRINT"V";X;Y;7;"S";X+1;Y+5;"V";X+2;Y+3;2;"S";X+3;
   Y+5;"V";X+4;Y;7:RETURN
55 ' X
56 LPRINT"V";X;Y;2;"S";X+1;Y+2;"S";X+2;Y+3;"S";X+3;Y+4;
   "V";X+4;Y+5;2;"V";X+4;Y;2;"S";X+3;Y+2;"S";X+1;Y+4;
   "V";X;Y+5;2:RETURN
57 ' Y
58 LPRINT"V";X;Y;3;"S";X+1;Y+3;"V";X+4;Y;3;"S";X+3;Y+3;
   "V";X+2;Y+4;3:RETURN
59 ' Z
60 LPRINT"H";X;Y;5;"S";X+4;Y+1;"S";X+3;Y+2;"S";X+2;Y+3;
   "S";X+1;Y+4;"S";X;Y+5;"H";X;Y+6;5:RETURN
61 ' 1
62 LPRINT"S";X;Y+1;"V";X+1;Y;7;"H";X;Y+6;3:RETURN
63 ' 2
64 LPRINT"S";X;Y+1;"H";X+1;Y;3;"V";X+4;Y+1;2;"S";X+3;
   Y+3;"H";X+1;Y+4;2;"S";X;Y+5;"H";X;Y+6;5:RETURN
65 ' 3
66 LPRINT"H";X;Y;4;"S";X+4;Y+1;"S";X+3;Y+2;"S";X+2;Y+3;
   "S";X+3;Y+4;"S";X+4;Y+5;"H";X+1;Y+6;3;"S";X;Y+5:
   RETURN
67 ' 4
68 LPRINT"V";X+3;Y;7;"S";X+2;Y+1;"S";X+1;Y+2;"V";X;Y+3;
   2;"H";X+1;Y+4;5:RETURN
69 ' 5
70 LPRINT"V";X;Y;3;"H";X+1;Y+2;3;"V";X+4;Y+3;3;"H";X+1;
   Y+6;3;"S";X;Y+5;"H";X+1;Y;4:RETURN
71 ' 6
72 LPRINT"S";X+4;Y+1;"H";X+1;Y;3;"V";X;Y+1;5;"H";X+1;
   Y+6;3;"V";X+4;Y+4;2;"H";X+1;Y+3;3:RETURN
73 ' 7
74 LPRINT"H";X;Y;5;"S";X+4;Y+1;"S";X+3;Y+2;"S";X+2;Y+3;
   "S";X+1;Y+4;"V";X;Y+5;2:RETURN
75 ' 8
76 LPRINT"H";X+1;Y;3;"V";X;Y+1;2;"H";X+1;Y+3;3;"V";X+4;
   Y+4;2;"H";X+1;Y+6;3;"V";X;Y+4;2;"V";X+4;Y+1;2:RETURN
77 ' 9
78 LPRINT"H";X+1;Y+3;3;"V";X;Y+1;2;"H";X+1;Y;3;"V"X+4;
   Y+1;5;"H";X+1;Y+6;3;"S";X;Y+5:RETURN
79 ' ! (EXCLAMATION POINT)
```

Program continues

```
80 LPRINT"V";X;Y-1;7;"S";X;Y+7:RETURN
81 ' ? (QUESTION MARK)
82 LPRINT"S";X;Y+1;"H";X+1;Y;3;"V";X+4;Y+1;2;"S";X+3;
   Y+3;"S";X+2;Y+4;"S";X+2;Y+6:RETURN
83 ' . (PERIOD)
84 LPRINT"S";X;Y+6:RETURN
85 ' , (COMMA)
86 LPRINT"V";X+1;Y+5;2;"S";X;Y+7:RETURN
87 ' : (COLON)
88 LPRINT"S";X;Y+2;"S";X;Y+4:RETURN
89 ' ; (SEMICOLON)
90 LPRINT"S";X+1;Y+2;"V";X+1;Y+4;2;"S";X;Y+6:RETURN
91 ' ' (APOSTROPHE)
92 LPRINT"S";X+2;Y-1;"S";X+1;Y;"S";X;Y+1:RETURN
93 ' " (QUOTATION MARKS)
94 LPRINT"V";X;Y-1;3;"V";X+2;Y-1;3:RETURN
95 ' - (HYPHEN)
96 LPRINT"H";X;Y+3;3:RETURN
97 ' / (SLASH)
98 LPRINT"V";X+4;Y;2;"S";X+3;Y+2;"S";X+2;Y+3;"S";X+1;Y+4;"V";
   X;Y+5;2:RETURN
99 ' PRINT EACH CHARACTER, IN TURN
100 LPRINT"ERS;M6
101 ' OEFINE X-Y COORDINATES AND SUBROUTINE POINTER
102 X=29: Y=25: Z=1
103 ' DEFINE CHARACTER OISPLAY COLOR
104 LPRINT"C1": GOSUB106: GOTO108
105 ' LOOP THROUGH CHARACTER SUBROUTINE FOR DISPLAY
106 ON Z GOSUB10,12,14,16,18,20,22,24,26,28,30,32,34,
   36,38,40,42,44,46,48,50,52,54,56,58,60,62,64,66,68,
   70,72,74,76,78,80,82,84,86,88,90,92,94,96,98:RETURN
107 ' HOLD CHARACTER OISPLAY 3/4 SECOND
108 FORT=1TO330:NEXT
109 ' OEFINE ERASE COLOR
110 LPRINT"CO
111 ' LOOP THROUGH CHARACTER SUBROUTINE TO ERASE
112 GOSUB106
113 ' INCREMENT GOSUB POINTER (Z) AND WAIT 1/4 SECOND
114 Z=Z+1: FORT=1TO110:NEXT
115 ' CHECK IF MORE CHARACTERS; IF YES, OO MORE LOOPS
116 IF Z<50 GOTO104
117 ' PRINT "EASY"
118 LPRINT"C1": Y=16: X=20:GOSUB18: X=27:GOSUB10: X=34:
   GOSUB46: X=41:GOSUB58
119 ' PRINT "OOES"
120 Y=26: X=20: GOSUB16: X=27: GOSUB38: X=34: GOSUB18:
   X=41: GOSUB46
121 ' PRINT "IT!"
122 Y=36: X=26: GOSUB26: X=31: GOSUB48: X=39: GOSUB80
900 CLS: END
```

Program Listing 1. Alphanumeric Characters BASIC Program

ALPHA PRODUCTS PRESENTS:

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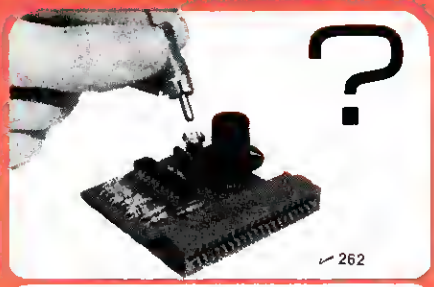

MUSIC-80 MUSIC-80 MUSIC-80 MUSIC-80 MUSIC-80
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or write your own. With this low cost 8 bit digital to analog converter you can synthesize up to 5 music voices. Built-in volume control handy when stereo not near TRS-80. Simply plug the "MUSIC-80" into the keyboard or the E/I screen printer port and connect the output (RCA jack) to any amplifier. The Radio-Shack $12 speaker/amplifier works fine.
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YOU ASKED FOR IT: "EXPANDABUS" X1, X2, X3 AND X4.
CONNECT ALL YOUR TRS-80 DEVICES SIMULTANEOUSLY on the 40 pin TRS-80 bus. Any device that normally plugs into the keyboard edge connector will also plug into the "EXPANDABUS". The "X4" is shown with protective covers (included). The TRS-80 keyboard contains the bus drivers (74LS367) for up to 20 devices, more than you will ever need. Using the E/I, it plugs either between KB and E/I or in the Screen Printer port. Professional quality, gold plated contacts. Computer grade 40 conductor ribbon cable.
X2...$29. X3...$44. X4...$59 X5...$74
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Measure Temperature, Voltage, Current, Light, Pressure, etc
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Specifications: Input range: 0-5V. to 0-500V Each channel can be set to a different scale
Resolution, 20mV (on 5V range). Accuracy: 8 bits (.5%). Port Address: jumper selectable Plugs into keyboard bus or E/I (screen printer port). Assembled and tested 90 day warranty
Complete with power supply, connector, manual . . $139.

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—8 TTL/CMOS inputs. Input 0 and 1 are optically isolated.
—Neat and compact design, very easy to use:
10 A=INP(0) 'Reads the 8 inputs (if A=0, all inputs are low) 20 OUT 0,X 'Controls the outputs and the relays
Assembled & tested, 90 day warranty. Price includes power supply, cable to KB or E/I, superb user's manual, free phone dialer program: $95. Manual only: $5.

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 offer the convenience of charging their purchase to major credit cards
How come we are the only green screen people doing it?
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497

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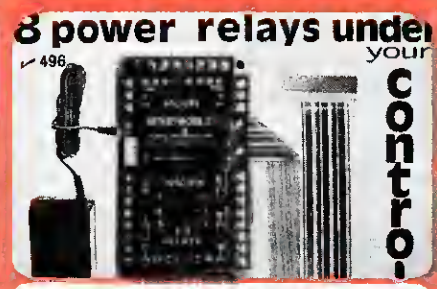

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only three characters, its X ordinates are adjusted to exactly center IT! under DOES.

These statements may be combined to conserve bytes. Just tag statement 120 and 122 X,Y plot information onto statement 118. The TRS-80 will send the same string of Electric Crayon commands out its printer port.

Using The Program

You must at least key in and record (SAVE, CSAVE, or @SAVE) even-numbered statements 10 through 98 to retain all character X,Y plots. You may skip the REM statements.

When programming alphanumerics, start with a sheet of graph paper or an Electric Crayon Sketchpad. Prepare and use this sheet to lay out words and phrases the way you want them to appear on the TV screen.

Partition the sheet into suitable pixel areas horizontally (X direction) and vertically (Y direction) for the intended graphics mode. Starting with 0 at the layout's upper left-hand corner, number the partitioned columns and rows. Display area dimensions in pixels are:

Mode 2	X64 x Y64
Modes 3 and 4	128 x 64
Modes 5 and 6	128 x 96
Modes 7 and 8	128 x 192
Mode 9 (dots)	256 x 192

Referring to your word/phrase layout sheet, locate the Y ordinate for the first line of words. Start a numbered statement with the first line's Y ordinate (520 Y = 20:, for example). Now add an X ordinate and GOSUB for each letter of each word on the first line. Increase successive X ordinates by six or seven of one or two-pixel letter separation, as desired. Repeat this procedure for each additional word or phrase line on the layout sheet.

When using I, 1, and most of the punctuations, check character matrix width in Fig. 1, and increase the next X ordinate by one or two plus the matrix width. Increase X four or five pixel positions to insert a space. Also, make sure you provide enough line separation to accommodate punctuation mark ascenders and descenders.

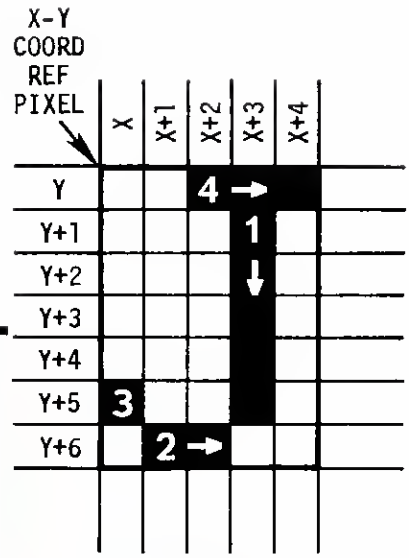
A typical two-word instruction you develop may look like statement 520 in Program Listing 2. Can you figure out what that statement displays? (See REMs of Program Listing 1 X,Y plot statements for clues.)

GRAPHICS MODE	CHARACTERS PER LINE	NUMBER OF LINES
2	10	7
3 and 4	21	7
5 and 6	21	10
7 and 8	21	21
9	36	21

Table 1. Achievable Character Densities

Preceding 520, you'll need separate display and erase command statements to implement line 520. Assuming you are already operating in some graphics mode, these statements may look like 500 and 510 in Program Listing 2.

Elsewhere in your program (such as in an action sequencing statement like 400), include GOSUB500, some delay timing, and GOSUB510. When called, statement 500 specifies a character color and jumps to 520. Statement 520 loops through eight X,Y plot statements in turn and displays their characters. After some GOSUBed delay timing, 510 specifies the background color for use in 520. 520 immediately erases the displayed characters by overprinting them.



STATEMENT 28
COMMAND SEGMENTS

1 "V";X+3;Y+1;5;
2 "H";X+1;Y+6;2;
3 "S";X;Y+5;
4 "H";X+2;Y;3:

Fig. 2. Letter J Plot Parameters

Cleanup

Upon completing all your alphanumerics statements, make a list of the characters used. Checking this list, visually skim statements 10 through 98, and delete those that are not used (called by GOSUBs). Each such deletion saves about 75 RAM bytes. ■

by Francis Kalinowski

```
200 '                    NOTE:
201 '
202 '     TO OPERATE THIS DEMONSTRATION PROGRAM,
203 '     ADO LISTING 1  X-Y PLOT STATEMENTS 18,
204 '     24, 25, 44, 48, AND 80 TO IT;  OR, ADO
205 '     STATEMENTS 300-800 BELOW, TO PROGRAM 1.
206 '     OMIT (REM) PORTIONS OF ALL STATEMENTS.
207 '
300 GOSUB800:LPRINT"ERS;M2;I":       '(GO MODE 2, INVERTED)
400 GOSUB500:GOSUB800:GOSUB510:GOTO900:       '(SEQUENCING)
500 LPRINT"C2":GOTO520:     '(USE MAGENTA TO DISPLAY WORDS)
510 LPRINT"C0":         '(USE BUFF TO ERASE DISPLAYED WORDS)
520 Y=20: X=7:GOSUB24: X=14:GOSUB25: X=18:GOSUB80: X=24:
  GOSUB48: X=31:GOSUB24: X=38:GOSUB18: X=45:GOSUB44:
  X=52:GOSUB18: RETURN:'(DISPLAY WORDS IN PRESTATED COLOR)
800 FORT=1TO1500:NEXT:RETURN:'(ANY AVAILABLE DELAY TIMING)
900 CLS:END
```

Program Listing 2. Two-word Display Demonstration

THE 80'S BELONG TO SNAPP!

MASTER / SLAVE
This software package was designed to support the transferring of files from one Model II to another via direct connection or modem/phone line connection. ALL kinds of files and baud rates up to 9600 are fully supported. Transfer files in either direction, even with the SLAVE Model II UNATTENDED! $150

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Allows remote control of Model II from another Model II, or any ASCII terminal. Our Host system, unlike the one supplied with TRSDOS 2.0, supports accurate screen positioning on the Term station. Without this feature, formatted displays appear on the terminal looking like randomly placed garbage. Requires NO user memory! This system is designed to provide software support in our customer locations without ever leaving the office. $5

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Software only $50

CONVERT
This turn key utility converts "V" format files (the sequential format used by the SNACKS, COBAL and BASIC Compilers) to the "T" format files (the sequential file format used by the BASIC interpreter and BASCOM) and vice versa. Without this product, programs written for the interpreter will have to be RE-KEYED in to be used by the SNACKS Compiler BASIC. $75

ITOII
A helping hand when converting BASIC programs from the Model I to the Model II. Automatically adjusts HEX$ and PRINT USING to compensate for differences in the language. Advises you where adjustments are necessary for PEEK, POKE, etc. $25

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This is not a football play but the way to play host to host in converting IBM 3741 to Radio Shack formatted disks in two ways. First is the normal file by file. $200

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Here is the way for structured programmers to increase their output by 5 fold. If you haven't jumped on the structured bandwagon, it's time to start rolling. The use of modern structured programming concepts can double your programmer's productivity. SBASIC is a high level BASIC with the BEST programming aids. PERFORM named subroutines, CONDITIONAL case structures, WHILE loops, UNTIL loops and much more. MODEL II version is compiled. From Ultimate Computer Systems: Model I—$50, Model II—$75.

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Our workhorse! Unlike the one supplied with TRSDOS 2.0, runs requires no special knowledge pertaining to the part of the operator. Actually runs performs much better. In the Tandy SPOOLER, everytime a disk is accessed, the printer stops dead! This package is available for Model I, in the TRSDOS, NEWDOS 80 versions, as for the Model II. Greatly enhances system performance when running typical business applications. Many applications have been benchmarked to run nearly TWICE AS FAST with the SPOOLER installed. Installs in minutes and no changes are required in your programs. Preferred Model II versions require NO user memory. Optional features for the Model II version only.
Serial printer support, DISK SPOOLING support which is particularly recommended for word processing applications. $100

SERIAL PRINTER OPTION	$50
DISK SPOOLING OPTION	$50

All products now available to run with TRSDOS 2.0.

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Print neatly formatted hard copy listings of BASIC programs from disk. Programs may be ASCII or compressed. Quick and easy group selection allows you to print many listings with one command. $35

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Now you can give your TRS-80 all the functions you wished BASIC had given you in the first place. These routines will give you programming abilities that make you look good. Adds the following function verbs: SHIFT, PEEKW, POKEW, DTIM$ and RTIM$. $50

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A collection of patches to TRSDOS 6 and BASIC to enhance their usability and function includes our well-known BREAK?E patches to keep the break key from being used accidentally. FREE WITH ANY MODEL II SOFTWARE PACKAGE.

TERMS OF SALE:
Credit card customers, add 2% C.O.D. customers add $2. Ohio residents add 6% sales tax. Shipments normally made the same day we receive your order. Credit granted to governmental agencies, educational institutions and E.G.I. rated business firms. Please include purchase order number when ordering.

OUR GUARANTEE:
If your diskette arrives damaged, we will replace it without charge. If you ever accidentally damage it, we will replace it for a $10 handling charge. For a period of one year, we will provide you with any enhancements or updates for a $10 handling charge. For a period of one year, if errors are discovered in the programs, they will be corrected without charge. In the event we cannot correct an error, you may return the program material for a refund.

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Reader Service—see page 242

A first look at the Shack's colorful new offering.

Color Computer Primer

Tim Ahrens
Jack Browne
Hunter Scales
3501 Ed Bluestein Blvd.
Austin, TX 78721

Tandy's newest market entry, the Color Computer, promises to be one of their most powerful and expandable units. The Color Computer has the same sleek silvery lines of its half-brother, the TRS-80 Model I, but unlike the early members of the Tandy family, the Color Computer abandons the Z-80 microprocessor for the new Motorola MC6809E chip and will feature plug-in ROM (Read Only Memory) cartridges.

System Overview

The keyboard, which stands out first, is not a Cherry or a Microswitch, but does have a good feel. One can easily touch-type on it. It has calculator like buttons with a long throw and tactile feedback, but not at all like the original Commodore PET.

The power supply is totally self-contained. There are outlets for joysticks, cassettes and a printer, but the TV connection —to a color or black and white set—is the only one necessary to its basic operation.

The Color Computer has several features of the original Model I. The first is a "power-up Level I BASIC." Whenever power is applied, or the reset button depressed, the computer displays a prompt of OK. The addition of an optional Level II will make the Color Computer much more powerful than its Z-80 predecessor.

Its second "hand-me-down" feature is a built-in cassette interface. The manual recommends the CTR-80. But after hours of use, we found our inexpensive off-brand recorder worked just as well. The internal cassette circuit also provides for a remote turn on/off type of recorder. This puts the most data on the tape in the least amount of time —no long gaps between recordings. Files can be skipped, displayed or loaded. (By the way, if you don't buy Radio Shack's recorder, you will have to make the cables that lead from your recorder to the computer.)

The Color Computer's joysticks (not included) for the program paks and other games have two-dimensional control sticks and buttons that "fire-when-ready." A software command, JOYSTK, allows the user to input coordinate values and "paint" on the screen like an "Etch-A-Sketch."

The Color Computer has a 600 baud serial printer port is fully RS-232 compatible and interfaces to any Radio Shack serial printer. The serial interface responds whenever a LLIST or print to device command is given.

The permanent Level I memory of the computer is stored in a single 8K × 8 ROM. Level II adds another 8K × 8. The basic Color Computer comes with 4K of dynamic RAM (Random Access Memory) which can be easily upgraded to 16K.

One of the nicest features of the TRS-80 Color Computer is its plug-compatible preprogrammed ROM software. Presently, several games ranging from pinball to chess are available, as well as a comprehensive personal finance package and a music generation program.

Color BASIC

Below are the commands available in Level I Color BASIC:

ABS	ASC	AUDIO
CHR$	CLEAR	CLOAD
CLOADM	CLOSE	CLS
CONT	CSAVE	DATA
DIM	EOF	END
EXEC	FOR TO STEP NEXT	GOSUB
GOTO	IF THEN ELSE	INKEY$
INPUT	INPUT#-1	INT
JOYSTK	LEFT$	LEN
LIST	LLIST	MEM
MID$	MOTOR	NEW
ON GOSUB	ON GOTO	OPEN
PEEK	POINT	POKE
PRINT	PRINT@	PRINT#-1
PRINT#-2	PRINT TAB	READ
REM	RESET	RESTORE
RETURN	RIGHT$	RND
RUN	SET	SGN
SIN	SKIPF	SOUND
STOP	STR$	USR
VAL		

Only the commands unique to Color BASIC will be discussed.

AUDIO: This command connects (ON) or disconnects (OFF) the cassette output to the TV speaker allowing easy recognition of data or voice on tapes.

CLS(c): The CLS command clears the screen with the color specified by c. If no c is present, the default color is green.

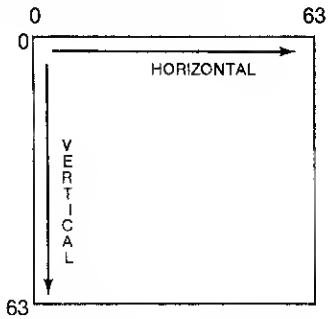
COLORS:

0	Black	5	Buff (White)
1	Green	6	Cyan
2	Yellow	7	Magenta
3	Blue	8	Orange
4	Red		

INKEY$: This checks the keyboard and returns with the key or non-key which is being pressed.

INPUT# – 1: This inputs data from the cassette.

JOYSTK(j): This command returns the specified joystick (j) position number. J can be 0 to 3, where 0 is the horizontal coordinate of the first joystick, 1 is the vertical coordinate of the first joystick, 2 is the horizontal coordinate of the second joystick, and 3 is the vertical coordinate of the second joystick. Note: JOYSTK(0) must be returned before 1, 2, or 3 may be displayed. The coordinates are represented below.



JOYSTK may be used for simple things like "painting" colors on the screen, or more exotic things like instrumentation and positional controls.

LLIST: Like the Model I, the LLIST command lists programs on the printer. All options of the list command, i.e., LLIST 100–150, may be used. Be sure to have the printer connected or the computer will hang up waiting for the necessary clear command to send the signal from the printer. A reset gets the computer back to you *without* losing your program.

MOTOR—MOTOR ON: Turns on the cassette remote jack, allowing you to rewind, or it will manually operate the recorder. **MOTOR OFF** will return the computer to its natural state of control. The computer comes out of reset with the motor off.

SET—SET: Used to turn on specific blocks of color within the display area. The format for this statement is SET(h,v,c) where h is a horizontal position (0–63), v is the vertical position (0–31), and c is the color block indicated in the CLS routine.

SKIPF: This statement will stop the recorder at the end of the next file. If a file name (p) is specified, the tape will be positioned at the end of p.

SOUND(f,d): This is used to send out a tone through the television's speaker with a specific frequency (f)—1 – 255—and a duration (d)—1 – 255.

POINT(h,v): Tests whether or not a specific graphic cell is on or off. H = 0 – 63 horizontal and v = 0 – 31 vertical increments. The value returned is a –1 if turned off, and a color number, if on.

CLOSE(d): This command closes all open files or specified devices (d). See OPEN for meaning of the devices.

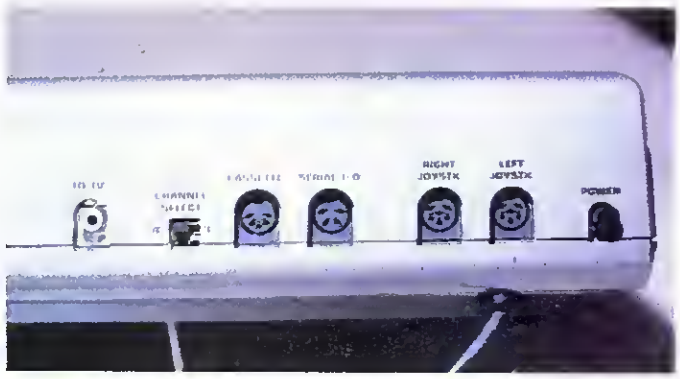
OPEN(m,d,f): This opens a file name (f) at the screen or keyboard (d = 0), cassette (d = – 1), or a line printer (d = – 2). This can be used in either the input (m = I) or output (m = O) modes.

CLEAR(n,h): The CLEAR command reserves n bytes of string storage space (0 – 32767). It initializes all variables, and h may specify the highest address that BASIC can use (for other machine language programs and such).

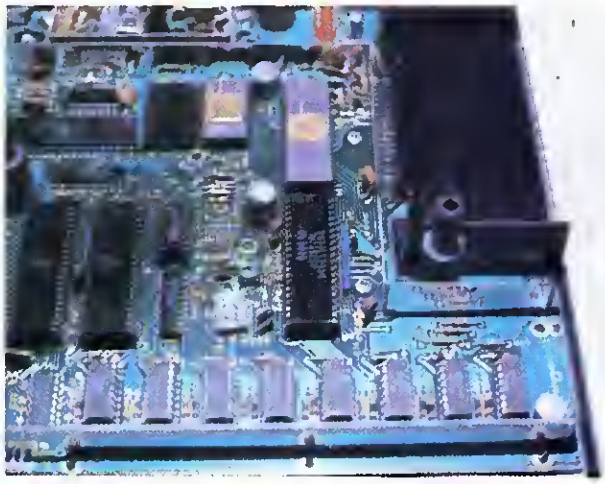
CLOAD: Like the Model I, CLOAD is used to load in programs from tape. This version allows filenames of up to eight characters. All other extra characters are ignored.

CLOADM: This loads a machine language program from the cassette. An optional offset address can be added to the load address. Unfortunately, there is no command to save a machine language program to tape!

✓Reader Service—see page 242



Back of case gives access to joysticks, cassette, serial input/output, channel selector, reset button, powar switch and rf output.



View of normally shielded CPU section of board. Miniature black jumpers (between the two PIA chips, at left, and to the right of address multiplexer) make switch from 4K to 16K a simple task.

Color computer has high quality grey scale when used on standard black & white television. This photo was made of an inexpansive portable black & white tv.

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CSAVE: This does the opposite of CLOAD, in that an eight-character name can be used to name the file. If the A option is used, the program is saved in ASCII format. Regardless of whether the option is used or not, the CLOAD command will load the tape.

EXEC(a): Transfers total control to a machine language program at the location specified by (a). If a is omitted, control is transferred to the address set in the last CLOADM. This command is basically the same as a machine language jump.

ON . . GOSUB: This represents a multi-way branch to a subroutine.

ON . . GOTO: This is a multi-way jump to a specified line.

PRINT# – 2: This prints an item or list of items.

PRINT TAB: This moves the cursor over the appropriate number of spaces.

RESET(h,v): This resets the graphic block which had been previously set by the SET command.

USR(x): This calls a user machine language subroutine whose address is stored at RAM locations 275 and 276. Don't forget to POKE the address into those locations.

There are also some special characters. An apostrophe is an abbreviation for REM, just as the question mark represents a PRINT. A colon separates statements on the same line, and a dollar sign introduces a variable string statement. The comma spaces over 16 character places to the next print zone, and the semicolon spaces over once to separate items in a printed list.

Full Use

The old adage that the job isn't done until the paperwork is finished holds true in many situations, including the Color Computer's. It is Tandy's documentation that will tell you how to get the most out of your computer. The manuals supplied tell the novice how to power-up and start programming in BASIC, but many statements are left out of Tandy's book, *Getting Started with Color Basic*. They are referenced on the "programming card" and this could be frustrating for the user who tries something and continually gets an error!

Happily, a card enclosed with the manual says that more information will be forwarded to you as it becomes available.

Despite our unanswered questions, Tandy's BASIC is capable of high level computations with nine-digit precision. Tandy has also promised a new Extended Color Basic with the following features (Level II):

- High density color graphics (256 × 192)
- Complex sound generation
- Save/load screen images
- Zoom in and out of an image
- Rotate that image
- Draw lines, circles, boxes and rectangles
- Move pictures around the screen
- A real time clock
- Print dollars and cents
- Program editing
- User-definable keys
- String arrays to 255 characters
- Full floating point
- Machine language routines (CLOADM ?)

Control Keys

Several keys on the Color Computer have special or dedicated functions.

The ← (left arrow) functions primarily as a back space. This cancels the last character typed and moves the cursor back one space. A shifted left arrow cancels the current line you are typing. This is similar to a control X command on other computer systems.

A Break will interrupt the program in progress and return to the command level. It will break anything except a cassette routine, a print with no printer connected, or the Sound command, while its executing.

The Clear key will fill the screen with green blocks, effectively "clearing" the screen.

The spacebar enters a space (blank) character and moves the cursor one space forward.

During a LIST command or other data display routine, shift @ temporarily halts the program. Pressing any other key causes it to resume.

As the computer powers up, it is in an uppercase lock condition. BASIC does not recognize lowercase characters, and the Color Computer cannot display them. For text work (printing in upper and lowercase), a shift 0 should be depressed once, which releases the uppercase lock. After that the shift is used like any typewriter to print an uppercase letter on the screen. If it is not pressed, a lowercase letter is printed represented by an inverted video character (black background with green characters).

If a printer is used, the characters will be printed in upper and lowercase. To return to uppercase only operation, merely type shift 0 again, and it will be restored.

Error Messages

Error messages in any computer can range from simple numbers to text strings describing exactly what you've done wrong. The Color Computer in Level I goes one step further than the simple numbers scheme and uses letter combinations which most closely represent the error. There are a total of 25 errors listed below:

IO: You cannot divide by zero!

AO: A data file cannot be opened, if it already is.

BS: Bad subscript. The array subscripts are out of range. Use the DIM statement

to dimension the array.

CN: It cannot continue. This happens when you say CONT after the program has encountered the END stetement.

DD: This is an attempt to redimension an array. You can dimension an array only once in a program.

DN: Device number error. There are only three devices which can be used with the OPEN, CLOSE, PRINT, or INPUT. Only use 0, −1, or −2.

DS: This error occurs in response to a direct statement within the data file. This can occur if you load a program with no line numbers.

FC: Illegal function call. This happens when a parameter is used with a BASIC word that is out of range. For instance, a SOUND (345,456) will cause an error code of FC.

FD: Bad file data. This happens when you try to PRINT data to a file, or INPUT data from the file, using the wrong type of variable for the corresponding data.

FM: Bad file mode. This happens when you try to INPUT data from a file OPEN for output, or PRINT data into a file OPEN for input.

ID: Illegal direct statement. INPUT can be used only es a line in the program, not as e command line.

IE: Input past end of file. You should use the EOF to see when you have reached the end of the file. Be sure and CLOSE it.

IO: Input/output error. Sometimes this happens when trying to load a bad tape.

LS: String too long. It can be only 255 characters.

NF: A NEXT without a FOR. It also occurs when NEXT lines are reversed in nested loops.

NO: The file is not open. A file must be open before data can be transferred to or from it.

OD: Out of data. There was not enough data for a READ. Also, there might have been a DATA statement left out of the program.

OM: You are out of memory. All space has either been used or reserved.

OS: Out of string space. There is not enough space left in memory for the string operation. Use the CLEAR at the beginning of the program to reserve more string space.

OV: Overflow. The number is too large for the Color Computer to handle.

RG: You have a RETURN without a GOSUB.

SN: Syntax error. Sometimes caused by a misspelled command. Retype the program line.

ST: The string formula is too complex. Divide the operation into shorter steps.

TM: Type mismatch. This happens when you try to assign a string variable to numeric data, or string data to a numeric variable.

UL: Undefined line. You have asked the computer to go to a non-existent line number.

Program Paks

After months of playing, dissecting and deciphering the Color Computer's hardware and software, we think it is a product which has great potential and many applications from home to educational programs. A number of accessories are already available for the Color Computer including a cassette recorder, quick printer, modem, joysticks and program paks. These program paks are actually plug-in ROMs. The ones available are listed below:

"After months of playing, dissecting and deciphering the Color Computer's hardware and software, we think it is a product which has great potential. . ."

Personel Finance: This program is a good way to get household finance problems in order.

Queeer Commander: A game to destroy enemy ships.

Football: It's almost like being on the field.

Checkers: There are several levels of expertise which the user selects.

Chess: The classic "think" game.

Music: Composing is a snap with a five-octave range and selectable duration of notes.

Bingomath: Teaches meth basics.

Pinball: You can design your own game.

Last, but not least, is a diagnostic ROM to help you locate any trouble spots in the Color Computer. These program paks range in price from $29.95 to $39.95. ■

These Next 4 Pages are for TRS-80* Owners ONLY!

The next 4 pages contain over 100 programs for your TRS-80. Whatever your interests, we have a software program for you. We list sections on Home/Personal, Business, Games, the Arts, Home Education, Utilities, Special Business, Flight Simulations, Electronics, Comp-U-Novels, and Popular Games. These programs can be purchased through your local Instant Software dealer, or you can call us directly using our toll free number. We ship our orders the same day we receive them. Browse through these 4 pages, we're sure you'll enjoy your selections. Remember: **WE GUARANTEE IT!**

UTILITIES

TRS-80 UTILITY I—Give your program that professional look. RENUM: Renumber any Level II program to make room for modification or to clean up the listing. DUPLIK: With this program you can duplicate any BASIC, assembly/machine language program, verify the data and record the program to tape. You can even record Level I programs on a Level II keyboard. (T1) **Order No. 0081R $9.95.**

TRS-80 UTILITY II—Change the drudgery of editing your programs into a quick, easy job. It includes: ● CFETCH: You'll be able to merge consecutively numbered BASIC programs into one program. It will also search through any Level II program tape and display the file names for all programs. ● CWRITE: Combine subroutines that work in different memory locations into one program. It works with BASIC and/or machine-language programs and will give you a general checksum to verify that your program hasn't dropped any bits. **(T1) Order No. 0078R $9.95.**

THE COMMUNICATOR—This package lets you transmit data over the telephone lines. The full ORIGINATE/ANSWER capability allows your TRS-80 to be controlled from a remote-based terminal, or allows two TRS-80s to "talk" to each other. You can transmit data or programs from home base to a remote terminal. There will be a simultaneous display of information on both video monitors. Requires a modem and RS-232 interface for each terminal. **(T1) Order No. 0126R $9.95.**

TERMINAL-80—Communicate with the rest of the world! These programs give you control of the RS-232 port of your Expansion Interface. You can connect one or more serial terminals to your TRS-80 and it will accept input from the RS-232 interface just as if it were entered from the keyboard. Your TRS-80 can also be transformed into a dumb terminal, for use in a time-sharing situation to talk with "big" computers via a modem. The LPRINT/LLIST commands will transfer a program to a receiving computer. Supports upper/lowercase, Level II & III control characters, and all functions such as CHR$. The baud rate is software controlled for your convenience. Requires an RS-232 interface. **(T1) Order No. 0130R $24.95.**

DISK SCOPE—Need to check out the contents of a disk? Then check out these three programs. ● FILELOC: If you know the name of the program or data file, FILELOC will show you which tracks and sectors contain that file, as well as how much memory the file takes when loaded into RAM. You can then print the information, search for a new file or exit to BASIC. ● CDISK: This utility and test program allows you to view any track and sector on your disks in ASCII, Hex and screen POKEs. It disregards all protection codes. ● PASSWORD: This machine-language program not only gives you a password for individual files, but for whole disks as well. **(T2) Order No. 0139R $19.95.**

DISK EDITOR—This machine-language program give you total access to ANY byte of information in ANY sector in ANY track of your disk! You can examine, alter, add and delete information with ease. You can even search for a specific string (up to 8 characters long). If you need hardcopy, use the LINEPRINT command to send a copy of the video display to your printer. It can be used with TRSDOS, NEWDOS and MicroDOS. Both the 35 and 40 track versions are included. **(T2) Order No. 0180RD $39.95.**

BPA (BASIC PROGRAMMING ASSISTANT)—BPA does three things for you: (1) It will list the variables used in a BASIC program. Optionally, it will list the line numbers where each variable appears; the variable-type symbol (string, integer, single or double precision); whether it is dimensioned and where it is changed. (2) It will produce a cross-referenced list of line numbers for GOTO's, GOSUB's and IF...THEN statements. (3) It will list the line numbers where a selected BASIC function word (e.g., INPUT, PRINT) is used. **(T1) Order No. 0203R $14.95.**

TLDIS & DLDIS—These two utilities are ideal for those who wish to decipher and/or modify machine-code programs. TLDIS (Tape-based Labeling DISassembler) and DLDIS (Disk-based Labeling DISassembler) are three-pass, label-assigning disassemblers that assign labels (where appropriate) to the routines in a machine-language program. Their output is almost identical to that of a hand-assembled source code. TLDIS can send the disassembly to cassette tape, DLDIS can send it to disk; both send it to the video monitor. Each version can be reassembled using Tandy's EDTASM or Apparat's disk extension of EDTASM, respectively. You can also send either disassembly to a printer (R/S parallel port). Because of the labels, it is a simple matter to change any object code program by disassembling it and making changes to the resulting source code, without losing track of the jump/load addresses. Labels start at "AA00" and increment up, in even numbered steps (AA02, AA04, etc.). The odd numbers (AA01, AA03, etc.) are left for your (optional) use in the reassembly. **TLDIS (T1) Order No. 0230R $14.95. DLDIS (T2) Order No. 0231RD $19.95.**

THE DISASSEMBLER—This is a single-pass, hex-notation that sends its output either to tape or to a lineprinter (R/S parallel port). The tape output is directly compatible with Tandy's EDTASM, so you can disassemble an object code tape and output it to tape, then use EDTASM to add, delete, change and re-assemble your new version. It displays the *displacement* and *absolute address* of any relative jumps made by the disassembled program. It also displays and ASCII characters used in an LD or CP op-code. It is relocatable and you can jump to memory locations and transfer control between Disassembler and other utility programs. **(T1) Order No. 0239R $9.95.**

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CODE—Minimum System Required

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(T2) = TRS-80 Model I Level II, 16K RAM with Expansion Interface 16 + K RAM and one disk drive
(T3) = TRS-80 Model II, 32K RAM

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THE ARTS

COMPU-CAROLS—We are proud to present a selection of Christmas carols, played by your TRS-80. Just place an AM radio next to your keyboard and you'll be amazed at the quality of this computer-generated music. You'll hear AWAY IN A MANGER, NOEL, SILENT NIGHT, O LITTLE TOWN OF BETHLEHEM and eight more of your favorite carols. **(T1) Order No. 0036R $9.95.**

DOODLES AND DISPLAYS II—It includes: ● DOODLE PAD: Draw pictures and save them on cassette tapes. ● SYMMETRICS: An electronic kaleidoscope that's constantly changing. ● DRAWING: Like DOODLE PAD, but for the serious artist. Over 40 user commands. ● RANDOM PATTERN DISPLAY: The computer does the drawing, but those with itchy fingers can make alterations. ● MATHCURVES: Bring those geometry lessons to life. Six different geometrical curves on the screen of your TRS-80. ● RUGPATTERNS: Designs rug patterns with a choice of user or computer control. **(T1) Order No. 0042R $7.95.**

MUSIC MASTER—Includes these four audio treats: ● MICRO-ORGAN: This program changes your computer into a musical instrument, with a range of four octaves with three voices! You can play sharps and flats to imitate the sounds of an organ, harpsichord or piano. ● KALEIDOPY: Now you can have a computerized "player piano." Generate a symmetrical graphics pattern and then see it transformed into music. ● COMPOSER: Experiment with computer-generated music. You can select the length of the piece, its scale, and its tempo. ● KEYMANIA: Test your memory and your musical ear. One to four players try to repeat the melody that the computer creates. **(T1) Order No. 0084R $9.95.**

ELECTRONICS

NAM PACKAGE I—This versatile package lets you solve many of the problems commonly encountered in electronics design, including: ● BASIC ELECTRONICS WITH VOLTAGE DIVIDER: Solve problems involving Ohm's Law, voltage dividers and RC time constants; ● DIPOLE AND YAGI ANTENNAS: Design antennas easily, without tedious calculations. **(T1) Order No. 0007R $7.95.**

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TEACHER'S AIDE—Now you can have the benefits of Computer Aided Instruction (CAI) in your own home. Create a question and answer lesson (up to 8000 characters), save the lesson on disk, then create an entire sequence of lessons. Perfect for parents, teachers and students who need the unlimited patience and undivided attention only a computer can provide. **(T2) Order No. 0214RD $34.95.**

GRADE BOOK—Teachers, now you can use the speed and accuracy of the computer to help calculate student grades. Just type in the grades for tests, quizzes, homework, classwork or special projects to calculate and display individual grade averages. You can also obtain a cumulative grade for a specific marking period—or a whole year! **(T1) Order No. 0050R $9.95.**

TEACHER—This program enables you to create your own tests, quizzes and exercises for the education of your children. You can even provide "graphic" reward for your children and provide hints for problem solving. **(T1) Order No. 0065R $9.95.**

LIFE—Create "living" organisms in which cells are constantly active. They are born, they multiply, they die. This computerized version of LIFE is based on the well known game popularized by Martin Gardner. You can create one-cell organisms, then observe their growth patterns. The library of commands give you unlimited versatility in the control of the cell patterns you have arranged. **(T1) Order No. 0078R $9.95.**

ARCHIMEDES' APPRENTICE—This two-part package will teach you the formulas used to find the volume of any solid object including parallelopipeds (cubes and rectangular solids), prisms, pyramids, cylinders, cones and spheres. It will show you on-screen diagrams of these figures, and present you with the formulas you'll need to compute their volumes. **(T1) Order No. 0092R $9.95.**

TYPING TEACHER—This complete seven-part package takes you from initial familiarization with the keys, through typing words and phrases, to complete mastery of the keyboard. Your computer can even become a bottomless page for typing practice. **(T1) Order No. 0099R $9.95.**

VIDEO SPEED READING TRAINER—Most people's reading speed is limited simply because they read individual letters or words. Now you can increase your reading speed and comprehension by reading whole words and phrases. This package will train your mind to quickly recognize numbers, words, letters and phrases. Start at any speed level at which you are comfortable and the computer will automatically advance you as your reading speed and comprehension increases. **(T1) Order No. 0100R $9.95.**

WORDWATCH—four different programs to entertain and educate. ● WORD RACE—race to the finish line of defining words correctly; ● HIDE N SPELL— find the misspelled word, then correct it; ● SPELLING TUTOR—a spelling lesson, but beware, the spelling may become unusual. There you have it, Wordplay × four = WORDWATCH. **(T1) Order No. 0111R $7.95.**

MIND WARP—This game includes: ● MIND TWIST: a Mastermind-type game with a twist. Try to guess the computer's secret digit sequence. ● MIND BENDER: A multi-level game where you must discover the computer's secret code. It's no mystery, the MIND WARP package is for puzzle lovers everywhere. **(T1) Order No. 0118R $9.95.**

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SPECIAL BUSINESS

BOWLING LEAGUE SECRETARY—This package is simple to operate and provides a dynamic reference to all the names of individual bowlers, their team numbers, scores, team names, league data and all necessary statistics. The system is highly adaptable, with 17 different scoring options that allow you to custom tailor the program to suit your league's special needs. And, if you even have any problems, simply type HELP and the program will give you an explanation of what information is needed—complete with a sample entry. The system puts at your fingertips all individual weekly scores, team cumulative scores, bowler cumulative scores and individual leaders in the following categories: high single, high series, high average and high points. **(T2) Order No. 0095RD $49.95.**

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BEGINNER'S RUSSIAN—In order to understand a foreign culture, you must know its language. The three programs in this package will give you on-screen displays of the characters of the Cyrillic alphabet, detailed instructions of their proper pronunciation and exercises that will have you recognizing and speaking simple Russian words. An excellent package for students, businessmen, scientists or anyone who is interested in learning the Russian language. **(T1) Order No. 0136R $9.95.**

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BOWLING LEAGUE STATISTICS SYSTEM—Keeps a computerized list of league data, team data and data for each bowler. Extremely flexible, it has a total of 16 different options to let you modify the program to suit your league's rules. It is easy to use and has a built-in "HELP" feature to aid you. **(T1) Order No. 0056R $24.95.**

HOME/PERSONAL

HOUSEHOLD ACCOUNTANT—Save with these two programs: ● BUDGET & EXPENSE ANALYSIS: It has nine sections for income and expenses and an option for quarterly/yearly reviews. ● LIFE INSURANCE COST COMPARISON: Compare the total costs of various insurance policies. Contrast term with whole life. It will store and display up to six prospective policies. **(T1) Order No. 0069 $7.95.**

PERSONAL BILL PAYING—You can keep a computerized list of ALL your bills (up to 22 accounts), each listed with its name, number, due date and amount owed. Individual accounts can be displayed with a month-by-month breakdown of payments (including check numbers) and current accounts can be seperated from inactive ones. It allows you to save the data to tape for future use. **(T1) Order No. 0103R $7.95**

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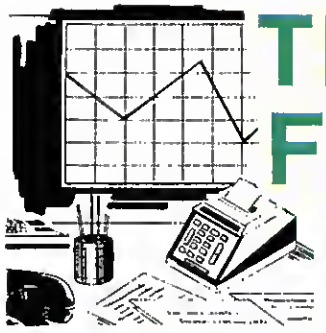

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POPULAR GAMES

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YOUR CRIBBAGE AND CHECKERS PARTNER—CRIBBAGE is a two-person game that you are sure to enjoy. This is NOT a tutorial—it is a game worthy adversary. CHECKERS: An old favorite which follows international rules, including multiple jumps. **(T1) Order No. 0068R $9.95.**

CARDS—A one-player package to let you play, with your computer, these famous games: ● DRAW AND STUD POKER: These programs will keep your game sharp; ● NO-TRUMP BRIDGE: Develop your strategy and (hopefully) increase your skill. **(T1) Order No. 0083R $7.95.**

FLIGHT SIMULATIONS

RAMROM PATROL/TIE FIGHTER/KLINGON CAPTURE—•RAMROM PATROL: Destroy the RamRom ships before they capture you. •TIE FIGHTER: Wipe out the enemy Tie fighters and become a hero of the Rebellion. •KLINGON CAPTURE: You must capture the Klingon ship intact. **(T1) Order No. 0029R $7.95.**

FLIGHT PATH—This three-part package includes: •MOUNTAIN PILOT: Become a daring bush pilot and fly supplies to a remote mining camp. You must cross mountain ranges and struggle with headwinds, tricky navigation and rapidly diminishing fuel. •O'HARE: A control tower simulation for you would-be Air Traffice Controllers. You are responsible for the lives of hundreds of passengers as you guide aircraft through your control sector. •PRECISION APPROACH RADAR: Combines the skills of pilot and Air Traffic Controller, as your commands guide an aircraft in its approach to the field and a safe landing. **(T1) Order No. 0171R $9.95.**

BALL TURRET GUNNER—Imagine yourself at the control console of a strategic laser weapon, deep in the space lanes. Your hindsight detector informs you of a Gnat fighter coming in for an attack so you swivel you laser turret until you can see the target. Watch the Range Indicator and your Targeting Computer's readout closely, because you'll only have a fraction of a second to catch him in your sights. Will you transform the Gnat into a ball of ionized gas or will you see that blinding flash that means The Big Demotion? BALL TURRET GUNNER, with you choice of multiple levels of difficulty, optional sound effects and excellent graphics, is more than a game. It's an event to be savored. **(T1) Order No. 0051R $9.95.**

JET FIGHTER PILOT—In this brilliantly realistic simulation, you become the pilot of a twin turbo-jet fighter. Begin your mission from either the deck of a carrier or from an airfield. During flight, you'll need to constantly monitor your display and make the necessary adjustments to the throttle, flaps, and air spoilers; you must decide when to retract landing gear and release your drop tanks! There is an on-board Navigational Computer, a Glideslope/Localizer and a Weapons Control Computer. Earn your wings with JET FIGHTER PILOT. **(T1) Order No. 0159R $14.95.**

SPACE TREK II—Protect the quadrant from the invading Klingon warships. The Enterprise is equipped with phasers, photon torpedoes, impulse power and warp drive. **(T1) Order No. 0002R $7.95.**

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SPACE TREK IV—•STELLAR WARS: Engage and destroy Tie fighters in your attack on the Death Star. For one player. •POPULATION SIMULATION: A two-player game where you control the economy of two neighboring planets. You must decide: Guns or Butter? **(T1) Order No. 0034R $7.95.**

BASIC AND INTERMEDIATE LUNAR LANDER—Bring your lander in under manual control. The basic version is for beginners; the intermediate version is more difficult, with a choice of landing areas and rugged terrain. **(T1) Order No. 0001R $7.95.**

COSMIC PATROL—We put you in command of a small interstellar patrol craft. You must defend Terran space and prey on the Quelon freighters that carry vital war supplies—but beware of their I-Fighter escorts. They're well armed, extremely fast and they NEVER miss! With its real-time action, impressive sound option and superb graphics, this machine-language program is the best of the genre. **(T1) Order No. 0223R $14.95.**

Airmail Pilot —Return to the early days of aviation. You must fly the mail from Columbus to Chicago. Your Jenny, a cloth-covered biplane, must take you through unpredictable winds, hail and electrical storms. Your mission is to get the mail through in the shortest possible time. There is an on-board clock to time you flight, from takeoff to touchdown. . . assuming you are able to complete it. **(T1) Order No. 0106R $9.95.**

NIGHT FLIGHT—Your mission is to fly over the North Atlantic and make a nighttime photo/recon flight above the enemy fleet. NIGHT FLIGHT lets you take-off, fly and land a propellar-driven aircraft. You can practice approaches and landings with an on-screen display of the landing field information—it will practically teach you to fly. **(T1) Order No. 0117R $9.95.**

COMP-U-NOVELS

WHO-DUN-IT? Criminal elements have committed five dastardly crimes. As the investigating detective, you must solve them.

You can compete against either Detective Nybbles, a computerized sleuth, or up to four other human detectives.

•DEDUCTION: Guess the order of four symbols out of six or seven different ones. To make things even more complicated, you can let the computer repeat symbols and have a range of 2401 possibilities. **(T1) Order No. 0047R $7.95.**

SANTA PARAVIA AND FIUMACCIO Become the ruler of a medieval city-state as you struggle to create a kingdom. Up to six players can compete to see who will become the King or Queen first. **(T1) Order No. 0043R $7.95.**

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v2

HOME/PERSONAL

THE WORDSLINGER—An economical word processing program that was designed for the individual user or small business featuring: automatic formatting; text editing; and tape storage. Once you've used the WORDSLINGER, you won't want to go back to your typewriter. **(T1) Order No. 0129R $29.95.**

MIMIC—Test your memory and reflexes with five versions of this popular game. You must match the sequence and location of symbols displayed on your monitor within the time limit. Instructions on how to produce accompanying sound effects. **(T1) Order No. 0066R $7.95**

CLIMATE COMP—This two-program package includes: WEATHER FORECASTER, which gives you a short range weather forecast based on the information that you enter and WEATHER PLOT, which will display climatological data for any major city in the United States. **(T1) Order No. 0102R-1 $19.95.**

BODY BUDDY—Includes these three programs: ● ADULT CALORIC REQUIREMENTS: Will determine your Basal Metabolic Rate and suggest strategies to achieve your ideal weight! ● FLEXI-DIET: Creates an "infinite" number of diet menus, on a day-to-day basis. Choose your caloric intake, from 600 to 2400 calories per day. The ● ANATOMY QUIZ program teaches a mini-lesson on the various organs of the human body, giving location, size and function(s). **(T1) Order No. 0109R $9.95.**

ENERGY CONSUMPTION—This program will record and analyze your utility bills for up to five years, when you supply the following information. Gas/Water/Electricity used and their respective costs. It will calculate six monthly usage averages and unit costs. Data can be compared for any month or multi-month periods. **(T1) Order No. 0132R $9.95.**

BUSINESS

SALES ANALYSIS—If your business is sales, you're faced with some unique problems. This package is divided into several modules to help solve those problems: The SALES ANALYSIS module is designed to provide guidelines for determining sales performance, to analyze this performance and show you where it can be improved. The DATA STORAGE module allows you to store data in an automated processing ledger. The MANAGEMENT ANALYSIS module can take all the sales records for your group and show you who your best salespersons are, who needs more training and give you a sales forecast. Finally, the MARKET ANALYSIS module can show you where determined sales efforts can produce the most success. **(T1) Order No. 0131R $24.95.**

ORACLE-80—will provide you with business analysis and forecasting capabilities previously available only on large computer and time-sharing systems. A flexible, professional time series analysis and forecasting package for use in product planning, business planning, sales forecasting and more. Financial managers and economists can analyze economic climates and investigate business cycles. ORACLE-80 is designed to be used and understood by the typical businessperson. All input and output is written in plain English and the package documentation carefully explains *all* the functions of the program. ORACLE-80 puts the future in your hands. **(T2) Order No. 0140R $75.00.**

BUSINESS PACKAGE IV—This business package contains two programs: ● BUSINESS CYCLE ANALYSIS: This program can plot the expansion and contraction cycles of any aspect of your business. ● FINANCIAL ANALYSIS: Now you can get the figures for any type of annuity, sinking fund, or mortgage and compute the yield and value for bonds. The package includes a blank data tape. **(T1) Order No. 0019R $9.95.**

FINANCIAL ASSISTANT—Compute the figures for a wide variety of business needs, including: ● DEPRECIATION: Figure depreciation on equipment five different ways. ● LOAN AMORTIZATION: Enter a few essential factors and get a complete breakdown of all costs and schedules of payment for any loan. ● FINANCIER: Performs thirteen common financial calculations. ● 1% FORECASTING: Use it to forecast sales, expenses, or any other historical data series. **(T2) Order No. 0072R $7.95.**

CHECK MANAGEMENT SYSTEM—Use this program for writing checks and maintaining records. You can make entries, edit/correct entries and print out the checks. It will also search and display records by number, code, date, description or amount. A Code and Search routine allows you to print a report of all checks written for specific expenses. You can print your letterhead and account number at the top of each report. System requirements: **(T2)** with a compatible tractor-feed printer. **0147RD $39.95.**

ACCOUNTS RECEIVABLE/ACCOUNTS PAYABLE—These Model I programs will handle the drudgery involved in AR/AP entries. They will also provide invoices, statements, reports and more. Each program is capable of handling up to 1500 entries per month, posted to as many as 760 accounts. The AR/AP package is ideal for any small business and can easily be used by anyone familiar with AR/AP operations. System requirements (in addition to **T2**: Three disk drives and a Line Printer (tractor-feed). **Order No. 0075RD $199.95.**

MAIL/LIST—With a five-inch drive, you can store up to 600 names per disk without DOS, or 300 names with DOS. The program maintains separate alphabetical and ZIP code files under constant sort. When you add a name or ZIP code to your list, it will be inserted into its correct position in the file. The program will record your data in nine fields: address, city, state, ZIP code, phone number, phone extension and name (2) plus a five character code field. The best feature of this program is the sort process that lets you determine alphabetical or ZIP code order for label printing. **(T2) Order No. 5000RD $99.00**

ONE-D MAILING LIST—A comprehensive mailing list program that will run on only ONE disk drive! Up to 17 fields of selection for name/address retrieval. Its features include: Auto-sort (alphabetic or ZIP code). Easy error correction and recovery. Prints selective listings. Supports up to 4 drives. Prints mailing labels and listing of all names on file. **(T2) Order No. 0123RD $24.95.**

EXECUTIVE EXPENSE REPORT GENERATOR—Provides you with emergency relief in the form of a clear, plausible expense layout. Input your grand total and cash advance (if any), and you'll receive an itemized expense report, from breakfast to snacks. **(T1) Order No. 0135R $9.95.**

GAMES

WINNER'S DELIGHT—Do you enjoy a challenge? Then try WINNER'S DELIGHT including: ● AMAZING: You must escape from a maze, one that you view from the inside, working against the clock; ● JUNIOR CHECKERS: Not your usual game of checkers. . . the challenge is to beat the computer in the fewest number of moves; ● JUMBO JIGSAW: Fit the pieces together in the fewest number of tries; ● THIRTEEN WAYS: Try to fill up your columns with the numbers you roll on the dice—the computer will try to fill its columns first! **(T1) Order No. 0124R $9.95.**

FUN PACKAGE I—Why call it "Fun Package"? Judge for yourself! This entertaining package includes: •ROCKET PILOT: Flying it is easy—it's the landing that's tough! •PAPER, ROCK, SCISSORS: It's the time-honored game just as you remember it, played against your TRS-80. •HEX I: Just when you master this puzzle game, the computer will increase the difficulty. •MISSILE ATTACK: Use your missiles to protect your city from jet attack. Requires a TRS-80 Level I 16K. Order No. 0037R $7.95.

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Some information for the neophyte.

On Modems

by Chris Brown
80 Staff

As new computer networks pop up with increasing frequency and large corporations like Tandy, CompuServe and Reader's Digest get into the act, the prospects of network interconnects become increasingly attractive. Modems make these interconnects possible.

Put simply, a modem places information on, and extracts it from, a medium. When located between a microcomputer and a telephone line, a modem makes it possible for the computer to send and receive information over that telephone line.

There are two types of modems in use with micros today: acoustically coupled and directly coupled. The acoustically coupled modem is the most popular since it requires only a working telephone for use (directly coupled modems require a special telephone wall outlet for connection).

Acoustic modems are devices which incorporate orifices to cradle the telephone handset. Like most modems they generate audio tones which are relayed through the handset and into the phone lines across a small air gap within each orifice. This air gap makes them susceptible to interference when operated in noisy environments. Directly coupled modems plug into a telephone wall outlet through a quick connect jack, bypassing the telephone set completely.

Transmission and Reception

A modem accomplishes data transmission and reception using a technique called frequency shift keying (FSK). This method of information transfer has been around for a long time and is a favorite among ham radio operators. They use it for radio teletype transmission.

The principles of FSK, as applied to modems, are simple. The modem converts the DC data pulses generated by the computer into two audio tones of specific frequency. These tones represent the data states one and zero. Modems also decode these audio tones and convert them back

In order to speed up information exchange, two pairs of tones are used, a high pair and a low pair. This mode of operation is called full duplex and allows modems to transmit and receive simultaneously.

The frequency of the tones used is determined according to a standard known as Bell 103. This standard specifies a frequency of 2225Hz and 2025Hz for the high pair (the terminal end) and 1270Hz and 1070Hz for the low pair (the computer end). The terminal end modem is known as the originate modem and the computer end modem is the answer modem.

Format

All information that a micro sends through a modem is encoded in a format known as the ASCII code. The ASCII code assigns specific, eight-bit configurations of zeros and ones to numbers (0-9), letters (upper and lowercase), symbols (*, +, −, $, &, etc.) and frequently used control characters (CR, line feed, etc.).

For example, a lowercase "a" is represented as 01100001 in ASCII. No other letter, number symbol or control character will have this particular combination of ones and zeros. When a modem transmits the letter "a", the zero bits in the group will be represented by the lower frequency tone of a pair, the one bits by the higher frequency tone while the frequency shifts back and forth as the character is sent.

In addition to the eight-bit character groups, other bits are often assigned to individual numbers, letters, symbols and control characters. These additional bits are used to indicate when an eight-bit character starts and stops, and also to help in determining parity.

Parity is a check of the accuracy of the transmission and involves summing the total number of one bits in a character. If even parity is used, the sum of all one bits in a character group must be an even number. If odd parity is used, the sum must be an odd number. In groups that don't naturally meet parity requirements, an extra one bit will be added to obtain parity.

A summing function within the computer performs parity calculations. If a character group with unlike parity is transmitted, a parity error message results and the user knows that something has been lost in the translation.

All communication through a modem is in serial format, one bit after another. Within the computer, however, information transfer occurs on the data bus in a parallel format, eight bits at a time. To convert the computer's parallel method of communicating to the modem's serial method an RS-232 interface is required. The RS-232 card performs this conversion (as well as several other transmission functions) and is a necessary adjunct to any modem. The Radio Shack version of the RS-232 is a small PC board which mounts inside the expansion interface and costs about $100.

With the number of interconnect outlets growing every year, the benefits of modems will expand rapidly. The process is underway now, and for most 80 users, owning a modem is just a matter of time.■

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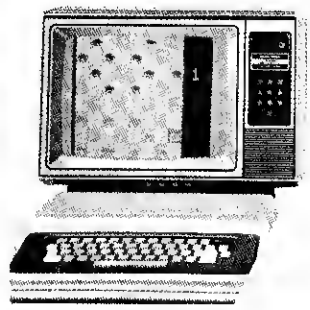

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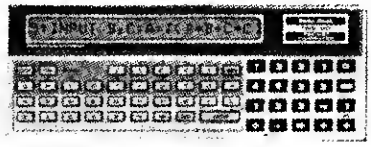

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The essence of variables.

Into the 80's

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We've spent four months programming a computer, with hardly a word about math. It was too good to last, folks, and this month we're going to dive into some of the mathematical capabilities of the TRS-80.

Simple Calculator?

Let's start at the beginning.

The + sign is the ADD command of the TRS-80, and when you use it with numbers or variables, which have number values, it does what you expect it to do. If you type: PRINT 25 + 37 and ENTER, the screen will show the number 62 below your line. This is using the TRS-80 just like a hand-held calculator, but that's not exactly what you bought it for, is it?

Program Listing 1 is a step in the right direction. In line 10, you are reminded of what the program should do. Then type in two numbers, separated by a comma, and ENTER. In line 20, the numbers are added, giving the total T. Line 30 prints this lot, helpfully indicating that the number being printed is the total. The program then prints a blank line, waits, and asks for another pair of numbers. If you want to break out of the endless loop, hit the BREAK key.

It's a simple program, but it does illustrate the big difference between a computer and a calculator. As we go on, that difference will become more obvious.

Suppose we want to keep a running total. We're going to enter many numbers, and we want to keep a record of how many we've entered and what the total is. Just to make it work for its money, we'll make it print the total and the number of entries each time we enter a new number. Program Listing 2 shows the method.

Start by setting two number variables T and N to zero. We set them at zero to start with and add to them during the program, and thereby maintain control over the total. It's like saying "Here's a dollar. Put it in your pocket. How much is now in your pocket?" If you knew that your pocket was empty, the problem is pretty simple.

At line 20, the program asks for a number to be typed in and entered, and this number is assigned the letter A. We use line 30 to end the program; if an entry is zero, steps 40 through 60 are skipped, and the program ends. If a number is not zero, line 40 does the arithmetic.

The statement T = T + A adds the input number to the total. The first time we do this, T has been set to zero, so if the number we fed in was 16, then T = T + A sets T to the value 0 + 16, which is 16. Next time T will start at 16, and whatever number you type will be added. This is the part of the program which totals up the numbers entered.

The second part of line 40 is N = N + 1. Once again, variable N is set to zero in line 10, and on the first step it becomes 1, because 0 + 1 is 1. Second time around, it's made equal to 2, and so on. This variable keeps note of how many numbers have been entered. At line 50, the number of entries and the total are displayed, and the program then loops back to line 20 for another number. Looping back to line 10 would set the count numbers T and N to zero again, and we would lose our totals.

Look at Program Listing 3, which produces the same effect as Program Listing 2, only by adding four sets of numbers at the same time and printing out four totals each time. Unless you can punch four calculator keyboards at once, you're not going to find much competition for the TRS-80 in tasks like this!

Subtraction is so similar to addition that we needn't spend any time on it. The subtract sign is on the keyboard, and it's used in programs the same way as the add sign. The difference is that subtraction can cause negative numbers to be printed, as when you subtract 5 from 3 leaving −2. This is no hassle for the TRS-80, which simply prints −2.

Multiplication

Multiplication uses the asterisk sign *. We can't use × for multiplication the way we do on paper because X is a letter symbol, and the TRS-80 can't tell the difference. We can check multiplication in action without writing a program by typing: PRINT (16*1.5) and ENTERing. The brackets are not needed in this expression, but bracketing is a good habit, as I'll explain.

As you've probably gathered by now, using the computing power of the TRS-80 just to multiply two numbers is a bit of a waste. The computer scores when a large number of operations are carried out and a result displayed. As an example, take a look at Program Listing 4, a simple program which prints out a multiplication table (up to 12 times) for any number you enter in line 10. Notice, we've made use of a FOR. . . NEXT loop to get the sequence of numbers from one through 12. Similarly, we can make use of division in programs by using the / sign,

so that division problems such as 38/4 are written easily into a program.

There's nothing difficult about any of these four operations, but it's not difficult to get into a muddle when performing different bits of arithmetic. For example, suppose you saw 3 + 3 * 6 – 8/2. The answer you get from this depends upon which order you carry out the operations. If you take it as it's written, you'll add three to three to get six, multiply by six to get 36, subtract eight to get 28 and then divide by two to end with 14. Some calculators would also solve the problem this way. Another scheme depends on what's called a hierarchy of order, where multiplication and division are done before addition and subtraction.

Your TRS-80 has been well trained to decide which operations to carry out first, and to obey your instructions. If there are no brackets around any quantities, multiplication and division are carried out first, in left to right order. Then, addition and subtraction, also left to right. This is only part of the order which is printed on page 1/6 of the Level II manual.

I never feel entirely happy letting a machine decide what order it will take for these operations, so I use brackets. The computer will carry out any operation inside brackets before it does anything else. If you have nested brackets (one pair inside another) the innermost are done first, followed by the next set outwards. Within a set of brackets, left-to-right priority rules apply.

As an illustration, look at Program Listing 5. It's an electrical problem concerning the internal resistance of a battery. A battery has a voltage which is steady when not drawing any current, but which decreases when drawing current because of internal resistance. The formula which is used is V = E – r * I, where E is the voltage, called the open-circuit voltage when no current is taken, r is the amount of internal resistance, V is the voltage which is present when current flows, and I is the amount of current. Suppose we want a table demonstrating the effect of a range of currents on the output voltage of a battery. Program Listing 5 does that, and also checks that the value of internal resistance looks reasonably sensible. The STEP instruction is one we haven't used before. It ensures that the step is 0.1, whereas if no STEP is given, a step of one would be automatic. The display used in this program shows the superiority of the computer over the calculator.

In line 60, two headings are printed, one for current and the other for voltage. Line 70 sets up another FOR...NEXT loop, using the same values of current, and in line 80 these are printed at the correct place. The voltage values are printed using the format command, PRINTUSING, so that no more than two decimal places are printed.

Program Listing 5 is one example of a program which works out results from a formula and sets them in table form. This sort of thing has wide applications in engineering, statistics and finance, among other uses. Before we go further along this track we need to know what other math operations the TRS-80 can do.

```
5 REM INTO THE 80'S FIG 5.1
10 CLS:PRINT "PLEASE TYPE NUMBERS TO BE ADDED";:INPUT A
    ,B
20 T=A+B
30 CLS:PRINT "THE TOTAL IS ";T: PRINT
40 FOR N=1TO1000:NEXT:GOTO10
```

Program Listing 1

```
5 REM INTO THE 80'S FIG 5.2
10 T=0:N=0
20 INPUT "NUMBER, PLEASE";A
30 IF A=0 THEN 70
40 T=T+A:N=N+1
50 PRINT N ;" ENTERED, TOTAL IS ";T
60 GOTO20
70 PRINT "TOTAL OF ";N;" NUMBERS IS ";T:PRINT"END OF TO
    TALLING RUN":END
```

Program Listing 2

```
5 REM INTO THE 80'S FIG 5.3
10 X=0:T1=0:T2=0:T3=0:T4=0
20 INPUT "FOUR NUMBERS, PLEASE";N1,N2,N3,N4
30 IF N1=0 THEN 70
40 T1=T1+N1:T2=T2+N2:T3=T3+N3:T4=T4+N4:X=X+1
50 CLS:PRINTTAB(20);;X;" SETS ENTERED, TOTALS ARE: ":PR
    INT T1,T2,T3,T4
60 GOTO20
70 PRINT "FINISHED":END
```

Program Listing 3

```
5 REM INTO THE 80'S FIG 5.4
10 INPUT "NUMBER, PLEASE";X:CLS
20 FOR N = 1 TO 12
30 PRINT N; " TIMES ";X;" IS ";N*X
40 NEXT
```

Program Listing 4

```
5 REM INTO THE 80'S FIG 5.5
10 INPUT "WHAT IS THE OPEN-CIRCUIT VOLTAGE";E
20 INPUT "WHAT IS THE AMOUNT OF INTERNAL RESISTANCE";R
30 IF R>E PRINT "VALUE IS RATHER HIGH - PLEASE RECHECK"
    :GOTO20
40 CLS:PRINTTAB(10)"CURRENT";TAB(30)"VOLTAGE":A$="##.##
    "
50 FOR I=.1 TO 1 STEP .1
60 PRINTTAB(10)I;TAB(33)USING A$;E-R*I
70 NEXT
80 END
```

Program Listing 5

"You're not really a beginner now, so you can try these out."

First is exponentiation, which means multiplying a number by itself. The expression 2^3 means multiply 2 by itself three times, meaning 2 * 2 * 2 = 8. In BASIC, this is written as 2 ↑ 3, so that entering PRINT 2 ↑ 3 should come up 8.

Exponentiation will always be carried out first, unless there are other expressions inside brackets in the same line. A fractional exponent has the same meaning as a root. For example, an exponent of 0.5 gives the same result as a square root, and an exponent of 0.33333 is the same as a cube root. For convenience, the square root is always separately coded as SQR, so that entering PRINT SQR(25) comes back with the value five, as it we used PRINT 25 ↑ .5.

Eternal Triangles

If you know the lengths of the two short sides of a right triangle, A and B, you can find the length of the long side, C (called the hypotenuse) by using the formula $C^2 = A^2 + B^2$. Program Listing 6 prints out the length of the hypotenuse for any pair of other sides entered. For good measure, we've made it show the total perimeter (equal to A + B + C) as well. Lines 20 and 30 ask for the side lengths, in any units you like, as long as they are the same measure. The calculation is carried out in line 40, and then there's a step which may have caused your eyebrows to lift slightly. What does C = (INT(100*C))/100 do?

The INT instruction means "take the integral part of"—chop off the decimal point and anything which follows. Suppose C starts as 26.2615. Since the order of carrying out instructions starts on the inside brackets, 100 * C is first of all evaluated as 2626.15. This is inside another set of brackets, so the next step is the INT step, taking the whole number part of 2626.15, which is 2626. This is finally divided by 100 to give 26.26, which is allocated the variable name C. The answer is down to two decimal places so that we don't have too many in the answer, printed in line 50.

Is this desirable? If we are entering values of A and B, which are numbers greater than one, fine, but if A = 0.3 and B = 0.4, then C should be 0.5. This works out all right, but if A = 0.003 and B = 0.004 then the value for C, which should be 0.005 comes out zero. There are two ways to avoid this. One is to reject (upon entry) any values of A or B which are too small. The other is to ignore the C = (INT(100*C))/100 step if A and B are less than 0.01. You're not really a beginner now, so you can try these out.

Translating other formulae into BASIC is not difficult, but you need to be familiar with algebra.

The TRS-80 can also cope with trigonometrical functions. The main functions can be obtained by typing SIN, COS, or TAN, but the angles have to be in units of *radians*, not in more familiar degrees. The Level II manual shows how you convert, by multiplying the angle in degrees by 0.017533, so that you can have SIN(A*.0174533) as a way of finding the value of SIN A, with A in units of degrees. If you are going to use several conversions, incidentally, it saves a lot of memory and running time if you have, early in your program, a step such as F = .0174533, and then write the formulae as SIN(A*F), or COS(A*F), or TAN(A*F). The manual also list the other trigonometrical functions and formulae. Listing 7 uses trigonometry to calculate the side of a triangle.

Imprecisions

Before we break away to other things, there are a few important points about using numbers in the TRS-80. You need to know about them if you are not to be mystified by the results of some of your own programs. At some time, you may try to write a simple financial program which involves adding and subtracting sums of money, and you'll be intrigued (if it's not your money) or infuriated (if it is your money) to find that sums are often a cent or so off. How can a computer do such a thing?

The answer is the problem of precision. The degree of precision of a quantity is measured by the number of digits it can handle—you are probably familiar with calculators which work with eight figures. Looking at some examples, the number 741.36 has five digits of precision, 42.5 has only three, and 1024.76 has six. Level II BASIC makes use of three levels of precision, and a lot of the odd results you get arise from "rounding off" within the computer, when numbers are cut to fit the level of precision chosen.

Unless you instruct the computer to the contrary, a variable is stored and printed as a single-precision variable. Single-precision, as far as the TRS-80 is concerned, means that it will store seven digits and print out six. The sixth digit will be rounded up, and if this happens often, the errors will add up (a cumulative error) to something noticeable. If you don't want this (or if you want it to happen in a bigger way!) you can change things.

An integer is a whole number, no fractions allowed, and the permitted range on the TRS-80 is −32768 to +32767. These are the range of numbers we can obtain by using two bytes to store the binary numbers that the TRS-80 uses, so that by declaring a variable to be an integer, we need reserve only two bytes of memory for it. We can declare a letter to be an integer variable by using DEFINT at the start of a program, or by using a "type declaration" character, in this case %. N% means that N is an integer variable, just as N$ would mean that N is a string variable. If we use DEFINT N at the start of a program, then N must be used as an integer throughout, but if we use N%, then we can also use N$, N#, and N!, all meaning different values. The hashmark # means a double-precision variable, and the ! means single-precision. Notice, by the way, that if you use integers, no fractions can appear, so that if you type N% = 5:PRINT N%/2, you get 2, and not 2.5.

The other degrees of precision, as mentioned above, are single and double precision; all variables are treated as single-precision if we don't make any effort to declare them as anything else. A single precision variable needs four bytes of memory, a double-precision variable needs eight, and contains 17 digits, of which 16 can be printed. A string variable will need as many bytes as there are characters in the string (up to 255).

If your programs use a lot of counting loops, with variables like N,Z,T and so on, you can make them run faster and use less memory if the first line is formulated as DEFINT N,Z,T (and any others like them). This way, the numbers will take less memory and can be taken in and out of memory more quickly.

The other point comes back to these missing cents. The rounding down which is done when a number is printed can also cause errors. The most suspicious steps in any program are where numbers containing decimals are multiplied together because, when you multiply two single-precision numbers, the result may have too many digits to store as a single-precision number. Consequently, a rounding-off error results. If the quantities are added, more errors of the same type will occur.

There are two useful wrinkles for avoiding this problem. One is to work all money amounts in cents. If you work in cents and use S = INT(S) every now and again after a step which might cause fractions to appear, you should avoid trouble. The other is to round up occasionally (and close the corral gate after you). We do this with the instruction C = INT(C + .5).

How does it work? Suppose C has taken its value from multiplying two numbers, and rounding off has caused this to be 176.999 instead of 177. Adding .5 to this makes it 177.499, and INT(177.499) is 177, since INT chops off the decimal part of the number.

Free Range Methods

We took a brief look last time at the graphics characters of the TRS-80 which allow you to put shapes on the screen by using the CHR$( ) command, or a PRINT A$, where A$ is defined as a number of graphics strings. This time we're going to look at

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RADIO SHACK*	NO	40ms.	YES	NO	109K bytes	NO	NO
PERCOM	YES	25ms.	YES	NO	250K bytes (both sides)	YES	NO
MPI	NO	5ms.	YES	YES	125K bytes	YES	NO
SHUGART	NO	40ms.	YES	NO	109K bytes	NO	NO
TANDON	NO	5ms.	NO	NO	125K bytes	NO	NO

Factual material from current manufacturer's data sheets is believed reliable but cannot be guaranteed, comparing Aerocomp Model 40-1 to similar models.

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free range methods, including those used to display bar charts and graphs.

The commands which make this possible are SET and RESET. SET means light up a graphics cell, one of the block of six at each PRINT position. RESET means turn it off. If you command SET and the cell has been lit, there is no change. Similarly, if you command RESET and the cell has not been lit, there is no change.

SET and RESET are followed by numbers in brackets which tell the computer which cell to SET or RESET. The first number measures how far on the width of the screen the SET position is. If you're into graphs, this is the X-direction. We have a maximum of 64 print positions, each two graphics cells wide, making 128 cells, numbered 0 to 127. In the vertical direction we have 16 lines, each three cells deep, making 48 numbered 0 to 47. The SET or RESET must be followed by (X,Y), where X is a number (an integer) between 0 and 127 and Y is another integer between 0 and 47.

These commands open up possibilities for interesting graphics work, not least of which is the opportunity to do a bit of animation. Look at Program Listing 8, which flashes a graphics block on and off. To get out of this you need to use BREAK, because the loop is endless, but you already know how to make this flash a number of times and then stop. Program Listing 9 is a crawling worm graphic which we're going to develop a bit further. It starts by clearing the screen (line 10) and setting Y = 5, which is the vertical setting for the worm's path. The worm is created in line 30 by setting a line of five graphics blocks. Line 40 simply adds a delay. The animation starts in line 50. Taking values from 0 to 127, we reset the left-hand cell of the worm and set a new right-hand cell, so making it appear that the worm crawled one cell to the right. The FOR ...NEXT loop using Z then another delay, and then the process is repeated. If we are not careful, we will get an error message, because the SET(N+5,Y) instruction will not operate when N exceeds 122, we have only 127 cell numbers along the line. We get around that by using an IF...THEN statement. If the value of N is 122 or less, the line runs normally, but if N is 123 or more, the ELSE part of the statement simply bypasses the SET command, returning to the next value of N.

Want a snake rather than a worm? We'll need to stretch it out a bit in line 30, or you won't notice the wiggle. To make it "wiggle," we'll make the value of Y change now and again, and that's more difficult. A reasonable way of making Y vary is to make use of the SIN function. The math majors will tell you that the sine of an angle is the ratio of two sides of a right-angled triangle, but I prefer to think that the name suggests more interesting things. The word sine comes from the Latin word for snake, because if you plot a graph of the sine of an angle against the angle (Program Listing 10), the shape is the wiggle.

Take the value of Y as Y + (5*SIN(N)). SIN values repeat every 360°, so that if we use angle values in degrees we would see the shape repeating. As we noted though, the SIN function of the TRS-80 does not use angles in degrees but in radians. In Program Listing 10 we use the correcting factor taken from the Level II manual, of .1745, which converts degrees to radians.

Program Listing 11 is the wiggling program. We set up a series of subscripted

```
5 REM INTO THE 80'S FIG 5.6
10 PRINT"THIS PROGRAM CALCULATES THE LENGTH OF THE HYPO
     TENUSE OF":PRINT"A RIGHT-ANGLED TRIANGLE, GIVEN TH
     E OTHER TWO SIDES."
20 INPUT"PLEASE TYPE IN LENGTH OF SIDE A";A
30 INPUT "PLEASE TYPE IN LENGTH OF SIDE B";B
40 C=SQR(A[2 + B[2):C=(INT(100*C))/100
50 PRINT "THE HYPOTENUSE LENGTH IS ";C:PRINT"THE PERIME
     TER LENGTH IS ";A+B+C
```

Program Listing 6

```
5 REM INTO THE 80'S FIG 5.7
10 CLS:PRINT"THIS PROGRAM FINDS THE LENGTH OF A SIDE OF
     A TRIANGLE,":PRINT"GIVEN TWO SIDES AND THE ANGLE
     BETWEEN THEM"
20 INPUT"TWO SIDE LENGTHS, PLEASE";B,C
30 INPUT"ANGLE, IN DEGREES,PLEASE";A:IF A/180 =INT(A/18
     0) THEN 70:ELSE IF A=90 THEN X=SQR(B[2+C[2):GOTO50
40 X=SQR(B[2+C[2-(2*B*C(COS(A*.0174533))))
50 PRINT "LENGTH OF THIRD SIDE IS ";X; " UNITS LONG"
60 END
70 PRINT "IMPOSSIBLE ANGLE - PLEASE TRY ANOTHER VALUE"
```

Program Listing 7

```
5 REM INTO THE 80'S FIG 5.8
10 CLS
20 SET(63,23):FOR N=1TO100:NEXT
30 RESET(63,23):FOR N = 1TO100:NEXT:GOTO20
```

Program Listing 8

```
5 REM INTO THE 80'S FIG 5.9
10 CLS
20 Y=5
30 FOR N=0TO4:SET(N,Y):NEXT
40 FOR Z=1TO50:NEXT
50 FOR N=0TO127:RESET(N,Y):IF N<122 THEN SET(N+5,Y):FOR
     Z=1TO50:NEXT Z:ELSE FOR Z=1TO50:NEXT Z
60 NEXT N:Y=Y+1:IF Y=48 THEN END ELSE 30
```

Program Listing 9

```
5 REM INTO THE 80'S FIG 5.10
10 CLS:FOR X=1TO 127
20 SET (X,10+10*(SIN(.1745*X))):NEXT
30 PRINT@640,""
```

Program Listing 10

```
5 REM INTO THE 80'S FIG 5.11
10 DIM Y(128):CLS
20 FOR N=0TO127:Y(N)=5*SIN(N/4):NEXT
30 FOR N=0TO24:SET(N,7+Y(N)):FOR Z=1TO50:NEXT Z,N
40 FOR N=24 TO 127:SET(N,7+Y(N)):RESET(N-24,7+Y(N-24)):
     FOR Z=1TO50:NEXT Z,N
50 FOR N=103 TO 127:RESET (N,7+Y(N)):FOR Z=1TO50:NEXT Z
     ,N
60 END
```

Program Listing 11

```
5 REM INTO THE 80'S FIG 5.12
10 CLS:Y=47:FOR X=0TO127
20 SET(X,Y-(X[2)/384)
30 NEXT
40 PRINT@0,"*":FOR Z=1TO50:NEXT:PRINT@0," ":FOR Z=1TO50
     :NEXT:GOTO40
```

Program Listing 12

number variables, Y(N), not forgetting to dimension this correctly in line 10. With the screen cleared, line 30 introduces the snake from the left-hand side by setting values of N, and a value of Y equal to 7 + Y(N). Y(N) takes on values which can range between +3 and −3 because of the 3*SIN(N/4) function in line 20, and this creates the wiggle between values for Y of 10 and 4 (7 + 3 and 7 − 3, see?). The value doesn't just leap from one extreme to the other, but snakes its way there, which is what we want.

To animate a track across the screen, we need line 40. It advances the "head" of the snake and rubs out the "tail" at each step, using a short delay to make sure that progress is slow enough to follow. If you fancy faster or slower snakes, you only have to alter the delay loop which starts with FOR Z = 1 TO 100. The reason for putting the wiggle values into a subscripted variable is so that we can rub them out correctly as the snake moves along. It's not the only way of doing this, but it's the easiest.

Graphs and Bar Charts

The uses of SET and RESET aren't confined to games and amusements; there are several serious and useful applications in math and statistics. For our puposes, the most useful are for drawing graphs and bar-charts. The conventional directions of a graph are X and Y, with X being used to represent the size of the quantity which we can control, and Y the other quantity which is varying. Program Listing 12 illustrates this by drawing the shape of a graph of X^2 plotted against X, for a range of values of X which will cover the screen, but leave room for a flashing asterisk on the top line. In this example, SET has been used as the command which prints the graph spot.

Because we use only 128 cells across the screen, and 48 down, graph drawing is a bit limited, but the use of a printer makes it possible to draw more extensive graphs. A graph-plotter is the ultimate luxury. For the beginner, however, a printer is a luxury item, so we won't spend time looking at graph techniques which make use of a printer, except to say that we turn out graphs on their sides when printing. That way, we have all 64 print points available in one direction, and as many as we like in the other.

Most graph programs require you to change a line of the program to enter the equation. Program Listing 13 doesn't. It uses TRS-80 BASIC to create a line of data from the input in line 60. Then it draws the graph using this data. The program is by Ian O'Neill of Ealing, London, England.

A complete description of how this program works is a bit beyond us now, but it deserves a description of how it should be used. It depends on changing the expression entered in line 60 into the data statement in line 500. To do this, the computer has to find the address of line 500 by searching through memory for the character @, whose ASCII code is 64. This causes a slight pause, as the computer searches. If, by any chance, line 500 has been zapped, line 20 deals with the problem and reports the bad news. The program then ends, so you can type in a new line, 500.

All being well, the title "Graph Plotter" will come up, followed by the instruction "PRINT THE FUNCTION IN TERMS OF X", followed by a query caused by INPUT in line 60. At this point you have to type in the

Reader Service—see page 242

"You can't expect the computer to know you want one function plotted from 0 to 100 and another from −10 to +10."

equation to be graphed, in the form of Y = function (X), with no Y^2 or Y^3 or $\sqrt{Y}$ permitted. This is usually straightforward if the equation to be graphed is already in this form, such as $Y = 2X^2 + 3$, which can be entered as: 2*X↑2 + 3; or the equation $Y = \sqrt{X^2 + 2C^2}$, which can be entered as: SQR(X↑2 + 2*C↑2). It becomes harder when the equation has a form like $Y^2 = 2aX + 7$ because the program does not allow you to use Y^2. To enter this equation, you have to rearrange it by taking the square root of each side of it, transforming it to $Y = \sqrt{2aX + 7}$, which is then entered as SQR(2*A*X + 7).

Practically any equation you graph is catered to because the standard BASIC functions, + − * / ↑ SGN, INT, ABS, RND, SQR, LOG, EXP, SIN, COS, TAN and ATN can be used. The quantity entered into line 60 should be typed so that if it were a line of BASIC in another program, it would run without an error signal. An important point: *No spaces are permitted.* The permitted characters can be seen in line 40.

If you've mistyped your expression, line 90 rejects it, and then line 100 transfers into the form of data in line 500.

You are then asked a few more questions which affect the appearance of the graph. The first question is about the equation you have typed. Is it symmetrical about the X-axis? That sounds unfair because you probably want to see the graph to know the answer. A useful hint here is that if the expression uses SQR(X), then you should probably answer YES to the symmetry question, otherwise NO. The reason is that a square root can have a positive or negative value so that there are two possible values of Y for a given value of S. For example, if Y = SQR(X), then for X = 4, Y can be +2 or −2; and for X = 9, Y can be +3 or −3. The symmetry question lets you see both parts of a function like this. If you haven't the faintest idea, just answer YES to the question and if there is only one graph line, run again, this time answering NO.

The next question is for LIMITS. The computer will print the previous limits of X and Y, if any, so that you can use these again if you like. They must be entered when the questions, "X-AXIS: LOWER LIMIT?" and "X-AXIS: UPPER LIMIT?" appear. You can't expect the computer to know you want one function plotted from 0 to 100 and another from −10 to +10. You'll be asked for a lower limit for Y. You can type AUTO and the computer will calculate its own limits so that the graph will fit the video screen. If you've never seen the shape of the graph, it's wiser to opt for AUTO because you'll see the complete graph, with no chance of points disappearing. You can then try setting lower and upper limits for Y in order to view an expanded section. If you enter a lower limit for Y, you will be prompted for an upper limit.

A flashing bar (cursor) appears to warn you that everything is ready for action. You can now issue a command by pressing any one of the keys D,F,L,N,P, or # without using ENTER.

D means display the limits, to tell which X and Y limits are being used. This can be done before or after drawing and will show what limits the computer chose for Y if you opted for AUTO. F causes the equation (function) to be displayed again. If you have a print routine which transfers the screen information to a printer, this is useful. L will allow you to insert new limits. If you want to see more or less of the graph, you don't have to run the program again from start. N selects a new function, so that you can enter another equation.

Press P and the equation is plotted in lines 310 to 330. You can look at your work with admiration. The prompt cursor will then flash to remind you that you can choose any of the command letters again.

If you hit the hashmark, which means using SHIFT and 3 together, the program re-

Continued to p. 111

```
5 REM INTO THE 80'S FIG 5.13 : GRAPH BY IAN O'NEILL,EAL
    ING,LONDON
10 CLEAR 400:CLS:PRINT@474,"PLEASE WAIT.":DEFINTA-P:DEF
    STRQ-W:ON ERROR GOTO350:FORL=19000TO20000:IF PEEK(
    L)=64 THEN 30
20 NEXTL:PRINT@471,"NO DUMMY LINE 500.":END
30 FORJ=L TO L+4:IF PEEK(J)=64 THEN NEXT ELSE 20
40 DIMV(20),R(20):FOR J=0TO20:READ V(J),I:R(J) = CHR$(I
```

Program continues

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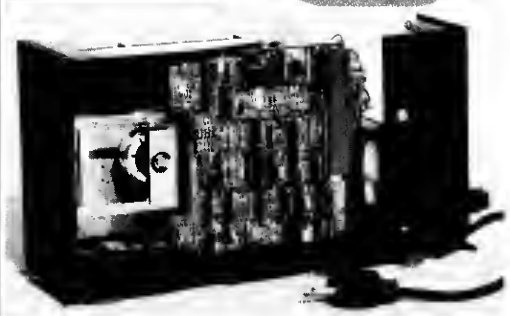

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```
     ):NEXT:DATA+,205,-,206,*,207,/,208,[,209,(,40,),41
     ,.,46,EXP,224,X,88,SGN,215,INT,216,ABS,217,SQR,221
     ,RND,222,LOG,223,COS,225,SIN,226,TAN,227,ATN,228,E
     ,69
50 CLS:PRINT:PRINTTAB(25)"GRAPH PLOTTER":PRINTTAB(24)ST
     RING$(15,62):PRINT:PRINT:PRINT"TYPE THE FUNCTION I
     N TERMS OF X:":PRINT
60 INPUT" Y=";T:J=1:U="":IFT="" THEN 50
70 IF MID$(T,J,1)>"/" AND MID$(T,J,1)<":" THENU=U+MID$(
     T,J,1):J=J+1:GOTO100
80 FOR I=0 TO20:IF MID$(T,J,LEN(V(I)))=V(I) THEN U=U+R(
     I):J=J+LEN(V(I)):GOTO100 ELSE NEXT
90 PRINT"ILLEGAL REFERENCE:   Y="LEFT$(T,J)"?"RIGHT$(T,
     LEN(T)-J):PRINT"RETYPE FUNCTION.":GOTO60
100 IF J<=LEN(T)THEN70 ELSE U="Y"+CHR$(213)+U+":"+CHR$(
     147):FOR J=1 TO LEN(U):POKE L+J-1,ASC(MID$(U,J,1))
     :NEXT:H=0:GOSUB500:IF H=2 THEN 50
110 PRINT:INPUT"IS FUNCTION SYMMETRICAL ABOUT X-AXIS (Y
     /N)";S:S=LEFT4(S,1):IF S<>"Y" AND S<>"N" THEN 110
120 CLS:PRINT:PRINT"LIMITS":PRINT"======":PRINT:M=0
130 PRINT"PREVIOUS LIMITS:    X="XL"TO"XU CHR$(8)", Y=
     "YL"TO "YU: PRINT@384,"";:INPUT" X-AXIS:    LOWER
     LIMIT"; XL:INPUT"    UPPER LIMIT";XU:XS=(XU-XL)/12
     8:PRINT:INPUT"Y-AXIS:    LOWER LIMIT" ; Q
140 IFQ="AUTO"THEN150ELSE YL=VAL(Q):INPUT"     UPPER LI
     MIT";YU:YS = (YU-YL)/48:IF XS=0 OR YS=0 THEN PRINT
     "    ILLEGAL LIMITS:  AXIS LENGTH ZERO.":FOR I=1TO
      900:NEXT:GOTO120ELSE M=1:GOTO190
150 M=0:X=XL:GOSUB500:YL=Y:YU=Y:FORX=XL+XS TO XU STEP 3
     *XS:GOSUB500:IFY>YU THEN YU=Y ELSE IF Y<YL THEN YL
      = Y
160 NEXT:IF YU<>YL THEN M=1:Y=YU-YL+.04*Y:YL=YL-.04*Y:Y
     S=Y/48
170 IF S="Y" AND M=1 THEN YU=ABS(YU+YL+ABS(Y))/2:YL=-YU
     :YS=YU/24
180 PRINT@576,CHR$(30)" Y-AXIS:   AUTO LIMITS  ="YL" TO
      "YU:Q=STR$(YL)
190 AT=16040:IF W = "P" THEN AT=15360
195 PRINT@3,"d-LIMITS:F-FUNCTION:L-NEW LIMITS:N-NEW FUN
     CTION:P-PLOT:#-END PROGRAM"
200 POKE AT,143:FOR I=1 TO 40:W= INKEY$:IF W="" THEN NE
     XT:POKE AT,32:FOR I=1 TO 32:W=INKEY$:IF W="" THEN
     NEXT:GOTO200
210 POKE AT,ASC(W):FORI=1 TO 250:NEXT:IF W="#" THEN 370
220 IF W = "P" THEN 280
230 IF W = "L" THEN 120
240 IF W = "N" THEN 50
250 IF W = "F" THEN PRINT@5,CHR$(30)"Y = "T;:GOTO200
260 IF W = "D" THEN PRINT@5, "LIMITS:  X= "XL" TO "XU C
     HR$(8)",  Y = "YL" TO "YU;:GOTO 200
270 POKE AT,63:FOR I = 1 TO 300:NEXT:GOTO200
280 IF M=0 THEN CLS:PRINT:PRINT"ILLEGAL LIMITS:   AXIS
     LENGTH ZERO.":FOR I=1 TO 900:NEXT:GOTO120 ELSE CLS
290 A=INT(.5-XL/XS):IF 0<A AND A<=127 THEN FOR I=0 TO 4
     7:SET(A,I):NEXT
300 A=47 - INT(.5-YL/YS):IF 0<A AND A<=47 THEN FOR I =
     0 TO 127:SET(I,A):NEXT
310 FOR N=0 TO 127:X=XL + N*XS:H=0:GOSUB500:IF H=1 THEN
      340
320 P=47-INT((Y-YL)/YS+.5):IF P>=0 AND P<=47 THEN SET (
     N,P)
330 IF S="Y" THEN P=47-INT(.5-(Y+YL)/YS):IF P>=0 AND P<
     =47 THEN SET(N,P)
340 NEXT:GOTO190
350 IF ERR=2 OR ERR=40 THEN CLS:PRINT"    Y= "T:PRINT:P
```

Program continues

sets itself, ready to run again. If you use the BREAK key at any time, line 500 will be left as a data line, containing the expression you previously entered. You'll have to restore the line or use GOTO200 to get back to the command cursor. If you choose a letter which is not part of the command set, the computer will display a query (line 270) and return to the set.

This program is such a joy to use I had to include it when considering graph drawing. When you finish this series, look back on this one, and try to unravel it. You'll learn a lot about programming and how your TRS-80 operates. ■

```
     RINT "ERROR IN FUNCTION. RETYPE CORRECTLY.":FOR I=
     Ø TO 2000:NEXT:H=2:RESUME NEXT
360  H=1:RESUME NEXT
370  FOR I=L TO L+10:POKE I,64:NEXT:CLS:PRINT "RUN COMPL
     ETE.":END
500  @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
     @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
     @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
     @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
     @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
510  RETURN
```

Program Listing 13

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- Optional Upper/Lower case

The PMC-80 is a "work-alike" computer to the popular TRS-80* Model I, Level II by Tandy, Radio Shack. The PMC-80 has 16K bytes of RAM and the complete Level II 12K BASIC ROM by Microsoft that makes it 100% software compatible with programs from Radio Shack and from the hundreds of other independent suppliers. The built-in cassette player reads standard Radio Shack programs for the TRS-80.*

The PMC-80 will operate with any of the many peripherals Radio Shack and other independent vendors have invented to plug into the TRS-80.* Most importantly, the Interface Adapter permits Expansion Interfaces with memory expansion to 48K to be added. An Expansion Interface will also permit the addition of Radio Shack compatible 5¼" disks and disk operating systems, RS 232, printers, etc.

Sold through computer stores.

*TRS-80 is a registered trademark of Tandy Radio Shack.

Personal Micro Computers, Inc.

✓422

475 Ellis Street, Mountain View, CA 94043 (415) 962-0220

Fastload

FOR TRS-80* MODEL I USERS ONLY

16 Times Normal Speed

*TRS-80 is a trademark of Tandy Corp.

- High speed load TRS-80* Level II cassettes
- Input 15K byte Level II program in 15 seconds
- Search BASIC or SYSTEM programs by name

Unlike other high speed tape input devices, FASTLOAD uses standard format cassettes. Therefore, there is no need to re-record on other media. At 8000 baud, FASTLOAD is faster than disk for short programs. FASTLOAD reads tapes at the fast-forward speed of the CTR-41 cassette recorder. The recorder can also be used for CSAVE at the normal speed.

FASTLOAD connects to the 40 pin I/O or to the Expansion box. The control program does not use computer memory because it is in a built-in PROM. Other valuable features are keyboard debounce program, automatic key repeat routine and key-beep via cassette speaker. Price is $188.00 for FASTLOAD and $95.00 for the modified CTR-41 recorder.

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Here are some curses and cures in its honor.

CLOAD Is Just A Five Letter Word

Dennis Bathory Kitsz
Roxbury, VT 05669

CLOAD may not be a four-letter word, but it surely provokes some unpleasant thoughts in the minds of many 80 users. The computer's tape loading routines were designed to be slow but sure; using a few simple precautions, your inexpensive CTR, or other portable, can be as reliable as any storage system developed for the TRS-80.

Many fixes have been proposed for the seemingly whimsical CLOAD routine, from Radio Shack's own XRX modifications to such expensive alternatives as the purchase of a disk system. For the moment, let's discard the latter choice and concentrate on ways by which we tape users can optimize our system.

Audio

This tape process is a proverbial apples-and-oranges mismatch. Portable tape recorders are intended to reproduce audio signals, and they are undeniably weak for this purpose. Only a person with a very tin ear would not appreciate the difference between the portables and a high quality tape deck, much less the original music. We can recognize the harmonies and instrumentation only because we have an acculturated understanding of what we believe we are hearing. We average, smooth over, forgive. In short, our internal computer *remembers* its experiences.

Photo 1 is an oscilloscope representation of a digital signal generated over a short period of time—the CSAVE signal. The signal moves from zero-level to one-level and back again quite crisply, spending virtually no time in the questionable zone between zero and one. Measured at a point inside the machine, the period of transition occurs on the order of a few billionths of a second, and has no meaning on the audio level.

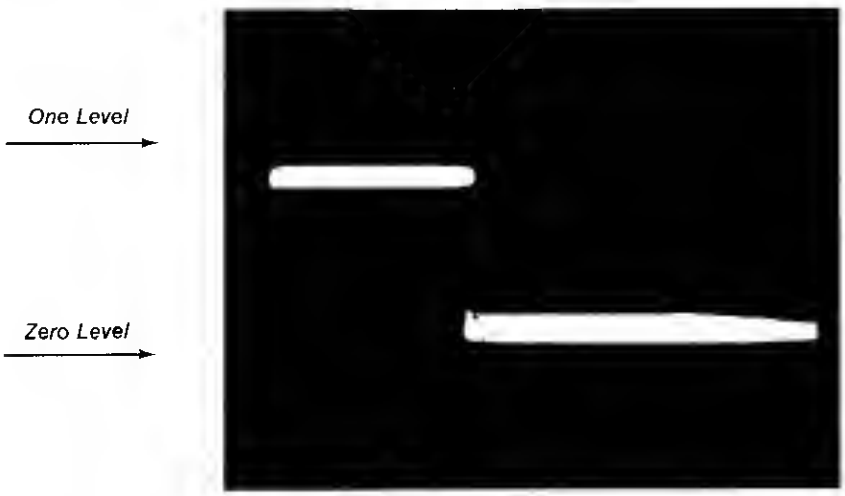


Photo 1. CSAVE signal measured before audio processing. Note that change from one-level to zero-level is invisible.

Let's examine some of the contributions made by the 80's poorly-handled audio electronics. The first is the audio output circuitry itself. Photo 2 presents the digital signal as it exits the cassette port. The sharp edges have been blurred, the first step in the long path of signal deterioration. Audio "processing" changes the digital one-zero pattern to an audio plus-zero-minus signal. This is needed because the polarity of audio output (and input) in many recorders is not standardized, and a simple one-zero would come out zero-one. No tape would CLOAD correctly.

An unexpected interreaction between the computer's output wiring and most tape recorders also produces a low-pitched hum. The data signal rides up and down on this low frequency hum, and some of the ones and zeros come close to being out of bounds. Although the 80 contains a filtering system to reduce the quantity of hum that reaches the data circuitry, it cannot fully overcome its effects. If you use too high or low a volume setting on playback, some of the top and bottom level of signal will be out of the decipherable range. Fig. 1 is a slightly exaggerated sketch of this effect.

The most damaging hardware flaw is the audio recorder. By the time the digital signal passes through the miserable audio electronics to the tape head, it has deteriorated considerably. Furthermore, even the best tape contributes its own level of signal degradation; Photo 3 portrays the recorded data as reproduced on the CTR-41 portable cassette player, with the recorder adjusted

the electric pencil II™

for the TRS-80 Model II* Computer

The Electric Pencil is a Character Oriented Word Processing System. This means that text is entered as a continuous string of characters and is manipulated as such. This allows the user enormous freedom and ease in the movement and handling of text. Since lines are not delineated, any number of characters, words, lines or paragraphs may be inserted or deleted anywhere in the text. The entirety of the text shifts and opens up or closes as needed in full view of the user. Carriage returns as well as word hyphenation are not required since each line of text is formatted automatically.

As text is typed and the end of a screen line is reached, a partially completed word is shifted to the beginning of the following line. Whenever text is inserted or deleted, existing text is pushed down or pulled up in a wrap around fashion. Everything appears on the video display screen as it occurs thereby eliminating any guesswork. Text may be reviewed at will by variable speed or page-at-a-time scrolling both in the forward and reverse directions. By using the search or the search and replace function, any string of characters may be located and/or replaced with any other string of characters as desired. Specific sets of characters within encoded strings may also be located.

When text is printed, The Electric Pencil automatically inserts carriage returns where they are needed. Numerous combinations of Line Length, Page Length, Character Spacing, Line Spacing and Page Spacing allow for any form to be handled. Right justification gives right-hand margins that are even. Pages may be numbered as well as titled.

the electric pencil

—a Proven Word Processing System

The TRSDOS versions of The Electric Pencil II are our best ever! You can now type as fast as you like without losing any characters. New TRSDOS features include word left, word right, word delete, bottom of page numbering as well as extended cursor controls for greater user flexibility. BASIC files may also be written and simply edited without additional software.

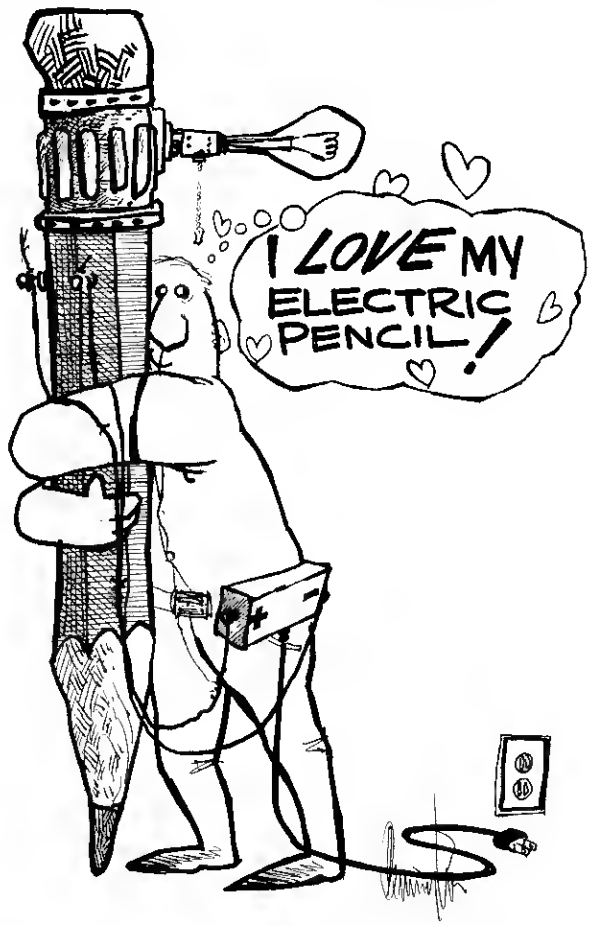
Our CP/M versions are the same as we have been distributing for several years and allow the CP/M user to edit CP/M files with the addition of our CONVERT utility for an additional $35.00. CONVERT is not required if only quick and easy word processing is required. A keyboard buffer permits fast typing without character loss.

	CP/M	TRSDOS
Serial Diablo, NEC, Qume	$ 300.00	$ 350.00
All other printers	$ 275.00	$ 325.00

The Electric Pencil I is still available for TRS-80 Model I users. Although not as sophisticated as Electric Pencil II, it is still an extremely easy to use and powerful word processing system. The software has been designed to be used with both Level I (16K system) and Level II models of the TRS-80. Two versions, one for use with cassette, and one for use with disk, are available on cassette. The TRS-80 disk version is easily transferred to disk and is fully interactive with the READ, WRITE, DIR, and KILL routines of TRSDOS.

TRC	Cassette	$ 100.00
TRD	Disk	$ 150.00

✓255



Features

TRSDOS or CP/M Compatible * Supports Four Disk Drives * Dynamic Print Formatting * Diablo, NEC & Qume Print Packages * Multi-Column Printing * Print Value Chaining * Page-at-a-time Scrolling * Bidirectional Multispeed Scrolling * Subsystem with Print Value Scoreboard * Automatic Word & Record Number Tally * Global Search & Replace * Full Margin Control * End of Page Control * Non Printing Text Commenting * Line & Paragraph Indentation * Centering * Underlining * Boldface

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(714) 323-1400

✓ Reader Service—see page 242

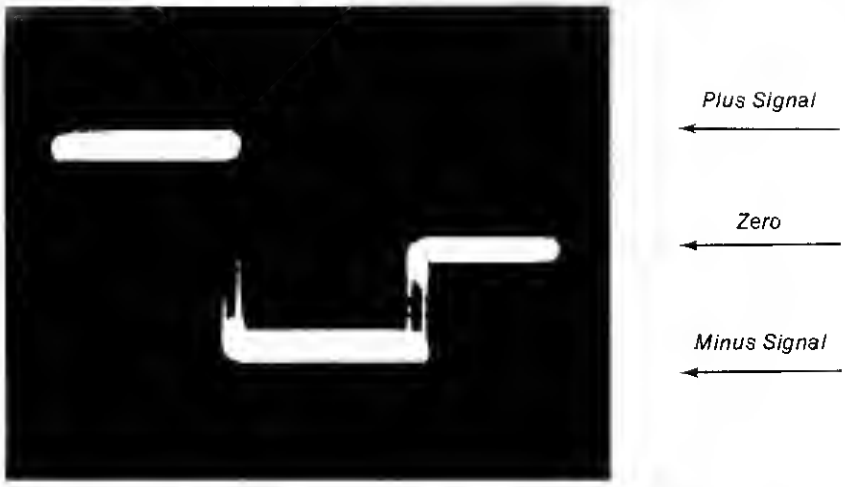

Photo 2. After audio processing, a plus-minus-zero shape is evident, as well as a softening of the crisp digital waveform. This signal was measured at the cassette output jack.

to optimum playing conditions and high-grade digital tape used. It bears little resemblance to the original CSAVEd data by this time, and contains hiss and other residual garbage.

The audio electronics have reduced the clean, crisp digital elements shown in Photo 1 to a noisy, blurred, rounded audio waveform. The signal spends so much time in the "no person's land" between zero and one that it is well nigh impossible for the rigid digital electronics to interpret the signal as valid data. Add tape hiss, system noise, speed variations, and a host of electronic interference (including another wealth of hum added during playback by the computer's wiring difficulties), and we're lucky to get a successful CLOAD at all.

Some redemption is provided by the TRS-80, however. Photo 4 shows the recorded waveform after it passes through the filters and digital shaping circuits inside the computer. If the signal has been properly detected at all, it will be re-shaped in preparation for the Level II routine which must turn it back into a BASIC program.

Photo 5 shows the unfortunate effect of speed variations (tape flutter), produced as the computer tries to sync with the incoming signal.

Flaws

CLOAD can work—but only haphazardly. What could make it worse? Here are some major flaws and solutions:

● **Head Misalignmant:** This is probably the number one cause of bad loads. If the tape head is not aligned vertically with respect to the tape's recorded signal, a further loss in volume and signal clarity will result. The CTR-80 has a provision for adjusting the playback head; use this feature especially when trying to load commercial tapes. If you have another type of recorder, get a drill and make a hole directly over the head's adjusting screw, which can be seen when putting the machine in play position. It is an easy process for the CTR-41; the hole can be drilled (gently) 1/8-inch above, and equally as wide as, the letters ERY (in the word "battery") on the CTR's face plate.

For general use with your own data tapes, align the head by using high-grade commercial audio recordings with plenty of cymbals. The audio industry has much better quality control than the personal computer houses, so avoid standardizing with anyone's digital tape. Use a small crosspoint screwdriver to adjust for the "brightest" playback sound from at least two different audio tapes; compromise between them if necessary, and keep these tapes as your references. Always CSAVE your programs using this alignment, readjusting the head as necessary only when loading program tapes. Don't forget to adjust the head back to your references, and re-dub problem tapes, if possible, with the proper alignment.

● **Spaed Variations:** This is a secret gremlin of bad loads. The signals pass by the TRS-80 latching circuits too soon or too late; a 5 percent variation can be deadly (see also CLOAD below). Have an electronics whiz adjust the speed for you, especially if you can detect any pitch difference between the tapes played on your machine and on a deck of known accuracy. Don't compare with commercial digital tapes; again, they may be wrong!

● **Bad Tapa:** This one is easy. Just listen to the tape using music or even computer data. Listen for dropouts (momentary loss of sound), skew (alternating bright and muffled sound), print-through (an echo—partial transfer of the signal to previous or subsequent layers of tape), poor oxide (general dullness of sound), and so on. You can't get good tape at cheap prices. My friend Danny Debug uses top-of-the-line TDK tape for his computer (but then I think Danny probably listens to data as background music. . .). If you're giving away or selling tapes, this is doubly important. If it's a marginal load on your machine, chances are it won't work at all on someone else's.

● **Dirty Head:** This cuts both the volume and the sharpness with which the signal rises and falls. If the cassette player's rubber puck is brownish, the head is probably dirty. Regularly clean the head and puck gently with swabs soaked in rubbing alcohol (don't use anything stronger), and do the erase head too.

● **Starting at 000:** Don't be so economical that you risk losing programs. Let some tape go by before starting to record. The first few inches of tape may have a bump created by the leader splice, causing dropout. Even so-called "leaderless" cassettes have a short leader attached to the take-up hub.

● **Magnetized Head:** This isn't a big problem, but heavy computer users may consider it. A slightly demagnetized head will erase the precious high frequency edge of the signal, encouraging a laggard rise in the waveform. Take care of it with an inexpensive head demagnetizer—but keep it away from your tapes!

● **CLOAD:** The authors of Level II apparently did not expect such, uh, cheap hardware to be employed by Radio Shack for a tape

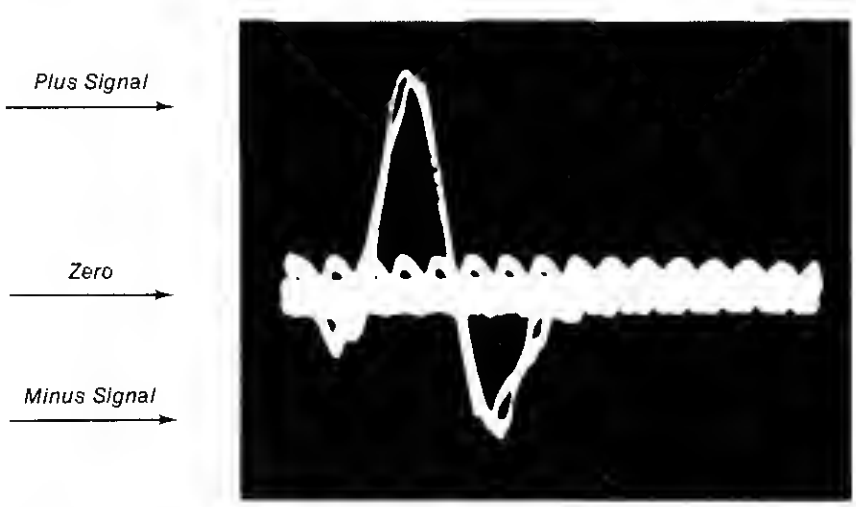

Photo 3. The signal produced during playback by a properly adjusted CTR-41 contains noise components and residual record bias frequency.

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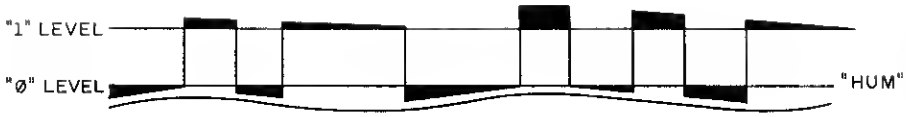


Fig. 1 Left. Exaggerated depiction of data pulses "riding" on the hum signal induced by ground loops between the TRS-80 and the cassette machine.

system. Thus, this digitally-oriented routine expects too much from any low-cost cassette system, checking for the one or zero bit too soon. Those of you with Level III BASIC (and some of the new Level II ROMs) will notice that tapes load easily without added hardware. Excluding such expansions to Level II, however, there's nothing you can do about this problem, except perhaps experiment with a tape player whose speed can be easily adjusted. Dictating recorders often have this feature.

The foremost cure for the wealthy are the disk or Stringy-Floppy systems, which avoid the need for cassettes in most cases. Nevertheless, you still have to buy some tape-only commercial software from time to time, so CLOAD improvement can remain important. If you are cassette-bound for the foreseeable future, devices such as the Data Dubber (sold by The Peripheral People), or E-Z Loader can successfully take the signal from the tape, clear out the hum and some noise, and carefully reshape the waveform into a digitally-digestible format for the 80. These add-ons can accept some wide variations in input, and still work successfully.

A product called Fastload, marketed by Personal Computer Products, is a modification to the cassette recorder, combined with a small amount of resident software. This creates a true digital recording process. It is quite reliable, and considerably faster than CLOAD. It is also fairly expensive.

There is also Radio Shack's XRX modification, in its various forms already an infamous cure, and one which can provide you with some mighty headaches. It's what is called a synchronous device, meaning it is pre-set to operate only at standard CLOAD speed. Forget about high-speed loaders, speed-increase modifications, and other improvements on the built-in, snail's-paced 500-baud cassette data rate. The XRX mod opens a window every 1/1000 of a second to check the signal, then shuts it tight before the noise and garbage gremlins can leap through and seriously affect the result. It works fine, superbly in fact, at 500 baud. Unfortunately, excellent software such as ABS Systems' remarkable 2250-baud B-17 loader was nearly destroyed by the introduction of the XRX mod. A talented staff at ABS cleverly got around the problem, but it's too bad that it was necessary in the first place. XRX also means that higher speed modifications to the CPU clock will not allow the cassette load to work at all.

A temporary bypass of XRX is possible if you want to dive into your TRS-80 (readers of my articles are well aware of a predilection for such activity). Open the machine and find the mod. It is an inch-square board mounted with tape, usually to the foil side of the main circuit board. Follow the wires

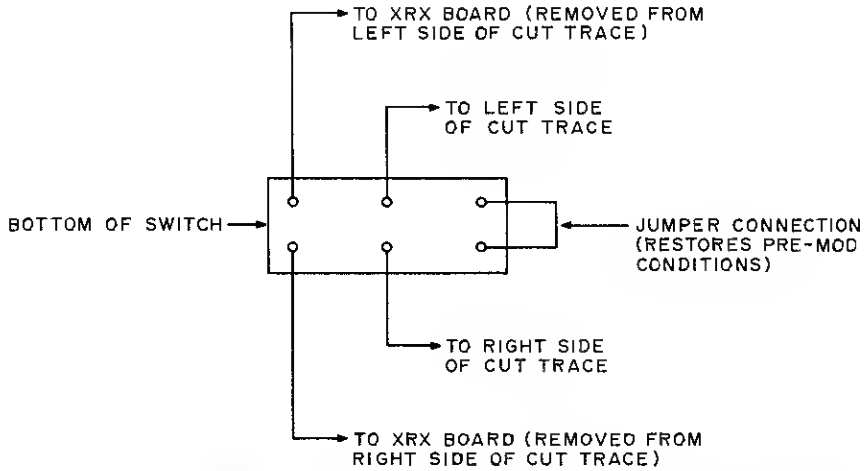


Fig. 2. Connections to temporarily bypass the XRX modification for use with high- or low-speed data I/O.

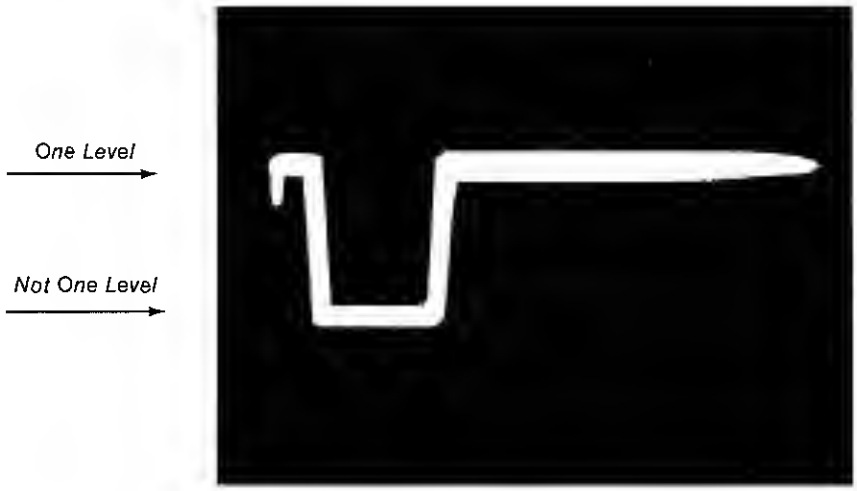


Photo 4. After filtering and re-shaping, the signal regains a digital appearance. The signal shown is inverted after initial processing.

the right side of the main board until you locate a trace which has been cut through, with a wire from the XRX board soldered to each side. Remove those two wires, remembering their locations, and solder a new pair of wires to the traces (use wire-wrap wire). Obtain a miniature double-pole, double-throw switch from your local Radio Shack, affix it to a convenient location, and attach the wires as shown in Fig. 2. In one position, XRX is active. In the other, it is out of the circuit, and special loaders and high-speed (or low-speed, if you are using the Mumford Microsystems SK board) modifications will function perfectly. ■

Photo 5. Speed fluctuations drive the syncing process to its limit. This signal was measured at the same point as in Photo 4.

You can gauge the value of your precious metals cache with this program.

After the Goldrush

Goldbugs gather 'round. Those of you who'd calculate the current values of your holdings of precious metals, hasten to your TRS-80s and load this program! Tarry not in your journey to the scales carrying your forks of silver and chains of gold. Rescue baubles long forgotten in the depths of jewelry boxes and feast your greedy eyes on the riches you've gathered.

Jerry Frost
3398 Sir Henry St.
East Point, GA 30344

Many of you will say, "But I don't have bags of silver or gold chains." You may surprise yourself when you find that Uncle Walter's Masonic ring or Grandpa's pocket watch has more than sentimental value. A close examination of silver coins left in your bureau, baby cups and cufflinks will tell if they are sterling, or 14K or 18K gold.

The accompanying program will store your inventory of gold and silver and produce an up to the minute account of these holdings compared to the daily spot prices in any of the world's precious metal markets—New York, London, Paris, Zurich, Hong Kong.

The market analysis section of the program will tell, at a glance, the percentage of gain or loss on your holdings, as gold and silver continue to climb.

Tipping the Scales

The first thing to do is to determine, as accurately as possible, the actual pure gold or silver content of that class ring or sterling teapot. Obviously, weighing them with a bathroom scale won't do unless, of course, you possess a hundred pounds or so of these precious metals.

The best solution is to use a jeweler's scale.

Since most of us don't have one you'll want to visit your local jeweler and, for a fee, have your cache weighed. If you have a postage scale at the office, you'll get a fairly accurate measurement in avoirdupois ounces.

Precious metals are currently weighed in troy ounces in the United States and Canada as a standard of measurement.

Simply multiply avoirdupois ounces by .9114583 to obtain the equivalent troy weight. For example, weigh a sterling silver spoon on a standard scale and observe a weight of 1.5 avoirdupois ounces. Multiplying 1.5 by .9114583 gives you a troy ounce weight of 1.367 ounces.

This is only a gross weight, not the actual pure silver content. All sterling silver has non-precious metals added to it as hardeners. Fineness, therefore, is defined as being that part of the metal alloy containing pure gold or silver. Sterling silver has 925 parts silver in 1000 parts alloy. You must now find the pure silver weight of the sterling spoon: Multiply .925 by the gross weight of 1.367 troy ounces. This yields 1.264 troy ounces of *pure* silver, expressed in what's called "1000 fine."

Pure gold is considered to be 24 karats. The relation of fineness to karats is also proportional. A 14K gold ring, for example, contains 583.3 parts gold in 1000 parts of alloy. An 18K ring would contain 750 parts gold in 1000 parts of alloy. Weigh the ring or any other gold item, then convert it to troy ounces and multiply by its fineness. Table 1 shows the conversion of karats to fineness. A warning: Do not weigh different karat items together; combine all 14K jewelry, all 18K, etc. and weigh them separately.

A magnifying glass will help you see the karat stamp on jewelry. Beware of any gold item stamped *G.P.* or *G.F.* This means the piece of jewelry is gold plated or filled. It is not a solid gold alloy. So, don't waste your time weighing these items.

Fineness

Both United States and foreign gold and silver coins contain various amounts of fineness. Table 2 lists the most common intrinsic domestic and foreign gold coins with

their pure troy ounce content. Multiply this weight by the number of coins you have.

U.S. silver coins minted through 1964 contain 90 percent silver. Clad fifty-cent pieces minted from 1965 through 1970 contain 40 percent silver. Coin dealers and precious metal buyers consider that a $1000 face value bag of circulated United States coins minted through 1964 contain about 720 troy ounces of silver, while a $1000 face value bag of circulated Kennedy silver clad half dollars minted from 1965 though 1970 contain about 295 troy ounces.

All United States coins (other than some proof sets minted for collectors) minted after 1970 are nothing more than copper clad coins with no silver content whatsoever!

Foreign coins are another source of silver. Some countries even stamp the purity and weight right on the coin. If you aren't sure, a trip to a local coin dealer or libary will tell if there is treasure in that hoard. An excellent coin catalog, *Standard Catalog of World Coins* is published by Krause Publishers, Iola, Wisconsin. You'll find a reference to your coin and its silver content in this catalog.

Inventory Program

Once the groundwork has been laid and all of your gold and silver holdings accurately measured, converted to troy ounces and their fineness determined, you're ready to enter inventory data statements in a program.

The program lists the following information: description, quantity, pure troy weight (in ounces) and original cost (or close estimate). Refer to Table 3 for examples and proper format. Make sure that the last statement in the inventory of precious metals data line always terminates with END.

The computer will have to determine whether your data is of gold or silver. To do this, precede the description and spot price dates with the marker # for gold and * for silver. Therefore lines 20010 and 30010 refer to gold, while lines 20020, 20030 and 30020 refer to silver. The marker will be stripped for all CRT displays and printouts.

Referring to line 20030, notice that if you include sterling knives they are listed separately from other silverware. This is because knife handles are usually hollow and filled with wax. The blade is often made of stainless steel. A good rule of thumb is to weight the knife and take two/fifths of the total weight as sterling content.

The quantity number 1 in line 20010 means that you gathered your 14 karat gold jewelry as a group, weighed it and came up with 1.75 total troy ounces. The eight knives in line 20030 were weighed separately, giving a weight of 1.20 troy ounces. The program takes the quantity eight and multiplies it by 1.20 for a total weight of 9.6 troy ounces. This is for the convenience of those who wish to list their gold and silver items separately.

Lines 30010 and 30020 keep tab on the daily market closing price. You can consult the business sections of most newspapers to obtain this data. Line 30010 shows, for example, that on January 21, 1980 gold closed at $850 an ounce, while line 30020 shows that on the same day, silver closed at $50 an ounce.

You can enter new data daily, weekly or monthly to keep up with the fluctuating bullion market, as compared to the latest spot metals price. Always terminate the last closing dates and spot prices line with END.

The program needs no explanation. The input commands are self-prompting. If you require hard copy (recommended) just change PRINTs to LPRINTs. Better yet, if you're using a disk system with NEWDOS (also recommended), simply hit the JKL keys simultaneously and you'll get a hard copy of the screen displays. If you require larger arrays, increase at line 800.

After creating your data statements, selecting menu item 4 will automatically re-SAVE the program (METALS/BAS) and data to disk. A sequential or random file method could be used, but I feel the method or re-SAVING is adequate for this data management without increasing the size and complexity of the program. Cassette users must change the SAVE "METALS/BAS" to CSAVE "METAL" in line 2200. It is good practice to keep a separate copy of your program in case of I/O errors.

Other Metals

You can incorporate other precious metals, platinum, for example, in the program. You may also want to keep track of the price of copper. That lowly penny in your pocket may someday be worth more for its intrinsic value than for its monetary value!

To include these or other metals in the program, first create additional menu lines between lines 1200 and 1500. Then edit lines 2900 and 4900, inserting new markers denoting the new metals. Any uppercase symbols such as % and ! will do. You'll have to add IF statements between lines 1900 and 2200. Edit line 2300. Be sure to precede all data lines with the new marker(s).

After the program is run, the first display produces an itemized inventory of your precious metal holdings. The MKT. VALUE

24	karats = 1000 fine	20	karats = 833.3 fine
23	karats = 958.3 fine	18	karats = 750. fine
22	karats = 916.6 fine	16	karats = 666.7 fine
21.6	karats = 900.0 fine	14	karats = 583.3 fine
21	krats = 875.00 fine	1	karat = 041.7 fine

Table 1

U.S. $20 gold piece	.9675
$10 gold piece	.4838
$5 gold piece	2419
$2.50 gold piece	.1209
$1.00 gold piece	.0483

Table 2

Russia 10 Rubles	.2489
Columbia 5 Pesos	.2354
England 1 Pound	.2354
Hungary 100 Koronas	.9802
S. Africa Krugerrand	1.0000
Austria 100 Koronas	.9802
20 Koronas	.1960
10 Koronas	.0980
4 Ducats	.4430
1 Ducat	.1107
Mexico 50 Pesos	1.2057
20 Pesos	.4823
10 Pesos	.2411
5 Pesos	.1205
2½ Pesos	.0603
2 Pesos	.482
France 20 Francs	.1867
Holland 10 Guilders	.1947
Belgium 20 Francs	1867
Italy 20 Lire	.1867
Switzerland 20 Francs	.1867

Table 2A

```
REM * INVENTORY OF PRECIOUS METALS *
20010 DATA #14K JEWELRY, 1, 1.75, 250
20020 DATA *STERLING SILVER, 1, 120, 680
20030 DATA *STERLING KNIVES, 8, 1.20, 75
20040 DATA END
```

Table 3

```
REM * CLOSING DATES & SPOT PRICES *
30010 DATA #01/21/80, 850
30020 DATA *01/21/80, 50
30030 DATA END
```

Table 3A

(market value) column tells, at a glance, its current value. The COST column refers to your original investment. The CHANGE column gives the percentage of difference between the current market value and the initial cost. The automatic scrolling feature of the program allows you to pause between displays.

The next display contains the current total dollar value of your investment, compared to the original value. These holdings are represented in pure 1000 fine troy ounces.

The final display is an up to the minute market analysis showing past closing dates and closing spot prices, and the percentage of change from the current spot price of the metal in question.

This analysis allows you to keep up with the volatile activity in the precious metals exchange and to record its history. The automatic scrolling pauses between these displays.

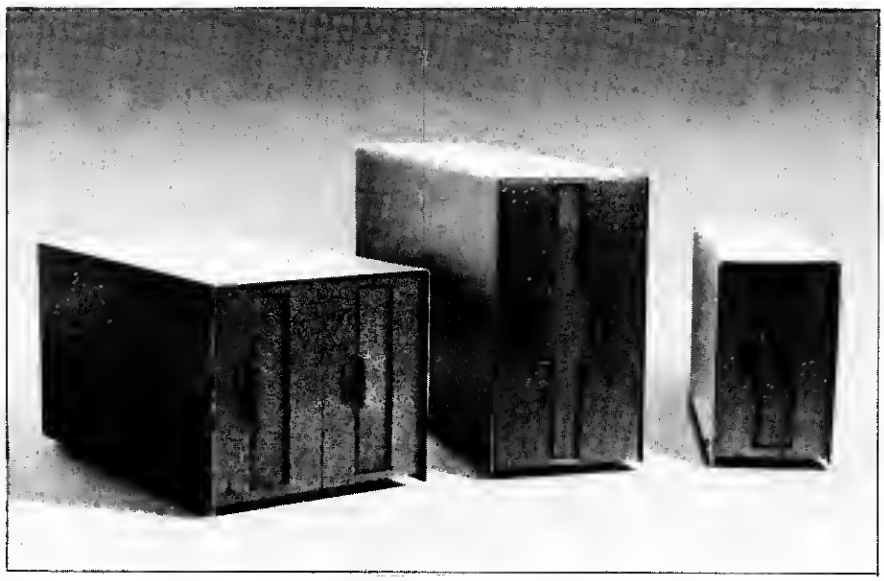
Another addition to the program will help determine the pure troy ounce content of your holdings. Although troy ounces are used, you may refer to Table 4 and convert most common weights to troy ounces. United States silver coins don't have to be weighed because the program will do it for you. Enter the face value and its percentage (90 percent or 40 percent) of silver.

Now delete the example data lines, 20010 through 30090, and add your own. Run the program and see how "loaded" you are. ■

1 troy ounce	= 31.1033 grams
1 troy ounce	= 480 grains
1 troy ounce	= 20 pennyweight (DWT)
12 troy ounces	= 1 pound troy
14.5833 troy ounces	= 1 pound avoirdupois
0.9114 troy ounces	= ounce avoirdupois
32.15 troy ounces	= 1 kilogram
1 gram	= 5.3 karats (roman)
1 gram	= 15.432 grains
1 gram	= 0.643 pennyweight (DWT)
1.5552 grams	= 1 pennyweight (DWT)
1,000 grams	= 1 kilogram
28.3495 grams	= 1 ounce avoirdupois
24 grains	= 1 pennyweight (DWT)
5,760 grains	= 1 pound troy
15,432 grains	= 1 kilogram
437.5 grains	= 1 ounce avoirdupois
7,000 grains	= 1 pound avoirdupois
1 grain	= 0.0648 grams
240 pennyweight (DWT)	= 1 pound troy
643.01 pennyweight (DWT)	= 1 kilogram
18.2291 pennyweight	= ounce avoirdupois
291.666 pennyweight (DWT)	= 1 pound avoirdupois
1 kilogram	= 2.68 pounds troy
1 kilogram	= 35.274 ounces avoirdupois
1 kilogram	= 2.2046 pounds avoirdupois

Table 4

```
700 CLEAR1000
800 DIM M$(50),Q(50),F(50)
900 CLS
1000 PRINT:PRINT:PRINT:PRINTTAB(25)"* MENU *
1100 PRINT:PRINT
1200 PRINTTAB(15)"1 - GOLD MARKET ANALYSIS"
1300 PRINTTAB(15)"2 - SILVER MARKET ANALYSIS"
1400 PRINTTAB(15)"3 - TROY OUNCE WEIGHT CALCULATION"
1500 PRINTTAB(15)"4 - WRITE NEW DATA STATEMENTS TO DISK
     "
1600 N$=INKEY$:IFN$=""GOTO1600
1700 N=VAL(N$)
1800 CLS
1900 IF N=1THENGS$="GOLD"
2000 IF N=2THENGS$="SILVER"
2100 IF N=3THEN7200
2200 IF N=4 THEN PRINT@590,"";:INPUT"HIT <ENTER> TO SAV
     E NEW DATA";X$:PRINT@580,"NOW RE-WRITING PROGRAM A
     ND ADDING NEW DATA TO DISK":SAVE"METALS/BAS":RUN
2300 IFN<1ORN>3THEN900
2400 PRINTTAB(25)GS$;" ANALYSIS"
2500 PRINTTAB(20)STRING$(23,131)
2600 PRINT:PRINT
2700 PRINT"<ENTER> current spot * ";GS$;:INPUT" * price
      per troy ounce ";P
2800 PRINT
2900 IFN=1THENR$="*"ELSEIFN=2THENR$="#": REM * SET DATA
      MARKER *
3000 INPUT"<ENTER> TODAY'S DATE (MM/DD/YY) ";D$
3100 FORX=1TO50
3200 READ M$(X)
3300 IF M$(X)="END"THENX=X-1:Z=X:GOTO3700
3400 READ Q(X),F(X),C(X)
3500 IFLEFT$(M$(X),1)=R$THENX=X-1: REM * READ DATA MARK
     ER *
3600 NEXTX
3700 FORX=1TOZ:MV(X)=P*F(X)*Q(X):MV=MV+MV(X):C=C+C(X):Q
     =Q+Q(X):F=F+F(X)*Q(X)
3800 NEXTX
3900 CLS
4000 GOSUB 6300:GOTO4100
4100 FORX=1TOZ
4200 PRINTUSING"###";Q(X);:PRINTTAB(6)RIGHT$(M$(X),LEN(
     M$(X))-1);:PRINTTAB(31)USING"##,###.##";MV(X);:PRI
     NTTAB(42)USING"##,###.##";C(X);:PRINTTAB(54)USING"
     +####.#";((MV(X)-C(X))/C(X)*100);:PRINT" %"
4300 ZZ=ZZ+1:IFZZ=10THENZZ=0:PRINTSTRING$(63,45):GOSUB6
     200:IFX=ZGOTO4700ELSEGOSUB6300
4400 NEXT
4500 GOSUB6200
4600 PRINTSTRING$(8,32):PRINTSTRING$(63,45)
4700 PRINTTAB(8)"current Market Value = $";:PRINTUSING"
     ##,###.##";MV
4800 PRINTTAB(9)"Original INVESTMENT = $";:PRINTUSING"#
     #,###.##";C
4900 IFN=1THENR$="*"ELSEIFN=2THENR$="#": REM * SET DATA
      MARKER *
5000 PRINT:PRINTTAB(10)"REPRESENTING ";:PRINTUSING"###.
     ##";F;:PRINT" Troy ounces of 1000 fine ";GS$
5100 PRINTSTRING$(63,45)
5200 GOSUB6200:GOSUB7000:ZZ=0:GOTO5300
5300 FORX=1TO50:READD$(X)
5400 IFD$(X)="END"THENZ=X:GOTO5800
5500 READSP(X)
5600 IFLEFT$(D$(X),1)=R$THENX=X-1: REM * READ DATA MARK
     ER *
5700 NEXTX
5800 Z=Z-1:FORX=1TOZ:PRINTRIGHT$(D$(X),LEN(D$(X))-1),:P
     RINTUSING"#,###.##";SP(X);:PRINT,USING"+###.##";((
     P-SP(X))/SP(X)*100);:PRINT" %"
5900 ZZ=ZZ+1:IFZZ=10THENPRINTSTRING$(63,45):ZZ=0:GOSUB6
     200:IFX=ZGOTO6100
6000 NEXTX
6100 PRINT@980,"PRESS <ENTER> RETURN TO MENU";:LINEINPU
     TA$:RUN
6200 PRINT@980,"PRESS <ENTER> TO CONTINUE";:LINEINPUTA$
     :CLS:RETURN
```



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```
6300 PRINTD$;TAB(20)GS$" PORTFOLIO";TAB(46)"SPOT = $";:
     PRINTUSING"#,###.##";P
6400 PRINTTAB(15)STRING$(25,61)
6500 PRINT
6600 PRINTSTRING$(63,45)
6700 PRINT"QTY";TAB(10)"dESCRIPTION";TAB(32)"MKT. VALUE
     ";TAB(46)"COST";TAB(55)"CHANGE"
6800 PRINTSTRING$(63,45)
6900 RETURN
7000 PRINTD$;TAB(15)GS$" MARKET ANALYSIS";TAB(46)"SPOT
     = $";:PRINTUSING"#,###.##";P:PRINTTAB(15)STRING$(2
     3,61):PRINT:PRINTSTRING$(63,45):PRINT"CLOSE DATE";
     TAB(19)"SPOT";TAB(34)"CHANGE TO DATE":PRINTSTRING$
     (63,45)
7100 RETURN
7200 '         * GOLD & SILVER TROY OUNCE WEIGHT *
7300 CLS
7400 PRINTTAB(25)"* MENU *"
7500 PRINT:PRINT
7600 PRINTTAB(15)"1 - GOLD CALCULATION"
7700 PRINTTAB(15)"2 - SILVER CALCULATION"
7800 N$=INKEY$:IFN$=""GOTO7800
7900 CLS
8000 N=VAL(N$)
8100 IFN=2GOTO10000
8200 CLS
8300 PRINTTAB(15)"GOLD CONVERSION TABLE"
8400 PRINTTAB(15)STRING$(21,45)
8500 PRINT:PRINT
8600 INPUT"<ENTER> KARAT WEIGHT OF GOLD ITEM "; K
8700 K=.041666667*K
8800 PRINT:PRINT
8900 INPUT"<ENTER> WEIGHT SYSTEM:   1 - AVOIRDUPOIS
       2 - TROY "; AT
9000 IF AT<1ORAT>2GOTO8900
9100 IF AT=1AT=.9114583ELSEAT=1
9200 PRINT
9300 INPUT"<ENTER> WEIGHT OF GOLD ITEM (OUNCES) "; W
9400 W=W*K*AT
9500 PRINT
9600 PRINTSTRING$(46,45)
9700 PRINT"ITEM CONTAINS";:PRINTUSING"##.###";W;:PRINT"
      TROY OUNCE(S) OF PURE GOLD."
9800 PRINTSTRING$(46,45)
9900 GOSUB6100
10000 PRINTTAB(15)"SILVER CONVERSION TABLE"
10100 PRINTTAB(15)STRING$(23,45)
10200 PRINT
10300 PRINT"<ENTER>   1 - STERLING SILVER    2 - U.S. C
     OINS"
10400 N$=INKEY$:IFN$=""GOTO10400
10500 PRINT@192,STRING$(63,32)
10600 N=VAL(N$)
10700 IFN<1ORN>2GOTO10300
10800 IF N=1N=.925:GOTO12600: REM * .925 = STERLING FIN
     ENESS *
10900 PRINT
11000 PRINTTAB(10)"1 - 90% PRE-1965 U.S. SILVER COINS"
11100 PRINT
11200 PRINTTAB(10)"2 - 40% 1965-1970 KENNEDY SILVER CLA
     D HALVES"
11300 X$=INKEY$:IFX$=""GOTO11300
11400 X=VAL(X$)
11500 IFX<1ORX>2GOTO11000
11600 IFX=1X=.72: REM * 90% SILVER WEIGHT PER $1 FACE V
     ALUE *
11700 IFX=2X=.295: REM * 40% SILVER WEIGHT PER $1 FACE
     VALUE *
11800 PRINT
11900 INPUT"<ENTER>   FACE VALUE OF U.S. COINS ";FV
12000 FV=FV*X
12100 PRINT
12200 PRINTSTRING$(57,45)
12300 PRINT"U.S. COINS CONTAIN ";:PRINTUSING"#,###.###"
     ;FV;:PRINT" TROY OUNCE(S) OF PURE SILVER."
```

Program continues

```
12400 PRINTSTRING$(57,45)
12500 GOSUB6100
12600 PRINT
12700 INPUT"<ENTER> WEIGHT SYSTEM:   1 - AVOIRDUPOIS
        2 - TROY "; AT
12800 IF AT<1ORAT>2GOTO12700
12900 IF AT=1AT=.9114583ELSEAT=1
13000 PRINT:PRINT
13100 INPUT"<ENTER> WEIGHT OF STERLING ITEM (OUNCES) ";
      W
13200 W=W*N*AT
13300 PRINT:PRINT
13400 PRINTSTRING$(59,45)
13500 PRINT"STERLING ITEM CONTAINS ";:PRINTUSING"#,###.
     ###";W;:PRINT" TROY OUNCES OF PURE SILVER."
13600 PRINTSTRING$(59,45)
13700 GOSUB6100
13800 END
```

Program Listing 1


```
20000 REM * EXAMPLE INVENTORY DATA LINES *
20010 DATA #14K JEWELRY, 1, 1.75, 250.00
20020 DATA *STERLING SILVER, 1, 120, 680.00
20030 DATA *STERLING KNIVES, 8, 1.20, 75.00
20040 DATA #$20 U.S. GOLD PIECE, 1, .9675, 325.00
20050 DATA *$40 FACE 90% U.S. COINS, 40, .720, 624.00
20060 DATA *$75 FACE 40% U.S. COINS, 75, .295, 400.00
20070 DATA #18K NECKLACE, 1, .475, 548.00
20080 DATA END
20090 '

30000 REM * EXAMPLE CLOSING DATE & SPOT PRICE DATA LINE
      S *
30010 DATA #01/21/80, 850.00
30020 DATA *01/21/80, 50.00
30030 DATA #01/22/80, 682.00
30040 DATA #01/30/80, 690.00
30050 DATA *01/30/80, 34.00
30060 DATA *04/02/80, 14.60
30070 DATA #04/02/80, 493.00
30080 DATA END
30090 ' END OF LISTING
```

Example 1

GAMBIET '80

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WARNING: not for beginning Dunjonquest players! If you are new to these fascinating games, start out with "Temple of Apshai", "Morloc's Tower" or "Datestones of Ryn".

	Tape	Disk
HELLFIRE WARRIOR	$24.95	$29.95
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DATESTONES OF RYN	$14.95	$19.95

GALAXY INVASION

By Bill Hague from Big-Five
"The rage of the arcades" is now available for TRS-80! Exciting sound effects add to the action as the invaders swoop down to destroy your base. Even while you have your hands full battling the aliens, you have to watch out for the Flagship! Super graphics, super action, super fun!

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DUEL «N» DROIDS

By Leo Christopherson from Acorn
Your 'droid has already learned NIM, so now it's time to teach it how to wield a laser sword! Leo Christopherson, author of "Android NIM," "Dancing Demon" and other animations, has developed a new type of animation and high-quality sound in his latest work.

Your 'droid starts out as a lowly clown. You teach it how to use a laser sword by controlling its movements. After training it to be a "Grand Master," you enter the tournament against the program's skilled 'droid! Entertainment for all ages.

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TRS-80 Level II 16K unless otherwise noted

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For the serious war gamer, these three World War II strategic simulations offer incredible historical accuracy. Take command of the U.S. and Allied armies, try various approaches to specific WWII battles. Would you have faired better than the actual result -- or worse?
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The wait is over! If 3-D graphics seem impossible on the low resolution TRS-80, you haven't seen this brilliant program. During FLIGHT SIMULATION, you instantly select instrument flight, radar, or a breathtaking pilot's-eye-view. But be sure to strap yourself in -- you're liable to get dizzy!

Once you put in some air time learning to fly your TRS-80, head for enemy territory and try to bomb the fuel depot and airstrip while fighting off five enemy warplanes. Good Luck!

Level I or II Tape...$25.00

INVADERS FROM SPACE

By Carl Miller from Acorn
A new and faster machine language approach to this classic (and addictive) space game. As you play, the aliens are dropping bombs, moving from side to side, and trying to overrun your bases. You try to by shooting at them, and your score grows larger with each hit. But, just as you think you've got the invaders under control, they speed up their action.

INVADERS FROM SPACE offers variable game speed, enemy bomb frequency and accuracy, number of shots on screen and number of your bases. Move your base and simultaneously fire at the invaders -- which you cannot do in most other similar games. Full sound effects, incredible speed and action!

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ELECTRONIC BASKETBALL HANDICAPPER

By Sothen, Laurence & Gavenda from Acorn
Basketball is the first of the Electronic Handicapper Series from Acorn. It will introduce you to the benefits of predicting the winners of this season's basketball games. This two-tape package gives you power ratings to get you started, then you keep the the data tape informed of game scores as they are played. The program will calculate a projected winner and point spread, based on available data. Last season Handicapper was able to predict 85% of the winners, with 64% point spread accuracy. Requires only 16K.

On Tape...$99.00

Z80ZAP

From Org-Tex
New machine language disk access/modification program. With Z80ZAP, you will be able to...
...Read, Display and Modify disk sectors ...Remove Passwords from any disk file ...Zero Out any disk sector ...Recover killed or lost disk files ...Compare disk sectors, byte-by-byte ...Find any designated byte in a disk sector ...Apply patches, fixes, etc.

Z80ZAP automatically calculates the Hash Index Code for any file and tells you exactly how to use it when recovering killed files. The flashing cursor acts as a pointer to the byte on which you are working plus its ASCII equivalent, making direct disk editing considerably easier. Designed to outperform SUPERZAP in speed and capabilities, Z80ZAP is a "must" for disk drive owners.

On Disk.....$29.95

BOSS

By V. Hester from Soft Sector
This utility is the perfect tool for creating and debugging Basic programs. It allows single stepping through the Basic program, setting up to five breakpoints within the program and tracing of program logic using only a small portion of the display screen. With BOSS, you can review selected variables during program execution and return to the program with the display restored. Allows storing programs in high memory for later retrieval. For Level II, TRSDOS, NEWDOS+, NEWDOS/80, VTOS.

On Tape...$29.95

DISASSEMBLER

By Roy Soltoff from Misosys & Acorn
A two-pass disassembler for TRS-80 that converts machine code to Z-80 assembly language listings. DISASSEMBLER produces symbolic labels with output to video, printer or tape. Radio Shack's Editor/Assembler will read and load the tapes for easy modification and reassembly. Extend the capabilities of Editor/Assembler with this utility. On tape for two different memory locations.

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Reader Service—see page 242

Kill those Bugs fast with. . .

ZBUG. . . Super DEBUG Monitor

Lt. John B. Harrell
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Saratoga Springs, NY 12866

Anyone who programs in assembly or machine language debugs his code with some sort of monitor. When I ordered my system a year ago, I anxiously awaited the arrival of my 16K Level II computer, the Editor-Assembler, and T-BUG monitor. I found that the monitor performs adequately, supplying a basic tool at machine level.

Its major drawback is that it is written to support users of a 4K system. Thus, it suffers many limitations. This prompted me to write a monitor aimed at a system built on the 16K Level II computer with cassette input/output.

T-BUG Drawbacks

The T-BUG monitor provides nine one-character commands, many with serious drawbacks. For example, the memory modify/display (M) command has the option of seeing and changing memory with a one-byte keyhole, only in hexadecimal. The register display (R) command also displays registers with no labeling, and the user must remember a table of memory addresses to modify any register contents. The fix breakpoint (F) command can be catastrophic; when you use it, the contents of the address in the user PC to PC+2 are replaced with whatever is in the breakpoint save area; no checking is performed to see if a breakpoint is actually set at these addresses prior to the change.

The ZBUG Super DEBUG Monitor has the following features:

- Twenty-three single key commands.
- A full video screen display of the complete status of your computer, at a single glance.
- The ability to locate a single byte or a single address (two bytes) in any specified block of memory.
- Ability to set up to seven breakpoints, which will remain set until cleared. All breakpoints are one byte in length to prevent problems with overlapping code.
- Breakpoint clearing selectively by use of the fix breakpoint command or clearing all at once.
- Memory display in eight lines of 16 bytes beginning at a user-selected address in either hexadecimal or alphanumeric/graphics format. Memory paging in 128-byte blocks starting at any address using a single key.
- Conversion of decimal numbers to a two-byte hexadecimal display and back for easy reference to addresses, etc.
- Loading and writing of cassette tapes easily into the SYSTEM loader format. (Who ever heard of "punching" a cassette tape?)
- Easy change of contents to any eight or 16-bit register by using its symbolic name.
- Ability to move blocks of memory or fill memory with any byte between specified addresses.
- Ability to modify memory starting at any address, using a moving cursor that shows where you change.
- Exchange primary and secondary eight-bit registers.
- Read a SYSTEM format tape and perform checksums on each record. When finished reading, display the record number, length, and the hexadecimal load address of each in the file.

```
                          SUPER BUG MONITOR
REGISTERS      ADDR   MEMORY CONTENTS          MODE = HEX
AF'  11  FF    0000   F3 AF C3 74 06 C3 00 40   C3 00 40 E1 E9 C3 9F 06
BC'  22  33    0010   C3 03 40 C5 06 01 18 2E   C3 06 40 C5 06 02 18 26
DE'  55  00    0020   C3 09 40 C5 06 04 18 1E   C3 0C 40 11 15 40 18 E3
HL'  66  77    0030   C3 0F 40 11 1D 40 18 E3   C3 12 40 11 25 40 18 DB
               0040   C3 D9 05 C9 00 00 C3 C2   03 CD 2B 00 B7 C0 18 F9
AF   AA  93    0050   0D 0D 1F 1F 01 01 5B 1B   0A 00 08 18 09 19 20 20
BC   BB  CC    0060   0B 78 B1 20 FB C9 31 00   06 3A EC 37 3C FE 02 D2
DE   DD  EE    0070   00 00 C3 CC 06 11 80 40   21 F7 18 01 27 00 ED B0
HL   FF  00
               (PC)   F3 AF C3 74 06 C3 00 40   C3 00 40 E1 E9 C3 9F 06
IX   FACE      FLAGS SET   F=S--H--NC   F'=SZXHXVNC
IY   DEAD      BREAKPOINTS-XXXX XXXX XXXX XXXX XXXX XXXX XXXX
SP   C000      COMMAND:
PC   0000
```

Table 1. Video Display

- Copy any SYSTEM format tape within the capacity of your configuration.
- Lastly, although this monitor is approximately 3000 bytes and 1600 source statements, I have segmented the source code into four modules, each easily assembled on a 16K Level II computer. Each is relocatable to suit user preference and system size.

Creating Your ZBUG Monitor

Using your Editor/Assembler, enter the source code modules in Program Listing 1. When entered, assembled and checked for errors (E/A command A/WE/NS/NO), save the source module on tape. Then assemble and save the object code on tape. Repeat this for each of the four source code modules. When all four have been assembled and written to tape, use the SYSTEM command to load each object module. When the last module is entered, execute the ZBUG monitor by typing / ENTER. The video display should now resemble the display shown in Table 1. Use the ZBUG write command (WRITE 4300 4F1B 4338 ZBUG ENTER) to write the entire object program on tape as one file under the name ZBUG.

CHAR	FORMAT
A	FIND ADDR SSSS EEEE AAAA (ENTER)
B	BRKPT AAAA (ENTER)
C	CLEAR (ENTER)
D	DISPLAY AAAA (ENTER)
F	FIXBKP (ENTER)
G	GO (ENTER)
H	HEX AAAA = DDDDD (ENTER), (ENTER) clears the command line
I	INT DDDDD = AAAA (ENTER), (ENTER) clears the command line
J	JUMP AAAA (ENTER)
L	LOAD (ENTER)
M	MOVE SSSS EEEE AAAA (ENTER)
Q	FIND BYTE SSSS EEEE BB
R	REG Z:BB (ENTER) or REG ZZ:AAAA (ENTER)
S	SET AAAA BB. . . BB (BREAK)
W	WRITE SSSS EEEE AAAA PGNAME (ENTER)
X	XREGS (ENTER)
Z	ZAP SSSS EEEE BB
'	COPY (ENTER)
.	CAT (ENTER)
@	immediate command—toggle display mode
*	immediate command—return to BASIC
↑	immediate command—scroll display down
↓	immediate command—scroll display up

Table 2. Command Format

Using The ZBUG Monitor

After loading the monitor, ZBUG will accept the 23 single-key commands in Table 2.

Let's take a detailed look at the program's special features and commands. This monitor uses a one-byte breakpoint, the code for an RST 28 (EFH). If you examine the ROM code starting at 0028H, it contains the code for a JP 400CH (C3 0C 40). During normal Level II operation, address 400CH contains a RET (C9H) instruction. This is the vector jump-out area used by the keyboard scan routines for the BREAK key. The initial entry to the ZBUG monitor patches this area. This is to transfer control to the location in part one of the program (in Listing 1) labeled RST28, every time the computer executes any RST 28H code. ZBUG examines the return address saved on the stack, and if the call comes from the ROM chip (addresses in the range of 0000H to 2FFFH), it is assumed to be for the BREAK key being pressed. If not, it is handled as a breakpoint call to the monitor.

Commands

FIND ADDR: The FIND ADDR command searches the block of memory from the starting to ending address for each occurrence of the two-byte address specified. Every time a match is found, the 128 bytes of memory starting with the match address are displayed. The computer pauses, waiting for any key to be pressed. If the BREAK key is pressed, control is returned to the command loop with the video display as is. Any other key restarts the search. When all matches have been found, the display is reset to the original address prior to the command. Control is returned to the command loop.

BRKPT: The BRKPT command searches the breakpoint address table (BRKAD) for an empty entry (contains 0s). If one is found, the specified address is saved as the breakpoint address and the byte at that address is saved in the corresponding entry in the breakpoint save data table (BRKSV). The contents of the specified address are then set to the RST 28H code (EFH) for a breakpoint call to the monitor.

CLEAR: The CLEAR command takes each non-zero entry in the breakpoint address table and repairs the code at that address with the one byte in the corresponding entry in the BRKSV table. The entry in BRKAD is then zeroed. When all table entries have been examined, control is returned to the command loop.

DISPLAY: The DISPLAY command sets the display pointer to the address specified and returns control to the command loop. This causes the screen to be rewritten, displaying memory in the 128-byte block starting with the address entered. The memory display is in the mode controlled by MODEFL. In the alphanumeric/graphics mode, no attempt is made to massage the byte value of the character to display. Characters with a value of less than 32 decimal are displayed however the character generator decodes them. Those with values in the range of 32 to 127 decimal are displayed as the appropriate ASCII equivalent (except that lowercase is displayed as uppercase on an unmodified TRS-80). Characters having a value in the range of 128 to 255 decimal are displayed as graphics characters.

FIXBKP: The FIXBKP command uses the contents of the user PC register as a search argument in the BRKAD table. If a match is found in the table, the code at that address is repaired with the one-byte entry in the corresponding location in the BRKSV table. The entry in the BRKAD table is zeroed. Control is returned to the command loop.

GO: The GO command loads all the Z-80 registers from the corresponding entry in the user register table. It pushes the value of the user PC register on the stack and returns control to the user by executing a RET instruction. Because the user stack pointer is initially cleared to zero, it is necessary to use the REG command to intialize the SP prior to executing a program.

HEX: The HEX command converts the two-byte hexadecimal value entered to an integer value in the range of 0 to 65535 decimal. BASIC ROM routines process the number in single precision floating point. This avoids problems in handling the leading sign bit.

INT: The INT command takes the one to five decimal digit integer value entered and converts it to a two-byte hexadecimal form and displays it on the command line. The decimal integer must be terminated with an = to force the conversion. Again, floating point arithmetic is used to develop the hexadecimal number.

JUMP: The JUMP command sets the user PC to the entered address. Then it executes a GO command.

LOAD: The LOAD command loads the next SYSTEM format file from the cassette. The program is checked for errors by performing a checksum on every record loaded. The name of the file being loaded is displayed in the upper right hand corner of the video screen. The transfer address is saved in the user PC register for future execution. Refer to Table 3 for the format of SYSTEM tapes.

MOVE: The MOVE command moves the block of memory specified to the target address.

FIND BYTE: The FIND BYTE command searches the specified block of memory for each occurrence of the byte specified. This command works like

Continues to page 143

Program Listing 1. ZBUG Source Code

```
                00006 ;COMMANDS:
                00007 ;1. <A> - "FIND ADDR" START END ADDR <CR>
                00008 ;2. <B> - "BRKPT" ADDR <CR>
                00009 ;3. <C> - "CLEAR" <CR> CLEAR ALL BREAKPOINTS
                00010 ;4. <D> - "DISPLAY" ADDR <CR>
                00011 ;5. <F> - "FIXBKP" <CR> FIX BREAKPOINT AT (PC)
                00012 ;6. <G> - "GO" <CR> EXECUTE STARTING AT (PC)
                00013 ;7. <H> - "HEX" NNNN   DISPLAY HEX CONVERTED TO INTEGER
                00014 ;8. <I> - "INT" DDDDD=  DISPLAY HEX EQUIVALENT
                00015 ;9. <J> - "JUMP" ADDR <CR>   START EXECUTION AT ADDR
                00016 ;10.<L> - "LOAD" <CR>  LOAD TAPE IN "SYSTEM" FORMAT
                00017 ;11.<M> - "MOVE" START END NEW <CR>
                00018 ;12.<Q> - "FIND BYTE" START END BB <CR>
                00019 ;13.<R> - "REG" Z:BB <CR>  Z=A,B,C,D,E,F,H,L OR PRIMES
                00020 ;         "REG" ZZ:BBBB <CR> ZZ=IX,IY,SP,PC
                00021 ;14.<S> - "SET" ADDR    CHANGE MEMORY AT ADDR, ENTER
                00022 ;               BYTES UNTIL DONE AND HIT <BREAK>
                00023 ;15.<W> - "WRITE" START END ENTRY NAME <CR> WRITE SYSTEM
                00024 ;               TAPE IN PROPER FORMAT
                00025 ;16.<X> - "XREGS" <CR>  EXCHANGE PRIMARY & SECONDARY REGS
                00026 ;17.<Z> - "ZAP" START END BB <CR>   FILL MEM WITH BB
                00027 ;18.<,> - "COPY" <CR>   COPY SYSTEM TAPE. CHECKSUMS
                00028 ;               EACH RECORD FOR GOOD LOAD.  LOAD STARTS
                00029 ;               AT 5000H AND CONTINUES TO END OF MEM
                00030 ;19.<.> - "CAT" <CR>  READ AND CHECKSUM A SYSTEM TAPE
                00031 ;               DISPLAYS RECORD NR, LENGTH, LOAD ADDR.
                00032 ;               DISPLAYS ENTRY POINT AT END.
                00033 ;20.<@> - TOGGLE DISPLAY MODE BETWEEN HEX AND CHARACTER
                00034 ;21.<*> - EXIT TO BASIC WITH A CLEAR SCREEN
                00035 ;22.<UP ARROW>   - SCROLL MEMORY DISPLAY - 128 BYTES
                00036 ;23.<DOWN ARROW> - SCROLL MEMORY DISPLAY + 128 BYTES
                00037
                00038
4300            00039 ORGN    DEFL    4300H
0000            00040 RL      DEFL    ORGN-4300H
                00041
4300            00042         ORG     ORGN
4300 ED73624D   00043 RENTRY   LD      (SPSAVE),SP     ;SAVE STACK POINTER
4304 31624D     00044         LD      SP,SPSAVE       ;SET UP REG SAVE FOR USER
4307 FDE5       00045         PUSH    IY
4309 DDE5       00046         PUSH    IX
430B E5         00047         PUSH    HL
430C D5         00048         PUSH    DE
430D C5         00049         PUSH    BC
430E F5         00050         PUSH    AF
430F 08         00051         EX      AF,AF'
4310 D9         00052         EXX
4311 E5         00053         PUSH    HL
4312 D5         00054         PUSH    DE
4313 C5         00055         PUSH    BC
4314 F5         00056         PUSH    AF
4315 ED7B624D   00057         LD      SP,(SPSAVE)     ;USER SP
4319 E1         00058         POP     HL              ;GET RETURN ADDRESS
431A ED73624D   00059         LD      (SPSAVE),SP
431E 310043     00060         LD      SP,RENTRY       ;SET ZBUG SP
4321 2B         00061         DEC     HL              ;GET ADDRESS OF ZBUG CALL
4322 22644D     00062         LD      (PCSAVE),HL



4325 1837       00063         JR      MNLOOP          ;DISPLAY INFO
                00064
                00065 ;       RST28 CODE FOR BREAKPOINT OR BREAK
                00066
4327 E3         00067 RST28   EX      (SP),HL         ;SAVE HL - GET RET ADDR
4328 F5         00068         PUSH    AF              ;SAVE A AND FLAGS
4329 7C         00069         LD      A,H
432A D630       00070         SUB     30H             ;RST 28 FROM ROM - BREAK
432C FA3343     00071         JP      M,BREAK
432F F1         00072         POP     AF              ;RESTORE AF
4330 E3         00073         EX      (SP),HL         ;RESTORE HL, RETURN ADDR
4331 18CD       00074         JR      RENTRY          ;BREAKPOINT
4333 310043     00075 BREAK   LD      SP,RENTRY       ;RESET SP
4336 1826       00076         JR      MNLOOP          ;BREAK
                00077
                00078 ;       INITIAL ENTRY INTO ZBUG
                00079
4338 310043     00080 ENTRY   LD      SP,RENTRY
433B 1600       00081         LD      D,0
433D 21384D     00082         LD      HL,BRKAD
4340 010E00     00083         LD      BC,14
4343 CD674C     00084         CALL    FILL            ;CLEAR ALL BREAKPOINTS
4346 214E4D     00085         LD      HL,REGSTG
4349 011800     00086         LD      BC,24
434C CD674C     00087         CALL    FILL            ;CLEAR ALL USER REGISTERS
434F AF         00088         XOR     A
4350 324D4D     00089         LD      (MODEFL),A      ;SET HEX DISPLAY
4353 3EC3       00090         LD      A,0C3H
4355 320C40     00091         LD      (400CH),A       ;SET (400CH)= JP RST28
4358 212743     00092         LD      HL,RST28
435B 220D40     00093         LD      (400DH),HL
                00094
                00095 ;       MAIN COMMAND LOOP
                00096
435E CDC64A     00097 MNLOOP  CALL    LDSCRN          ;DISPLAY STATUS
4361 11943F     00098         LD      DE,VIDEO+916
4364 ED532040   00099         LD      (CURSOR),DE
4368 CD4900     00100         CALL    GETCH           ;GET CHARACTER
436B 217E4D     00101         LD      HL,CMDTAB+SIZE-1
436E 011700     00102         LD      BC,SIZE
4371 EDB9       00103         CPDR                    ;SEARCH FOR CMD IN TABLE
4373 2818       00104         JR      Z,MNLP1         ;MATCH FOUND
```

Program continues

```
                00105
4375 11CA3F     00106 MNERR   LD      DE,VIDEO+970
4378 21AD4D     00107         LD      HL,EMSG         ;*INPUT ERROR*
437B 010D00     00108         LD      BC,13
437E EDB0       00109         LDIR                    ;MESSAGE TO SCREEN
4380 1620       00110         LD      D,BLANK
4382 21933F     00111         LD      HL,VIDEO+915
4385 012B00     00112         LD      BC,43
4388 CD674C     00113         CALL    FILL            ;CLEAR COMMAND LINE
438B 18D4       00114         JR      MNLOOP+3        ;GET NEXT CMD CHAR
                00115
438D C5         00116 MNLP1   PUSH    BC              ;SAVE INDEX INTO TABLE
438E 1620       00117         LD      D,BLANK
4390 21CA3F     00118         LD      HL,VIDEO+970
4393 010D00     00119         LD      BC,13
4396 CD674C     00120         CALL    FILL            ;CLEAR ERROR MESSAGE
4399 E1         00121         POP     HL              ;GET INDEX
439A 29         00122         ADD     HL,HL
439B 117F4D     00123         LD      DE,CMDENT
439E 19         00124         ADD     HL,DE           ;GET CMD TABLE ADDR
439F 5E         00125         LD      E,(HL)          ;LSB OF COMMAND ADDR
43A0 23         00126         INC     HL

43A1 56         00127         LD      D,(HL)          ;MSB OF COMMAND ADDR
43A2 EB         00128         EX      DE,HL           ;CMD ADDR TO HL
43A3 E9         00129         JP      (HL)            ;EXECUTE COMMAND
                00130
                00131
                00132 ;       CLR     CLEAR ALL BREAKPOINTS SET
                00133
43A4 CDA84A     00134 CLR     CALL    WRCMD
43A7 43         00135         DEFM    'CLEAR,'
43AD CDBE4A     00136         CALL    WAITCR
43B0 0607       00137         LD      B,7             ;NUMBER OF BKPTS
43B2 21384D     00138         LD      HL,BRKAD
43B5 FD21464D   00139         LD      IY,BRKSV
43B9 5E         00140 CLR2    LD      E,(HL)          ;GET LSB OF NEXT ENTRY
43BA 23         00141         INC     HL
43BB 56         00142         LD      D,(HL)          ;MSB OF ENTRY
43BC 7B         00143         LD      A,E
43BD B2         00144         OR      D               ;TEST FOR 0 --> NO BKPT
43BE 2809       00145         JR      Z,CLR3          ;NEXT?
43C0 FD7E00     00146         LD      A,(IY)          ;GET SAVED BYTE
43C3 12         00147         LD      (DE),A          ;RESTORE PROGRAM BYTE
43C4 2B         00148         DEC     HL
43C5 AF         00149         XOR     A
43C6 77         00150         LD      (HL),A
43C7 23         00151         INC     HL
43C8 77         00152         LD      (HL),A          ;ZERO BRKPT ENTRY
43C9 23         00153 CLR3    INC     HL
43CA FD23       00154         INC     IY              ;BUMP POINTER
43CC 10EB       00155         DJNZ    CLR2            ;LOOP FOR ALL BRKPTS
43CE 188E       00156         JR      MNLOOP
                00157
                00158 ;       FIXUP   FIX BRKPT AT (PC)
                00159 ;               IGNORE COMMAND IF NONE SET
                00160
43D0 CDA84A     00161 FIXUP   CALL    WRCMD
43D3 46         00162         DEFM    'FIXBKP,'
43DA CDBE4A     00163         CALL    WAITCR
43DD 0607       00164         LD      B,7             ;NO. OF BKPTS
43DF 21384D     00165         LD      HL,BRKAD
43E2 FD21464D   00166         LD      IY,BRKSV
43E6 ED5B644D   00167         LD      DE,(PCSAVE)
43EA 7E         00168 FIXUP2  LD      A,(HL)          ;GET LSB OF BRKPT ENTRY
43EB BB         00169         CP      E               ;COMPARE TO LSB PC
43EC 23         00170         INC     HL
43ED 200F       00171         JR      NZ,FIXUP3
43EF 7E         00172         LD      A,(HL)          ;GET MSB
43F0 BA         00173         CP      D               ;COMPARE TO MSB PC
43F1 200B       00174         JR      NZ,FIXUP3
43F3 AF         00175         XOR     A
43F4 77         00176         LD      (HL),A          ;ZERO BRKPT ENTRY
43F5 2B         00177         DEC     HL
43F6 77         00178         LD      (HL),A
43F7 FD7E00     00179         LD      A,(IY)          ;GET PROGRAM BYTE
43FA 12         00180         LD      (DE),A          ;AND RESTORE IT
43FB C35E43     00181         JP      MNLOOP
43FE 23         00182 FIXUP3  INC     HL              ;BUMP POINTERS
43FF FD23       00183         INC     IY
4401 10E7       00184         DJNZ    FIXUP2          ;LOOK THRU TABLE
4403 C35E43     00185         JP      MNLOOP
                00186
                00187
                00188 ;       DIS     DISPLAY MEMORY - SET DISPLAY POINTER
                00189
4406 CDA84A     00190 DIS     CALL    WRCMD

4409 44         00191         DEFM    'DISPLAY,'
4411 CDEB4C     00192         CALL    INHEX
4414 CDBE4A     00193         CALL    WAITCR
4417 22664D     00194         LD      (DISPTR),HL     ;SAVE NEW DISPLAY POINTER
441A C35E43     00195         JP      MNLOOP
                00196
                00197 ;       BKPT    ENTER BREAKPOINT IN TABLE
                00198
441D CDA84A     00199 BKPT    CALL    WRCMD
4420 42         00200         DEFM    'BRKPT,'
4426 CDEB4C     00201         CALL    INHEX
4429 CDBE4A     00202         CALL    WAITCR
442C 22364D     00203         LD      (BRKTMP),HL     ;SAVE ADDRESS
442F 0607       00204         LD      B,7             ;NR OF ENTRIES IN TABLE
4431 21384D     00205         LD      HL,BRKAD
```

Program continues

✔ Reader Service—see page 242

```
4434 FD21464D 00206          LD      IY,BRKSV
4438 7E       00207 BKPT2    LD      A,(HL)          ;GET LSB OF TABLE
4439 23       00208          INC     HL
443A B6       00209          OR      (HL)            ;NON-ZERO --> ENTRY
443B 2012     00210          JR      NZ,BKPT3
443D ED5B364D 00211          LD      DE,(BRKTMP)     ;GET BRKPT ADDR
4441 2B       00212          DEC     HL
4442 73       00213          LD      (HL),E          ;ENTER ADDR IN TABLE
4443 23       00214          INC     HL
4444 72       00215          LD      (HL),D
4445 1A       00216          LD      A,(DE)          ;GET BYTE FROM PROGRAM
4446 FD7700   00217          LD      (IY),A          ;SAVE IT IN TABLE
4449 3EEF     00218          LD      A,0EFH          ;RST 28H
444B 12       00219          LD      (DE),A          ;ENTER BREAKPOINT IN PRGM
444C C35E43   00220          JP      MNLOOP
444F 23       00221 BKPT3    INC     HL
4450 FD23     00222          INC     IY              ;BUMP POINTERS
4452 10E4     00223          DJNZ    BKPT2           ;LOOP THRU TABLE
4454 C35E43   00224          JP      MNLOOP
              00225
              00226 ;        SCRDN/SCRUP     SCROLL MEMORY DISPLAY
              00227 ;                        DOWN/UP BY 128 BYTES
              00228
4457 118000   00229 SCRDN    LD      DE,128
445A 1803     00230          JR      SCRUP+3
445C 1180FF   00231 SCRUP    LD      DE,-128
445F 2A664D   00232          LD      HL,(DISPTR)
4462 19       00233          ADD     HL,DE           ;FORM NEW DISPLAY POINTER
4463 22664D   00234          LD      (DISPTR),HL
4466 C35E43   00235          JP      MNLOOP
              00236
              00237 ;        MODE    SHIFT DISPLAY MODE HEX/ALPHA
              00238
4469 214D4D   00239 MODE     LD      HL,MODEFL       ;GET MODE FLAG ADDR
446C 3E01     00240          LD      A,1
446E 96       00241          SUB     (HL)            ;MODEFL <-- 1-MODEFL
446F 77       00242          LD      (HL),A
4470 C35E43   00243          JP      MNLOOP
              00244
              00245 ;        JUMP    JUMP TO ADDR AND BEGIN EXECUTING AFTER
              00246 ;                RELOADING USER REGISTERS
              00247
4473 CDA84A   00248 JUMP     CALL    WRCMD
4476 4A       00249          DEFM    'JUMP,'
447B CDEB4C   00250          CALL    INHEX
447E CDBE4A   00251          CALL    WAITCR
4481 22644D   00252          LD      (PCSAVE),HL     ;SET USER PC TO JUMP ADDR
4484 1809     00253          JR      GO2


              00254
              00255 ;        GO      BEGIN EXECUTING AT CURRENT USER PC
              00256 ;                AFTER RELOADING ALL USER REGISTERS
              00257
4486 CDA84A   00258 GO       CALL    WRCMD
4489 47       00259          DEFM    'GO,'
448C CDBE4A   00260          CALL    WAITCR
448F ED7B624D 00261 GO2      LD      SP,(SPSAVE)     ;RELOAD USER SP
4493 2A644D   00262          LD      HL,(PCSAVE)     ;RETURN ADDR
4496 E5       00263          PUSH    HL              ;SET UP JUMP TO USER
4497 ED73624D 00264          LD      (SPSAVE),SP
449B 314E4D   00265          LD      SP,REGSTG       ;SET UP REGISTER RESTORE
449E F1       00266          POP     AF              ;DO IT!!
449F C1       00267          POP     BC
44A0 D1       00268          POP     DE
44A1 E1       00269          POP     HL
44A2 08       00270          EX      AF,AF'
44A3 D9       00271          EXX
44A4 F1       00272          POP     AF
44A5 C1       00273          POP     BC
44A6 D1       00274          POP     DE
44A7 E1       00275          POP     HL
44A8 DDE1     00276          POP     IX
44AA FDE1     00277          POP     IY
44AC ED7B624D 00278          LD      SP,(SPSAVE)
44B0 C9       00279          RET                     ;EXECUTE USER PROGRAM
              00280
              00281 ;        REG     SET BOTH 8 AND 16 BIT REGISTERS
              00282 ;                USE THE APPROPRIATE REGISTER NAME
              00283
44B1 CDA84A   00284 REG      CALL    WRCMD
44B4 52       00285          DEFM    'REG,'
44B8 CD244D   00286          CALL    GETCH2
44BB 010800   00287          LD      BC,8            ;CHARACTER COUNT
44BE 21CD4D   00288          LD      HL,REGCH+7
44C1 EDB9     00289          CPDR                    ;SEARCH AND GET INDEX
44C3 210800   00290          LD      HL,8            ;PRIMARY REG OFFSET
44C6 2021     00291          JR      NZ,REG1         ;NOPE - TRY 16 BIT
44C8 CD244D   00292          CALL    GETCH2
44CB FE27     00293          CP      QUOTE           ;SECONDARY 8 BIT?
44CD 2006     00294          JR      NZ,REG2         ;NOPE - CHECK SYNTAX
44CF 210000   00295          LD      HL,0            ;SECONDARY OFFSET
44D2 CD244D   00296          CALL    GETCH2
44D5 FE3A     00297 REG2     CP      ':'
44D7 C27543   00298          JP      NZ,MNERR        ;ERROR
44DA 09       00299          ADD     HL,BC           ;OFFSET+INDEX
44DB 114E4D   00300          LD      DE,REGSTG
44DE 19       00301          ADD     HL,DE           ;PROPER ADDRESS
44DF CDF44C   00302          CALL    HEXIN           ;READ BYTE
44E2 CDBE4A   00303          CALL    WAITCR
44E5 70       00304          LD      (HL),B          ;NEW REG VALUE
44E6 C35E43   00305          JP      MNLOOP
44E9 FE49     00306 REG1     CP      'I'             ;IY OR IX?
44EB 2816     00307          JR      Z,REGI
44ED FE53     00308          CP      'S'             ;SP?
```

Program continues

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```
44EF 2828      00309          JR      Z,REGS
44F1 FE50      00310          CP      'P'             ;PC?
44F3 C27543    00311          JP      NZ,MNERR        ;NOT VALID
44F6 CD244D    00312          CALL    GETCH2
44F9 FE43      00313          CP      'C'
44FB C27543    00314          JP      NZ,MNERR
44FE 11644D    00315          LD      DE,PCSAVE
4501 1821      00316          JR      REGST


4503 CD244D    00317 REGI     CALL    GETCH2
4506 FE59      00318          CP      'Y'             ;IY?
4508 280A      00319          JR      Z,REGY
450A FE58      00320          CP      'X'             ;IX?
450C C27543    00321          JP      NZ,MNERR
450F 115E4D    00322          LD      DE,REGSTG+16    ;POINTER TO IX
4512 1810      00323          JR      REGST
4514 11604D    00324 REGY     LD      DE,REGSTG+18    ;POINTER TO IY
4517 180B      00325          JR      REGST
4519 CD244D    00326 REGS     CALL    GETCH2
451C FE50      00327          CP      'P'             ;SP?
451E C27543    00328          JP      NZ,MNERR
4521 11624D    00329          LD      DE,SPSAVE
4524 D5        00330 REGST    PUSH    DE              ;SAVE POINTER
4525 CD244D    00331          CALL    GETCH2
4528 FE3A      00332          CP      ':'             ;CHECK SYNTAX
452A C27543    00333          JP      NZ,MNERR
452D CDEB4C    00334          CALL    INHEX
4530 CDBE4A    00335          CALL    WAITCR
4533 D1        00336          POP     DE              ;GET POINTER
4534 EB        00337          EX      DE,HL
4535 73        00338          LD      (HL),E          ;STORE VALUE
4536 23        00339          INC     HL
4537 72        00340          LD      (HL),D
4538 C35E43    00341          JP      MNLOOP
               00342
               00343
               00344 ;        ROM SYSTEM SYMBOL DEFINITIONS
               00345
0033           00346 DISPL    EQU     0033H
01C9           00347 CLS      EQU     01C9H
0049           00348 GETCH    EQU     0049H
               00349
               00350 ;        CONSTANTS
               00351
001E           00352 EREOL    EQU     30
3C00           00353 VIDEO    EQU     15360
0020           00354 BLANK    EQU     32
0027           00355 QUOTE    EQU     39
000D           00356 CRLF     EQU     13
4020           00357 CURSOR   EQU     4020H
0017           00358 SIZE     EQU     23
               00359
               00360 ;        ZBUG LABEL DEFINITIONS
               00361 ;        NOTE; THESE ARE ALL RELOCATABLE AS LONG AS
               00362 ;        THE OTHER SEGMENTS OF THE PROGRAM IS ASSEMBLED
               00363 ;        CORRECTLY
               00364
4D4E           00365 REGSTG   EQU     4D4EH+RL
4D66           00366 REGPTR   EQU     4D66H+RL
4D64           00367 PCSAVE   EQU     REGPTR-2
4D62           00368 SPSAVE   EQU     REGPTR-4
4D38           00369 BRKAD    EQU     4D38H+RL
4D46           00370 BRKSV    EQU     4D46H+RL
4D36           00371 BRKTMP   EQU     BRKAD-2
4C67           00372 FILL     EQU     4C67H+RL
4D4D           00373 MODEFL   EQU     4D4DH+RL
4D66           00374 DISPTR   EQU     4D66H+RL
4AC6           00375 LDSCRN   EQU     4AC6H+RL
4D68           00376 CMDTAB   EQU     4D68H+RL
4D7F           00377 CMDENT   EQU     4D7FH+RL
4DAD           00378 EMSG     EQU     4DADH+RL
4CEB           00379 INHEX    EQU     4CEBH+RL
4AA8           00380 WRCMD    EQU     4AA8H+RL


4ABE           00381 WAITCR   EQU     4ABEH+RL
4D24           00382 GETCH2   EQU     4D24H+RL
4CF4           00383 HEXIN    EQU     4CF4H+RL
4DBA           00384 REGCH    EQU     4DBAH+RL
               00385
               00386
453B           00387 LAST     EQU     $
4338           00388          END     ENTRY
00000 TOTAL ERRORS
```

Program Listing 1B. ZBUG

```
               00001 ;        ZBUG    PART 2
               00002
4300           00003 ORGN     DEFL    4300H
0000           00004 RL       DEFL    ORGN-4300H
               00005
453B           00006          ORG     453BH+RL
               00007
               00008 ;        LOAD    LOAD SYSTEM FORMAT TAPE
```

Program continues

Games from BIG FIVE will turn your computer into a TRS-80 HOME ARCADE

SUPER NOVA©

If you and your TRS-80 have longed for a fast-paced arcade-type game that is truly a challenge, then **SUPER NOVA** is what you've been waiting for. In this two player machine-language game, large asteroids float ominously around the screen. Suddenly your ship appears and you must destroy the asteroids before they destroy you! (But watch out because big asteroids break apart into little ones.) The controls that your ship will respond to are thrust, rotate, hyperspace, and fire. All right! You've done it! You've cleared away all the asteroids! But what is that saucer with the laser doing? Quick! You must destroy him fast because that guy's accurate!

GALAXY INVASION©

The sound of the klaxon is calling you! Cruel and crafty invaders have been spotted in battle formation warping toward Earth at an incredible speed. Suddenly, your ship materializes just below the huge flock of invaders. Quickly and skillfully you shift right and left as you carefully fire your lasers at them. But watch out! A few are breaking out of the convoy and flying straight at you! As the whine of their engines gets louder, you place your finger on the fire button knowing all too well that this shot must connect—or your mission will be permanently over! With sound effects!

ATTACK FORCE©

Your TRS-80 screen has been transformed into a maze-like playfield for this game. As your ship appears on the bottom of the screen, eight alien ramships appear on the top. All of them are traveling at flank speed directly at you! Quickly and boldly you move toward them and fire missiles to destroy them. But the more aliens you destroy, the faster the remaining ones become. If you get too good you must endure the wrath of the keeper of the mazefield: the menacing "Flagship". You must destroy him fast because, as you will find out, that guy's accurate! With sound effects!

COSMIC FIGHTER©

With thousands of stars whizzing by you, your **SPACE DESTROYER** ship comes out of hyperspace directly under a convoy of aliens. Almost effortlessly, you skillfully destroy every last one. But before you can congratulate yourself, another set appears. These seem to be slightly more intelligent than the first set. Quickly you eliminate all of them, too. But your fuel supply is rapidly diminishing. You must still destroy two more sets before you can dock with your space station. All right! The space station is now on your scanners! Oh no! Intruders have overtaken the station! You must skillfully fire your neutron lasers to eliminate the intruders from the station before your engines run out of fuel and explode! With sound!

METEOR MISSION II©

The second **Big Bang** has occurred and the galaxy is full of stray asteroids and meteors. As you look through your space port you see a belt of asteroids drifting across the screen blocking your path to the safety of the space station above. But be careful because meteor showers, exploding suns and invading aliens may strike your ship and send it hurtling back to ground level. How many times can you and your opponent maneuver through those obstacles before time runs out? With sound effects!

BIG FIVE SOFTWARE

P.O. Box 9078-185, Van Nuys, California 91409

357

Prices per game. Level I—$14.95, Level II—$14.95, Level II/Disk—$17.95
Specify which version when ordering.
10% discount for 2 games, 15% for 3 or more.
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Reader Service—see page 242

```
                00009
453B CDA84A     00010 LOAD      CALL    WRCMD
453E 4C         00011           DEFM    'LOAD,'
4543 CDBE4A     00012           CALL    WAITCR
4546 AF         00013           XOR     A
4547 CD1202     00014           CALL    SELECT          ;SELECT AND START TAPE
454A CD9602     00015           CALL    SYNCH           ;SYNCHRONIZE AND FIND A5
454D 21373C     00016           LD      HL,VIDEO+55
4550 CD3502     00017 LOAD1     CALL    READ            ;READ TAPE BYTE
4553 FE55       00018           CP      55H
4555 20F9       00019           JR      NZ,LOAD1        ;TEST FOR START OF TAPE
4557 CD3502     00020 LOAD2     CALL    READ
455A FE3C       00021           CP      3CH             ;TEST FOR START - 1ST BLK
455C 280B       00022           JR      Z,LOAD3+7       ;YEP
455E 77         00023           LD      (HL),A          ;NO - NAME TO VIDEO
455F 23         00024           INC     HL
4560 18F5       00025           JR      LOAD2
4562 CD3502     00026 LOAD3     CALL    READ
4565 FE3C       00027           CP      3CH             ;TEST FOR RECORD START
4567 201C       00028           JR      NZ,LOAD5        ;NO - CHECK EOF
4569 CD2C02     00029           CALL    BLINK           ;TWINKLE STARS
456C CD3502     00030           CALL    READ
456F 47         00031           LD      B,A             ;RECORD BYTE COUNT
4570 CD4E48     00032           CALL    READHL          ;LOAD HL REG AND C REG
4573 CD3502     00033 LOAD4     CALL    READ
4576 77         00034           LD      (HL),A          ;RECORD BYTE TO MEM
4577 23         00035           INC     HL
4578 81         00036           ADD     A,C
4579 4F         00037           LD      C,A             ;CHECKSUM BACK TO C
457A 10F7       00038           DJNZ    LOAD4           ;GET WHOLE RECORD
457C CD3502     00039           CALL    READ
457F B9         00040           CP      C               ;GET CHSUM FROM TAPE
4580 C24048     00041           JP      NZ,ERROR        ;BAD LOAD
4583 18DD       00042           JR      LOAD3           ;LOAD THE REST
4585 FE78       00043 LOAD5     CP      78H             ;TEST FOR END-OF-FILE
4587 C24048     00044           JP      NZ,ERROR        ;BAD LOAD
458A CD4E48     00045           CALL    READHL          ;LOAD HL FROM TAPE
458D 22644D     00046           LD      (PCSAVE),HL     ;SAVE TRANSPER ADDRESS
4590 CDF801     00047           CALL    TPOFF
4593 C35E43     00048           JP      MNLOOP
                00049
                00050 ;         WRITE   WRITE TAPE IN SYSTEM LOADER FORMAT
                00051
4596 CDA84A     00052 WRITE     CALL    WRCMD
4599 57         00053           DEFM    'WRITE,'
459F CD9E4A     00054           CALL    SETUP2          ;SET UP ADDRESSES
45A2 3E20       00055           LD      A,' '
45A4 CD3300     00056           CALL    DISPL
45A7 1620       00057           LD      D,' '
45A9 212A4D     00058           LD      HL,NAME
45AC 010600     00059           LD      BC,6
45AF CD674C     00060           CALL    FILL            ;CLEAR NAME FIELD
45B2 0606       00061           LD      B,6
45B4 212A4D     00062           LD      HL,NAME
45B7 CD4900     00063 WRITE0    CALL    GETCH           ;GET NAME CHAR
45BA FE0D       00064           CP      13              ;CRLF

45BC 280A       00065           JR      Z,WRITE2        ;END OF COMMAND
45BE 77         00066           LD      (HL),A
45BF 23         00067           INC     HL              ;SAVE CH AND BUMP POINTER
45C0 CD3300     00068           CALL    DISPL
45C3 10F2       00069           DJNZ    WRITE0
45C5 CDBE4A     00070           CALL    WAITCR
45C8 AF         00071 WRITE2    XOR     A
45C9 CD1202     00072           CALL    SELECT          ;SELECT AND START TAPE
45CC CD8702     00073           CALL    HEADER          ;WRITE HEADER/SYNCH BYTE
45CF 3E55       00074           LD      A,55H           ;SYSTEM HEADER
45D1 CD6402     00075           CALL    WRTAPE
45D4 0606       00076           LD      B,6             ;NAME COUNT
45D6 212A4D     00077           LD      HL,NAME
45D9 7E         00078 WRITE3    LD      A,(HL)          ;GET NAME CH
45DA CD6402     00079           CALL    WRTAPE
45DD 23         00080           INC     HL
45DE 10F9       00081           DJNZ    WRITE3
45E0 2A304D     00082           LD      HL,(START)      ;GET STARTING ADDRESS
45E3 11334D     00083 WRITE4    LD      DE,COUNT+1
45E6 1A         00084           LD      A,(DE)          ;GET BLOCK COUNT
45E7 B7         00085           OR      A
45E8 2825       00086           JR      Z,WRITE6        ;NO MORE 256 BYTE BLOCKS
45EA 3D         00087           DEC     A
45EB 12         00088           LD      (DE),A
45EC 3E3C       00089           LD      A,3CH           ;RECORD HEADER
45EE CD6402     00090           CALL    WRTAPE
45F1 AF         00091           XOR     A               ;BYTE COUNT = 256
45F2 47         00092           LD      B,A
45F3 CD6402     00093           CALL    WRTAPE
45F6 7D         00094           LD      A,L             ;LSB LOAD ADDR
45F7 CD6402     00095           CALL    WRTAPE
45FA 7C         00096           LD      A,H             ;MSB LOAD ADDR
45FB CD6402     00097           CALL    WRTAPE
45FE 85         00098           ADD     A,L             ;START CHECKSUM
45FF 4F         00099           LD      C,A
4600 7E         00100 WRITE5    LD      A,(HL)          ;GET NEXT BYTE
4601 CD6402     00101           CALL    WRTAPE
4604 81         00102           ADD     A,C             ;FORM CHECKSUM
4605 4F         00103           LD      C,A
4606 23         00104           INC     HL              ;BUMP POINTER
4607 10F7       00105           DJNZ    WRITE5
4609 79         00106           LD      A,C             ;WRITE CHRCKSUM FOR
460A CD6402     00107           CALL    WRTAPE          ;THIS RECORD
460D 18D4       00108           JR      WRITE4          ;NEXT ---
460F 3A324D     00109 WRITE6    LD      A,(COUNT)       ;BYTE COUNT FOR LAST ONE
4612 B7         00110           OR      A
4613 2821       00111           JR      Z,WRITE8        ;ALL DONE
```

Program continues

POSTMAN DATA HANDLER

Ver. 1.0 – by Fred LaForest

A **machine language** mailing list program that will do:

- 650 lables on a 35 track disk drive
- 1534 lables on an 80 track drive
- 10 fields (2 user defined)
- FAST SORTS 500 records in 30 seconds (use any or all keys in any order)
- Fully usable on a one (1) drive system (capacities shown are for a single drive system)
- Any label stock ½" thru 1½" vertical (single label horizontal)
- Print one label or a sequence of labels
- **Purge duplicates** with or without user assistance
- 9 digit zip code
- Fast search on any field - random access - 3 second average
- Easy screen editor for fast editing
- REQUIRES MIN. 1 DRIVE and 32K OF MEMORY. TRS-80 MOD I

This program is now available in 2 different packages.

1) A **sample package** that does all the functions of the full system (except the purge) and sells for $25 and is to be used as a sales tool only. This is a fully operational package but can not be enlarged or modified in anyway. Comes with the complete documentation and credit can be issued to the real package if returned to its place of purchase within 20 days.

2) The **full program** that includes the PURGE function with full documentation. This package will be updated as time goes on with new ideas so it includes a registration card

Note: works on all operating systems except NEWDOS-80.

INTRO SPECIAL – $100.00

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Send $25 for Sample Package – if not everything you expected, return sample disk for full refund (less shipping). You can't lose!!

SUPER-UTILITY

by K. Watt

— MAIN PROGRAM LIST —

ZAP UTILITY
Display Sector (Disk, File)
Display Memory
Compare Disk Sectors
Copy Disk Sectors
Verify Disk Sectors
Zero Disk Sectors
String Search
Sector Search

PURGE UTILITY
Kill Selected Files
Get Disk Directory
Zero Unused Directory Entries
Zero Unused Granules
Remove System Files
Kill By Category
Change Name, Date, Password, Auto Command
Change File Parameters
Remove Passwords

DISK FORMAT UTILITY
Standard Format
Format Without Erase
Special Format
Read Address Marks

DISK COPY UTILITY
Standard Copy With Format
Standard Copy Without Format
Special Copy (to back up any protected disks) Purchaser Use - Only for his own personal disks

TAPE COPY UTILITY
This program is to make back-up of any TRS-80 tape, no matter how it is recorded (note again this program is for the use of the original purchaser for his own programs only)

DISK REPAIR UTILITY
Repair Gat Table
Repair Hit Table
Repair Boot
Read Protect Directory Track
Recover Killed Files
Check Directory

MEMORY UTILITY
Move Memory
Exchange Memory
Compare Memory
Zero Memory
Test Memory
Input Byte From Port
Output Byte To Port
Memory To Disk
Disk To Memory

– For TRS-80, MOD I –

For a more complete overview, send a self addressed stamped envelope. This program is sold on disk only and retails for $49.95.

THE CREATOR

The CREATOR is a new type of program for the microcomputer operator. Yes operator!! Easy enough for the person just getting into the market. Use and create a program that is very sophisticated that programmers will comment highly about. The program will create error free basic programming code. Not almost ready to run BUT READY TO RUN WHEN YOU ARE FINISHED. YES gives birth to a program. Just answer simple questions and have a simple backgroud in the disk system of your computer (if you read your basic manual when you have questions you will have no problems). THIS PROGRAM IS NOT A DATA BASE!!

Now in the package comes the repart generator that is in the some concept as the CREATOR. It is called REPORTER. This program creates report output for the CREATOR for either screen or printer.

These 2 programs are on one diskette and are available for only $295 complete. The system requirements are one of the below.

TRS-80 MOD I, 32K DISK
TRS-80 MOD II, 64K DISK
APPLE II, 32K DISK

This is the most outstanding programming package available from anywhere. Now you can create INVENTORY SYSTEMS, PAYABLES and RECEIVABLES, CHECK REGISTER and EXPENSE REGISTER, and MUCH MORE!

This package is ready for delivery only $295 for any one of the systems above (PLEASE STATE SYSTEM WHEN ORDERING).

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For TRS-80 **LAZY WRITER** MOD I

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It is time to put your word processing program away and use a word processing system.

Soft Sector Marketing, Inc. & ABC Sales

Takes on Scripsit® by Radio Shack® and Electric Pencil©®

Has all the things that other word processing programs should have. Easy to use, written all in machine code / It permits the inserting and deleting by characters, words sentences, and paragraphs / Page scrolling up and down / Search ahead of the cursor or behind the cursor for any character / The cursor can be moved up, down, left and right / You can seek top of file and bottom of file / Block move of text, block delete of text / Search and replace or search delete / Unlimited insert (to the limit of your machines memory) / Permits use with lower case /

Has things that other programs should have, but don't. Upper and lower case output to your printer (if your printer accepts lower case) without having your computer modified ON UPPER CASE ONLY MACHINES. This program marks the capital letters so you can see which letters are CAPITALS and which are not / Will change all upper characters text to lower case or all lower case to upper, A SINGLE COMMAND / Will capitalize the first letter of all sentences and all proper noun I's, WITH A SINGLE COMMAND / LOADS ANY ELECTRIC PENCIL / FILE, ASCII SAVED FILES, EDTASM FILES or BASIC PROGRAMS SAVED ASCII / Permits installing special control characters in your text for your printers special features, like double wide or condensed print / Definable screen length and definable print length to 255 characters wide / Screen editing that is not final till your command. This means that you can edit your file on the screen and if you don't like how it reads you can cancel and leave it the way it was / You can append files (which means that you can put one file to the end of another file) / No lost cndracters at the end of the line even for the fastest typist / A directory of all your files is available to the user without leaving the program / Saving programs to disk easy enough for the non-computer user / To save memory, not all the program modules are in memory at one time but are called from the disk as needed / You can set tab positions like on a typewriter / 10 CUSTOM COMMAND KEYS for the experienced user there is a command file that permits many special functions that are all user defined (not enough space for better explanation in ad, send for complete overview) / Program has HELP file that is a short review of the commands that are available /

Stondord Printer Module. This printer module is provided for the user as a standard feature. Optional special printer routines for custom printer will be available in the near future. In this original release, it has the following prinfer drivers and will support the following printing devices RS232, TRS232 and PARALLEL printer ports. You have the following format commands: Justifies Text, Centers Text, Centers Title, Line Spacing, Line Length from 3-255 characters and Set Margins / Also send any ASCII code to any printer from the text / Save formatted text to the disk for spooling later / Information for customer to load his own special printer driver / Printing can be stopped and started by the user at any time and then restarted where you left off / You can print entire file or just print to bottom of the page/

Communication Package. RS232 COMMUNICATION TERMINAL PROGRAM permits you to communicate with other computers. Transfer files from one machine to another. Permits dumping memory across the phone lines. Receive files from other TRS-80's and "Shake Hands" with larger computers. This is the complete system called LAZY WRITER. There is no package written for the TRS-80 that is as comprehensive. This package is available for the TRS-80 Mod I, 32K or larger with at least a single disk drive. List price is from **$125.00**

Dealer Inquiries Invited. ↙434 **SSM** SOFT SECTOR MARKETING, INCORPORATED Dealer Inquiries Invited.

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```
4615 47        00112          LD      B,A
4616 3E3C      00113          LD      A,3CH           ;RECORD HEADER
4618 CD6402    00114          CALL    WRTAPE
461B 78        00115          LD      A,B
461C CD6402    00116          CALL    WRTAPE          ;BYTE COUNT
461F 7D        00117          LD      A,L
4620 CD6402    00118          CALL    WRTAPE
4623 7C        00119          LD      A,H
4624 CD6402    00120          CALL    WRTAPE          ;LOAD ADDR
4627 85        00121          ADD     A,L
4628 4F        00122          LD      C,A             ;START CHECKSUM
4629 7E        00123 WRITE7   LD      A,(HL)
462A CD6402    00124          CALL    WRTAPE
462D 81        00125          ADD     A,C
462E 4F        00126          LD      C,A
462F 23        00127          INC     HL
4630 10F7      00128          DJNZ    WRITE7

4632 4F        00129          LD      C,A
4633 CD6402    00130          CALL    WRTAPE          ;WRITE CHEFCKSUM
4636 3E78      00131 WRITE8   LD      A,78H
4638 CD6402    00132          CALL    WRTAPE          ;END-OF-FILE
463B 2A344D    00133          LD      HL,(NTRY)
463E 7D        00134          LD      A,L
463F CD6402    00135          CALL    WRTAPE          ;LSB XFER ADDR
4642 7C        00136          LD      A,H
4643 CD6402    00137          CALL    WRTAPE          ;MSB XFER ADDR
4646 CDF801    00138          CALL    TPOFF
4649 C35E43    00139          JP      MNLOOP
               00140
               00141 ;        CATLOG  CATALOG A SYSTEM TARE, PERFORM A CHECKSUM
               00142
464C CDA84A    00143 CATLOG   CALL    WRCMD
464F 43        00144          DEFM    'CAT,'
4653 CDBE4A    00145          CALL    WAITCR
4656 CDC901    00146          CALL    CLS
4659 21564E    00147          LD      HL,TITLE
465C CDA728    00148          CALL    OUTSTR
465F AF        00149          XOR     A
4660 CD1202    00150          CALL    SELECT          ;SELECT AND START TAPE
4663 CD9602    00151          CALL    SYNCH
4666 DD210050  00152          LD      IX,5000H        ;5000H IS BASE ADDR
466A CD3502    00153 CAT1     CALL    READ
466D FE55      00154          CP      55H             ;CHECK SYSTEM TAPE
466F 20F9      00155          JR      NZ,CAT1
4671 2A2040    00156          LD      HL,(CURSOR)
4674 CD3502    00157 CAT2     CALL    READ
4677 FE3C      00158          CP      3CH             ;TEST FOR RECORD
4679 280B      00159          JR      Z,CAT3+7        ;READ RECORD
467B 77        00160          LD      (HL),A          ;STORE NAME
467C 23        00161          INC     HL
467D 18F5      00162          JR      CAT2
467F CD3502    00163 CAT3     CALL    READ
4682 FE3C      00164          CP      3CH             ;START OF RECORD
4684 2028      00165          JR      NZ,CAT5
4686 CD2C02    00166          CALL    BLINK
4689 CD3502    00167          CALL    READ
468C 47        00168          LD      B,A             ;BYTE COUNT
468D DD7700    00169          LD      (IX),A          ;STORE IT
4690 CD4E48    00170          CALL    READHL
4693 DD7501    00171          LD      (IX+1),L
4696 DD7402    00172          LD      (IX+2),H        ;STORE LOAD ADDR
4699 110300    00173          LD      DE,3
469C DD19      00174          ADD     IX,DE           ;BUMP POINTER
469E CD3502    00175 CAT4     CALL    READ
46A1 81        00176          ADD     A,C
46A2 4F        00177          LD      C,A             ;CHECKSUM FORMATION
46A3 10F9      00178          DJNZ    CAT4
46A5 CD3502    00179          CALL    READ
46A8 B9        00180          CP      C               ;COMPARE CHECKSUM
46A9 C24048    00181          JP      NZ,ERROR
46AC 18D1      00182          JR      CAT3
46AE FE78      00183 CAT5     CP      78H             ;TEST FOR END OF FILE
46B0 C24048    00184          JP      NZ,ERROR
46B3 CD4E48    00185          CALL    READHL
46B6 22344D    00186          LD      (NTRY),HL       ;TRANSFER ADDRESS
46B9 DD22304D  00187          LD      (START),IX      ;ENDING ADDRESS
46BD CDF801    00188          CALL    TPOFF
46C0 CDC901    00189 CAT50    CALL    CLS
46C3 210000    00190          LD      HL,0
46C6 22324D    00191          LD      (COUNT),HL      ;USE IT FOR BLOCK COUNT
46C9 DD210050  00192          LD      IX,5000H        ;START ADDR

46CD 060E      00193 CAT6     LD      B,14            ;LINE COUNT
46CF DDE5      00194 CAT7     PUSH    IX
46D1 D1        00195          POP     DE
46D2 3A3140    00196          LD      A,(START+1)     ;CHECK FOR END
46D5 BA        00197          CP      D
46D6 2006      00198          JR      NZ,CAT8
46D8 3A3040    00199          LD      A,(START)
46DB BB        00200          CP      E
46DC 2850      00201          JR      Z,CATEND
46DE C5        00202 CAT8     PUSH    BC              ;SAVE LINE COUNT
46DF 21644E    00203          LD      HL,PART1
46E2 CDA728    00204          CALL    OUTSTR
46E5 2A324D    00205          LD      HL,(COUNT)
46E8 23        00206          INC     HL
46E9 22324D    00207          LD      (COUNT),HL
46EC CD9A0A    00208          CALL    HLACC           ;LOAD HL TO BASIC ACC
46EF CDBD0F    00209          CALL    CVTASC          ;CONVERT ACC TO ASCII
46F2 CDA728    00210          CALL    OUTSTR
46F5 216E4E    00211          LD      HL,PART2
46F8 CDA728    00212          CALL    OUTSTR
```

Program continues

```
46FB DD7E00    00213          LD      A,(IX)          ;GET BYTE COUNT
46FE B7        00214          OR      A               ;TEST FOR 0 = 256
46FF 2005      00215          JR      NZ,CAT9
4701 210001    00216          LD      HL,256
4704 1803      00217          JR      CAT9+3
4706 6F        00218 CAT9     LD      L,A
4707 2600      00219          LD      H,0             ;SET BYTE COUNT
4709 CD9A0A    00220          CALL    HLACC           ;LOAD TO ACCUMULATOR
470C CDBD0F    00221          CALL    CVTASC          ;CONVERT TO ASCII
470F CDA728    00222          CALL    OUTSTR
4712 217B4E    00223          LD      HL,PART3
4715 CDA728    00224          CALL    OUTSTR
4718 CD1848    00225          CALL    OUTIX           ;OUTPUT WORD AT IX
471B 113000    00226          LD      DE,3
471E DD19      00227          ADD     IX,DE           ;BUMP POINTER
4720 C1        00228          POP     BC              ;LINE COUNT
4721 10AC      00229          DJNZ    CAT7
4723 21C94E    00230          LD      HL,MSG5
4726 CD3348    00231          CALL    CONT            ;CONTINUE MSG
4729 CDC901    00232          CALL    CLS
472C 189F      00233          JR      CAT6
472E 21894E    00234 CATEND   LD      HL,PART4
4731 CDA728    00235          CALL    OUTSTR
4734 DD21334D  00236          LD      IX,NTRY-1       ;SET UP TRANSFER ADD
4738 CD1848    00237          CALL    OUTIX           ;OUTPUT
473B 21B64E    00238          LD      HL,MSG3
473E CD3348    00239          CALL    CONT
4741 FE40      00240          CP      '@'             ;TEST FOR RE-LIST
4743 CAC046    00241          JP      Z,CATS0         ;YES
4746 C35E43    00242          JP      MNLOOP
               00243
               00244 ;        CPYSYS  COPY SYSTEM FORMAT TAPE
               00245
4749 CDA84A    00246 CPYSYS   CALL    WRCMD
474C 43        00247          DEFM    'COPY,'
4751 CDBE4A    00248          CALL    WAITCR
4754 CDC901    00249          CALL    CLS             ;CLEAR SCREEN
4757 21964E    00250          LD      HL,MSG1
475A CDA728    00251          CALL    OUTSTR
475D AF        00252          XOR     A
475E CD1202    00253          CALL    SELECT          ;SELECT AND START TAPE
4761 CD9602    00254          CALL    SYNCH           ;SYNCH AND FIND A5 BYTE
4764 ED4B2040  00255          LD      BC,(CURSOR)     ;STORE NAME ON SCREEN
4768 DD210050  00256 CPY0     LD      IX,5000H        ;START OF BUFFER
476C CD0F48    00257 CPY1     CALL    RDSTOR          ;READ AND STORE BYTE
476F FE55      00258          CP      55H
4771 20F5      00259          JR      NZ,CPY0         ;TEST FOR START OF TAPE
4773 CD0F48    00260 CPY2     CALL    RDSTOR
4776 FE3C      00261          CP      3CH             ;TEST FOR START OF RECORD
4778 280B      00262          JR      Z,CPY3+7
477A 02        00263          LD      (BC),A          ;STORE NAME CH ON SCREEN
477B 03        00264          INC     BC
477C 18F5      00265          JR      CPY2
477E CD0F48    00266 CPY3     CALL    RDSTOR
4781 FE3C      00267          CP      3CH             ;TEST FOR NEW RECORD
4783 2024      00268          JR      NZ,CPY5         ;NO - TEST END-OF-FILE
4785 CD2C02    00269          CALL    BLINK
4788 CD0F48    00270          CALL    RDSTOR          ;GET BYTE COUNT
478B 47        00271          LD      B,A
478C CD4E48    00272          CALL    READHL          ;LOAD ADDRESS
478F DD7500    00273          LD      (IX),L
4792 DD7401    00274          LD      (IX+1),H        ;STORE IN BUFFER
4795 DD23      00275          INC     IX
4797 DD23      00276          INC     IX
4799 CD0F48    00277 CPY4     CALL    RDSTOR
479C 81        00278          ADD     A,C             ;FORM CHECKSUM
479D 4F        00279          LD      C,A
479E 10F9      00280          DJNZ    CPY4            ;GET WHOLE RECORD
47A0 CD0F48    00281          CALL    RDSTOR          ;GET CHECKSUM
47A3 B9        00282          CP      C
47A4 C24048    00283          JP      NZ,ERROR
47A7 18D5      00284          JR      CPY3
47A9 FE78      00285 CPY5     CP      78H             ;CHECK FOR END-OF-FILE
47AB C24048    00286          JP      NZ,ERROR
47AE CD4E48    00287          CALL    READHL          ;TRANSFER ADDRESS
47B1 DD7500    00288          LD      (IX),L
47B4 DD7401    00289          LD      (IX+1),H        ;STORE IN BUFFER
47B7 DD23      00290          INC     IX
47B9 DD23      00291          INC     IX
47BB CDF801    00292          CALL    TPOFF
47BE DD22324D  00293          LD      (COUNT),IX      ;SAVE BUFFER ENDING ADDR
47C2 DD210050  00294 CPY50    LD      IX,5000H        ;START OF BUFFER
47C6 21A14E    00295          LD      HL,MSG2
47C9 CDA728    00296          CALL    OUTSTR
47CC 21C94E    00297          LD      HL,MSG5
47CF CD3348    00298          CALL    CONT
47D2 CDC901    00299          CALL    CLS
47D5 210F4F    00300          LD      HL,MSG6
47D8 CDA728    00301          CALL    OUTSTR
47DB AF        00302          XOR     A
47DC CD1202    00303          CALL    SELECT          ;SELECT AND START TAPE
47DF CD8702    00304          CALL    HEADER          ;WRITE HEADER
47E2 DDE5      00305 CPY6     PUSH    IX              ;SAVE BUFFER ADDR
47E4 C1        00306          POP     BC              ;FOR END OF FILE TEST
47E5 3A334D    00307          LD      A,(COUNT+1)
47E8 B8        00308          CP      B
47E9 2006      00309          JR      NZ,CPY7
47EB 3A324D    00310          LD      A,(COUNT)
47EE B9        00311          CP      C
47EF 280A      00312          JR      Z,CPYEND
47F1 DD7E00    00313 CPY7     LD      A,(IX)          ;GET NEXT BYTE
47F4 DD23      00314          INC     IX
47F6 CD6402    00315          CALL    WRTAPE
47F9 18E7      00316          JR      CPY6
47FB CDF801    00317 CPYEND   CALL    TPOFF           ;TURN OFF TAPE
```

Program continues

```
47FE 21E34E   00318          LD      HL,MSG4
4801 CD3348   00319          CALL    CONT
4804 FE40     00320          CP      '@'
4806 C25E43   00321          JP      NZ,MNLOOP       ;NO RE-WRITE
4809 CDC901   00322          CALL    CLS
480C C3C247   00323          JP      CPY50           ;RE-WRITE
              00324
480F CD3502   00325 RDSTOR   CALL    READ
4812 DD7700   00326          LD      (IX),A
4815 DD23     00327          INC     IX
4817 C9       00328          RET
              00329
4818 ED5B2040 00330 OUTIX    LD      DE,(CURSOR)
481C DD7E02   00331          LD      A,(IX+2)        ;GET MSB TO OUTPUT
481F CDCE4C   00332          CALL    HEXCV
4822 CDC74C   00333          CALL    STHL
4825 DD7E01   00334          LD      A,(IX+1)        ;GET LSB TO OUTPUT
4828 CDCE4C   00335          CALL    HEXCV
482B CDC74C   00336          CALL    STHL
482E ED532040 00337          LD      (CURSOR),DE
4832 C9       00338          RET
              00339
4833 11C03F   00340 CONT     LD      DE,VIDEO+960
4836 ED532040 00341          LD      (CURSOR),DE
483A CDA728   00342          CALL    OUTSTR
483D C34900   00343          JP      GETCH
              00344
              00345 ;        ERROR ROUTINE FOR TAPE
              00346
4840 3E45     00347 ERROR    LD      A,'E'
4842 323E3C   00348          LD      (VIDEO+62),A
4845 CDF801   00349          CALL    TPOFF
4848 CD4900   00350          CALL    GETCH           ;WAIT FOR ANY KEY
484B C35E43   00351          JP      MNLOOP
              00352
              00353 ;        READHL  READ H & L REGISTERS FROM TAPE AND
              00354 ;                START A CHECKSUM IN C=(H)+(L)
              00355
484E CD3502   00356 READHL   CALL    READ
4851 6F       00357          LD      L,A             ;LSB  OF ADDRESS
4852 CD3502   00358          CALL    READ
4855 67       00359          LD      H,A             ;MSB OF ADDRESS
4856 85       00360          ADD     A,L             ;START CHECKSUM
4857 4F       00361          LD      C,A             ;SAVE IT
4858 C9       00362          RET
              00363
              00364 ;        LEVEL-II ROM DEFINITIONS
              00365
0212          00366 SELECT   EQU     0212H
0296          00367 SYNCH    EQU     0296H
0235          00368 READ     EQU     0235H
022C          00369 BLINK    EQU     022CH
0287          00370 HEADER   EQU     0287H
0264          00371 WRTAPE   EQU     0264H
3C00          00372 VIDEO    EQU     3C00H
0033          00373 DISPL    EQU     0033H
01F8          00374 TPOFF    EQU     01F8H
28A7          00375 OUTSTR   EQU     28A7H
4020          00376 CURSOR   EQU     4020H
0049          00377 GETCH    EQU     0049H
01C9          00378 CLS      EQU     01C9H
0A9A          00379 HLACC    EQU     0A9AH
0FBD          00380 CVTASC   EQU     0FBDH
              00381
              00382 ;        ZBUG SYSTEM DEFINITIONS
              00383
4CEB          00384 INHEX    EQU     4CEBH+RL
4CF4          00385 HEXIN    EQU     4CF4H+RL
4AA8          00386 WRCMD    EQU     4AA8H+RL
4ABE          00387 WAITCR   EQU     4ABEH+RL
4D66          00388 DISPTR   EQU     4D66H+RL
4CCE          00389 HEXCV    EQU     4CCEH+RL
4CC7          00390 STHL     EQU     4CC7H+RL
435E          00391 MNLOOP   EQU     435EH+RL
4338          00392 ENTRY    EQU     4338H+RL
4D64          00393 PCSAVE   EQU     4D64H+RL
4D2A          00394 NAME     EQU     4D2AH+RL
4D32          00395 COUNT    EQU     4D32H+RL
4D30          00396 START    EQU     4D30H+RL
4D34          00397 NTRY     EQU     4D34H+RL
4C67          00398 FILL     EQU     4C67H+RL
4E56          00399 TITLE    EQU     4E56H+RL
4E64          00400 PART1    EQU     4E64H+RL
4E6E          00401 PART2    EQU     4E6EH+RL
4E7B          00402 PART3    EQU     4E7BH+RL
4E89          00403 PART4    EQU     4E89H+RL
4E96          00404 MSG1     EQU     4E96H+RL
4EA1          00405 MSG2     EQU     4EA1H+RL
4EB6          00406 MSG3     EQU     4EB6H+RL
4EE3          00407 MSG4     EQU     4EE3H+RL
4EC9          00408 MSG5     EQU     4EC9H+RL
4F0F          00409 MSG6     EQU     4F0FH+RL
4A9E          00410 SETUP2   EQU     4A9EH+RL
              00411
              00412
4059          00413 LAST     EQU     $
4338          00414          END     ENTRY
00000 TOTAL ERRORS
```

the FIND ADDR command.

REG: The REG command stores the one or two-byte value entered in user register table as specified by the symbolic name for the Z-80 register. The display is updated and control returned to the commend loop.

SET: The SET command modifies memory one byte at a time, starting with the address entered. The display is automatically changed to the 128-byte block containing the starting address, if it does not already contain it. As the computer pauses to let you enter each successive byte, the cursor is moved to surround the byte. The past cursor marks are not cleared, leaving a record of what has been changed. To exit the command, use the BREAK key. Control is returned to the command loop.

WRITE: The WRITE command writes the specified block of memory to the cassette, with the entry point address and name in appropriate format. Cassette tapes are written in the SYSTEM format specified by Table 3 using as many 256 byte blocks to minimize the amount of tape used.

XREGS: The XREGS command swaps the user primary and secondary eight-bit registers in the user register table. It returns control to the command loop.

ZAP: The ZAP command fills the specified memory block with the byte value. Control is then returned to the command loop.

COPY: The COPY command is used to copy the next SYSTEM format file using one cassette recorder. The SYSTEM program copied may load in any area of memory. The program is read to a buffer beginning at 5000H, performing checksums on each record. Every byte of information is preserved for the future copy. Tapes of up to 12,288 bytes may be copied on a 16K Level II system. With the overhead required on SYSTEM tapes for formatting (10 bytes + five bytes/record), this means that a program of up to 12,032 bytes can be copied if 256 byte records were used. Once a tape has been loaded, as many copies as you desire can be produced without reloading the program.

CAT: The CAT command finds where all those mysterious SYSTEM tapes load. CAT reads the next SYSTEM format file from the cassette and performs checksums on each record. After the file is read, the record number, record size and hexadecimal load address are displayed on the video screen. The last line displayed is the entry point address in hexadecimal.

". . . this monitor is substantially ROM-dependent and there are two separate ROM configurations supplied. . . ."

The last four single-key commands act immediately to perform these functions:

* Return to the BASIC READY prompt after clearing the screen and resetting the break vector.

@ Toggle the 128-byte memory display mode.

↑ Page the memory display down by 128 (80H) bytes.

↓ Page the memory display up by 128 (80H) bytes.

Using ZBUG from TRSDOS

I have talked about the benefits of ZBUG on a Level II computer. What about from TRSDOS?

Table 4 is a summary of ROM routines used. It is a brief description of each routine. (If you want to know more about them, read *SUPERMAP* or other publications which list the ROM routines.)

Because ZBUG may alter the DOS environment, it assumes that it is operating in a Level II environment and that the vector area (4000H–42E8H) is initialized accordingly. Still, the benefits of DOS do not have to be sacrificed. The short program shown in Program Listing 2 provides the sequence used by the Z-80 processor on power-up, and resets the vector area to a Level II configuration.

This code was extracted from the ROM chip starting with the sequence at address 0000H and following the logic assuming no disk controller is present and stopping before the MEMORY SIZE? prompt is displayed. By now, many of you realize that this monitor is substantially ROM-dependent and there are two separate ROM configurations supplied by Radio Shack for the TRS-80. I have checked

BYTE	DESCRIPTION
55H	System file header code
NNH NNH NNH NNH NNH NNH	Program name (1–6 characters), there will always be 6 characters on tape with the name left-justified in the field and blank-filled.
3CH (*)	Data record header code
bbH (*)	Data record byte count (00H to FFH) a record size of 256 bytes is identified by a byte count of 00H
LLH (*)	Data record load address LSB
MMH (*)	Data record load address MSB
XXH (*) XXH (*) . . .	Data bytes repeated for as many bytes specified in the record byte count
ccH (*)	Data record checksum byte formed by adding the load address LSB and MSB bytes and all data bytes in the record
78H	System file end-of-file mark
LLH	Entry point address LSB
MMH	Entry point address MSB

(*) NOTE: This record information is repeated as necessary to load all the required information.

Table 3. System Tape Format

NAME	ADDR	DESCRIPTION
DISPL	0033	Display the byte in the A register to the video screen
CLS	01C9	Clear the video screen and home the cursor
GETCH	0049	Wait for a key pressed and return value in the A reg
SELECT	0212	Select the tape drive using the value in the A reg and start the motor
SYNCH	0296	Read the 256 byte zero header and find the A5H synch
READ	0235	Read the next byte from tape to the A register
BLINK	022C	Blink the asterisk in the upper right corner of the video screen
HEADER	0287	Write a 256 byte zero header and A5H synch byte
WRTAPE	0264	Write the byte in the A register to tape
TPOFF	01F8	Turn off the selected cassette motor
OUTSTR	28A7	Output to video the string pointed to by (HL) and terminated with a 00H or 22H (") byte
HLACC	0A9A	Load (HL) to the ACC (4121H-4124H) as an integer
CVTASC	0FBD	Convert (ACC) to a string pointed to by (HL)
CVTBIN	0E6C	Convert the string pointed to by (HL) to binary in the ACC, result can be integer or floating point
CINT	0A7F	ACC,HL = CINT(ACC)
CSNG	0AB1	ACC = CSNG(ACC)
PUSHAC	09A4	Push ACC to ACC + 3 on to the stack
TESTAC	0994	Test the ACC for +, −, 0 and set flags appropriately
FDIV	08A2	ACC = (BC) (DE)/ACC, single precision fp
FSUB	0713	ACC = (BC) (DE) − ACC, single precision fp
FADD	0716	ACC = (BC) (DE) + ACC, single precision fp
MULT	0BF2	ACC, HL = (DE) * (HL), integer with overflow to single precision floating point in ACC

Table 4. Summary of ROM Routines

```
21 xx yy  LD   HL,LOADAD  ;DISK LOAD ADDRESS TO (HL)
11 yy yy  LD   DE,RUNAD   ;RUN ADDRESS TO (DE)
01 zz zz  LD   BC,BYTES   ;BYTE COUNT OF BLOCK
ED B0     LDIR            ;MOVE IT TO RUN LOCATIONS
C3 tt tt  JP   ENTRYPT    ;ENTER SYSTEM PROGRAM
```

Table 5.

each of the routines on both ROM chips and found that the ROM entry points used are totally compatible.

I assembled my disk version starting at B300H and ending at BF1BH. The program in Program Listing 2 loads at BF70H. When loaded from the disk as a CMD file, execution begins at BF70H, initializes the vector area for Level II, and transfers control to the ZBUG entry point. To return to DOS, either execute a jump to 0000H or press the RESET button.

There is a benefit to having ZBUG on disk as described. It is easy to transfer any machine language program to the disk, regardless of its load point (eg., one that loads in low user RAM and overlays DOS, such as EDTASM). All you have to do is run ZBUG from DOS and, when loaded, use it to load the SYSTEM file to RAM. Using the MOVE command, move the block of code (which you located using the CAT command) to a high RAM address which does not interfere with DOS. Then move the code from Program Listing 2 still resident at BF70H, to be part of the previous block and change the jump instruction at the end (C3 38 B3) to the short code in Table 5 entered with the SET command.

When the program is loaded, the code patched as above, and you're satisifed that you've made the changes right, exit ZBUG to DOS. Use the DOS DUMP command to write the converted program to your disk as a CMD file. You may then run it, at will, from the disk by entering the name from the DOS command level.

One last point: Remember that the addresses used above in the short code sequence are entered in typical address format (eg., 4338H should be entered as 38 43).

Program Modifications

The program is easily converted to one source module for assembly on a 32K or 48K com-

Continues to page 161

✓ *Reader Service—see page 242*

Program Listing 1C. ZBUG

```
                00001 ;         ZBUG PART 3
                00002
4300            00003 ORGN      DEFL    4300H
0000            00004 RL        DEFL    ORGN-4300H
                00005
4859            00006           ORG     4859H+RL
                00007
                00008 ;         SET     CHANGE MEMORY BYTES UNTIL <BREAK> IS
                00009 ;                 PRESSED TO EXIT TO THE MAIN COMMAND LOOP
                00010
4859 CDA84A     00011 SET       CALL    WRCMD
485C 53         00012           DEFM    'SET,'
485D CDEB4C     00013           CALL    INHEX
4863 E5         00014 SET1      PUSH    HL              ;SAVE ADDRESS ON STACK
4864 3E80       00015           LD      A,80H
4866 A5         00016           AND     L               ;FORM DISPLAY POINTER
4867 6F         00017           LD      L,A             ;FOR A BLOCK OF 128 BYTES
4868 22664D     00018           LD      (DISPTR),HL
486B D1         00019           POP     DE
486C D5         00020           PUSH    DE
486D EB         00021           EX      DE,HL
486E B7         00022           OR      A
486F ED52       00023           SBC     HL,DE           ;LOCN OF BYTE IN BLOCK
4871 3E0F       00024           LD      A,0FH
4873 A5         00025           AND     L
4874 F5         00026           PUSH    AF              ;FORM BYTE NR AND SAVE IT
4875 AD         00027           XOR     L               ;FORM ROW NR
4876 6F         00028           LD      L,A
4877 29         00029           ADD     HL,HL           ;CALC VIDEO POSITION
4878 29         00030           ADD     HL,HL
4879 118F3C     00031           LD      DE,VIDEO+143
487C 19         00032           ADD     HL,DE
487D D1         00033           POP     DE
487E 5A         00034           LD      E,D
487F 1600       00035           LD      D,0
4881 19         00036           ADD     HL,DE
4882 19         00037           ADD     HL,DE
4883 19         00038           ADD     HL,DE           ;CALC POSITION IN THE ROW
4884 CB5B       00039           BIT     3,E             ;TEST FOR BYTES 8-15
4886 2801       00040           JR      Z,$+3           ;NOPE
4888 23         00041           INC     HL              ;YEP - BUMP POSITION BY 1
4889 E5         00042           PUSH    HL
488A CD6F4C     00043           CALL    MEMDIS          ;DISPLAY CHANGE AREA
488D 3EAA       00044           LD      A,170           ;GRAPHICS BYTE
488F E1         00045           POP     HL
4890 77         00046           LD      (HL),A          ;STORE GRAPHIC CURSOR
4891 23         00047           INC     HL
4892 23         00048           INC     HL
4893 23         00049           INC     HL              ;MOVE PAST BYTE
4894 3E3F       00050           LD      A,3FH
4896 A5         00051           AND     L               ;TEST FOR END OF LINE
4897 2803       00052           JR      Z,$+5           ;YEP - DON'T STORE
4899 3E95       00053           LD      A,149           ;2ND PART OF CURSOR
489B 77         00054           LD      (HL),A
489C 21983F     00055           LD      HL,VIDEO+920
489F 224040     00056           LD      (CURSOR),HL     ;SET CURSOR
48A2 3E1E       00057           LD      A,1EH
48A4 CD3300     00058           CALL    DISPL           ;ERASE TO END OF LINE
48A7 E1         00059           POP     HL              ;GET ADDRESS
48A8 E5         00060           PUSH    HL
48A9 E5         00061           PUSH    HL
48AA 7C         00062           LD      A,H             ;CONVERT ADDRESS
48AB ED5B2040   00063           LD      DE,(CURSOR)     ;TO ASCII-HEX FORM


48AF CDCE4C     00064           CALL    HEXCV           ;AND STORE IT IN VIDEO
48B2 CDC74C     00065           CALL    STHL
48B5 E1         00066           POP     HL
48B6 7D         00067           LD      A,L             ;LSB ADDRESS
48B7 CDCE4C     00068           CALL    HEXCV
48BA CDC74C     00069           CALL    STHL
48BD ED532040   00070           LD      (CURSOR),DE
48C1 3E20       00071           LD      A,' '
48C3 CD3300     00072           CALL    DISPL
48C6 CDF44C     00073           CALL    HEXIN           ;GET HEX BYTE
48C9 E1         00074           POP     HL
48CA 70         00075           LD      (HL),B          ;STORE IT
48CB 23         00076           INC     HL              ;BUMP MEMORY ADDRESS
48CC 1895       00077           JR      SET1
                00078
                00079 ;         ZAP     FILL MEMORY WITH SPECIFIED BYTE
                00080
48CE CDA84A     00081 ZAP       CALL    WRCMD
48D1 5A         00082           DEFM    'ZAP,'
48D5 CD8F4A     00083           CALL    SETUP1          ;READ START-END-BYTE
48D8 CD674C     00084           CALL    FILL            ;FILL MEM - REGS SET
48DB C35E43     00085           JP      MNLOOP          ;BY 'SETUP1'
                00086
                00087 ;         INT     CONVERT INTEGER TERMINATED BY = TO HEX
                00088
48DE CDA84A     00089 INT       CALL    WRCMD
48E1 49         00090           DEFM    'INT,'
48E5 213041     00091           LD      HL,4130H        ;USE BASIC FOR BUFFER
48E8 0605       00092           LD      B,5             ;NUMBER OF DIGITS
48EA E5         00093           PUSH    HL
48EB CD4900     00094 INT1      CALL    GETCH           ;GET CHAR
48EE FE3D       00095           CP      '='             ;TEST FOR DONE
48F0 2818       00096           JR      Z,INT3
48F2 FE30.      00097           CP      '0'             ;TEST FOR NUMBER
48F4 FAEB48     00098           JP      M,INT1          ;REJECT
48F7 FE3A       00099           CP      '9'+1           ;TEST FOR NUMBER
48F9 F2EB48     00100           JP      P,INT1          ;REJECT
```

Program continues

```
48FC 77       00101          LD      (HL),A          ;SAVE CHAR
48FD 23       00102          INC     HL
48FE CD3300   00103          CALL    DISPL           ;DISPLAY IT
4901 10E8     00104          DJNZ    INT1
4903 CD4900   00105 INT2     CALL    GETCH           ;HAVE 5 DIGITS WAIT FOR
4906 FE3D     00106          CP      '='             ;"=" TERMINATOR
4908 20F9     00107          JR      NZ,INT2
490A CD3300   00108 INT3     CALL    DISPL           ;"="
490D AF       00109          XOR     A
490E 77       00110          LD      (HL),A          ;TERMINATE STRING .
490F E1       00111          POP     HL              ;RESET TO BEGINNING
4910 CD6C0E   00112          CALL    CVTBIN          ;CONVERT TO BINARY
4913 CDB10A   00113          CALL    CSNG            ;SINGLE FP
4916 CD9409   00114          CALL    TESTAC          ;TET ACC<0
4919 FA7543   00115          JP      M,MNERR
491C CDA409   00116          CALL    PUSHAC          ;SAVE ACC
491F CDA409   00117          CALL    PUSHAC
4922 210001   00118          LD      HL,256
4925 CD9A0A   00119          CALL    HLACC           ;ACC<--256
4928 CDB10A   00120          CALL    CSNG            ;FLOAT
492B C1       00121          POP     BC
492C D1       00122          POP     DE              ;GET NUMBER
492D CDA208   00123          CALL    FDIV            ;NUM/256.0
4930 CD7F0A   00124          CALL    CINT            ;INT(NUM/256)
4933 7C       00125          LD      A,H
4934 B7       00126          OR      A               ;TEST>65535


4935 C27543   00127          JP      NZ,MNERR
4938 22324D   00128          LD      (COUNT),HL      ;SAVE IT
493B 110001   00129          LD      DE,256
493E CDF20B   00130          CALL    MULT            ;256*INT(NUM/256)
4941 CDB10A   00131          CALL    CSNG
4944 C1       00132          POP     BC
4945 D1       00133          POP     DE
4946 CD1307   00134          CALL    FSUB            ;NUM-256*INT(NUM/256)
4949 CD7F0A   00135          CALL    CINT
494C 7D       00136          LD      A,L             ;LSB OF HEX
494D CDCE4C   00137          CALL    HEXCV
4950 E5       00138          PUSH    HL
4951 3A324D   00139          LD      A,(COUNT)       ;MSB OF HEX
4954 CDCE4C   00140          CALL    HEXCV
4957 ED5B2040 00141          LD      DE,(CURSOR)     ;SET UP WRITE TO SCR
495B CDC74C   00142          CALL    STHL
495E E1       00143          POP     HL
495F CDC74C   00144          CALL    STHL
4962 CD4900   00145          CALL    GETCH           ;WAIT ANY KEY
4965 C35E43   00146          JP      MNLOOP
              00147
              00148 ;        HEX     CONVERT HEX NUMBER TO INTEGER
              00149
4968 CDA84A   00150 HEX      CALL    WRCMD
496B 48       00151          DEFM    'HEX,'
496F CDEB4C   00152          CALL    INHEX           ;GET HEX NUMBER
4972 E5       00153          PUSH    HL
4973 110001   00154          LD      DE,256
4976 6C       00155          LD      L,H
4977 2600     00156          LD      H,0
4979 CDF20B   00157          CALL    MULT            ;MSB*256
497C CDB10A   00158          CALL    CSNG            ;CONVERT TO FLOATING
497F E1       00159          POP     HL              ;GET NUMBER
4980 CDA409   00160          CALL    PUSHAC          ;SAVE MSB*256
4983 2600     00161          LD      H,0
4985 CD9A0A   00162          CALL    HLACC           ;LSB TO ACC
4988 CDB10A   00163          CALL    CSNG            ;CONVERT TO FP
498B C1       00164          POP     BC
498C D1       00165          POP     DE
498D CD1607   00166          CALL    FADD            ;MSB*256+LSB
4990 CDBD0F   00167          CALL    CVTASC          ;CONVERT TO ASCII
4993 3E3D     00168          LD      A,'='
4995 CD3300   00169          CALL    DISPL
4998 23       00170          INC     HL
4999 CDA728   00171          CALL    OUTSTR          ;OUTPUT NUMBER
499C CD4900   00172          CALL    GETCH
499F C35E43   00173          JP      MNLOOP
              00174
              00175 ;        EXCHG   EXCHANGE USER PRIMARY AND SECONDARY REGS
              00176
49A2 CDA84A   00177 EXCHG    CALL    WRCMD
49A5 58       00178          DEFM    'XREGS,'
49AB CDBE4A   00179          CALL    WAITCR
49AE 0608     00180          LD      B,8
49B0 214E4D   00181          LD      HL,REGSTG       ;SECONDARY REGS PTR
49B3 11564D   00182          LD      DE,REGSTG+8     ;PRIMARY
49B6 4E       00183 EXCHG1   LD      C,(HL)          ;GET ONE REG
49B7 1A       00184          LD      A,(DE)          ;GET OTHER
49B8 77       00185          LD      (HL),A          ;STORE IN PLACE
49B9 79       00186          LD      A,C
49BA 12       00187          LD      (DE),A          ;STORE OTHER
49BB 13       00188          INC     DE
49BC 23       00189          INC     HL


49BD 10F7     00190          DJNZ    EXCHG1
49BF C35E43   00191          JP      MNLOOP
              00192
              00193 ;        FBYTE   FIND BYTE AND SET (DISPTR) TO ITS ADDRESS
              00194 ;                CONTINUE UNTIL <BREAK> OR END OF SEARCH
              00195
49C2 CDA84A   00196 FBYTE    CALL    WRCMD
49C5 46       00197          DEFM    'FIND BYTE,'
49CF 2A664D   00198          LD      HL,(DISPTR)     ;SAVE DISPTR
49D2 22364D   00199          LD      (BRKTMP),HL
```

Program continues

DOSPLUS 3.1 D

1.5 MEG on MODEL 1

Increase Your Disk Storage!!!

Package 1 - 1.5 Megabytes for only $1,540.00
2: Model 160-2 AEROCOMP 80-track double headed drives
1: PERCOM DOUBLER †
1: DOSPLUS 3.1D
1: 2 Drive Cable (for the AEROCOMP drives)

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1: PERCOM DOUBLER †
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Package 3 - Add on disk storage and go double density for only $1,040.00
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1 PERCOM DOUBLER †
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1: 4 drive cable (for the AEROCOMP drives)

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1: DOSPLUS 3.1D
1: 3 drive cable (for the AEROCOMP drive)

Remember, ONE 80-track drive, running double density, will give you as much storage as FOUR 35-track drives running single density.

If interested, call or write us at the address below, and let us banish your disk storage problems forever!

MICRO SYSTEMS SOFTWARE INC.
5846 Funston Street, Hollywood, FL 33023
(305) 983-3390

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

PHONE _____

ACCOUNT # _____

MC ☐ VISA ☐ EXP. DATE _____

PROGRAM NAME _____

QUANTITY _____

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MODEL III
FOR $320.00

Yes, double density is here! Two 40 track drives give you 368K of storage. And if thats not enough, four 80 track drives will give you 1.4 megabytes of on line storage. All this with the added speed of double density operation, not to mention 80% more storage per diskette.

No loss of your software library or conversion of your single density diskettes is necessary. DOSPLUS 3.1D reacts to the diskette. It will read single or double density with equal ease. It is not JUST a double density operating system, it is a double AND single density system. It is the first of it's kind. No one can offer you what we can! To change a disk to double density you need only format a double density disk, and then ONE command (TRANSFER), will bring over all your files. Very simple to use, but not necessary, because DOSPLUS will read them as they are now. Just insert single density diskettes and run (with our operating system). The machine will know what you are doing without having to be told ANYTHING!

If you want your computer to **chain functions,** then you need DOSPLUS 3.1D (for example, from powerup you could have your machine call another computer, scan a data base for appointments, recording any that appear on your printer; and then load in BASIC, setting files and mem/size, and start your program so your secretary can go right to work). With our BUILD, DO and AUTO, all of the preceding would be child's play. By the way, you could have also set the time and date, looked at the directory of all your drives as well as checked the free space map (which tells you not only how much space you have on a diskette, but also where it is and what it is used for) DOSPLUS is a truly intelligent, easy to use operating system that gives you all your computer is capable of delivering.

You probably guessed that for $320.00 what we are doing is turning your Model I into a Model III. It's so easy **anyone can do it in 10 minutes!** Why spend $2,500.00 for a Model III when you can get the same computing power, with our kit, and NO SOFTWARE CONVERSION, for only $320.00. Don't throw away your Model I, let us expand it! Move up to the world of double density.

You will read the benefits of our **error-free software.** No miracles, just plain hard work and a lot of testing by experts and novices alike. Test us and judge yourself. We guarantee you will be 100% satisfied. If you are the first to find a legitimate "BUG" in our software you will be rewarded with a brand new $100 dollar bill.

Your systems disk will come complete with an all new single/double density disk editor called DISKZAP, and a BASIC program compressor called CRUNCH. Also included is PURGE, a utility to make the mass removal of unwanted files from a diskette easy, and RESTORE, a program that makes recovering a dead file as easy as typing in a command line. TRANSFER is just as it sounds, a program that moves all files (except systems) from one diskette to another. Single density to double or vice versa. CLEARFILE is used to zero data files on a diskette for a "clean slate". DISKDUMP is a new machine language sector display/modify program that works with filespecs instead of tracks and sectors. Used in conjunction with DISKZAP, you will have more disk editing power than ever before, with less frustration than was ever thought possible.

You will now be able to use all your **DOS commands from BASIC** with the CMD 'I' feature. And how about variable length records that really work, first time, EVERY time! This will allow you to use the ISAM programming technique for vastly improved handling of large data bases and lightning speed unheard of in BASIC. (ISAM stands for Indexed Sequential Access Method).

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```
49D5 CD8F4A   00200          CALL    SETUP1          ;START-END-BYTE
49D8 7A       00201          LD      A,D             ;BYTE TO (A)
49D9 EDB1     00202 FBYTE1   CPIR                    ;SEARCH FOR IT
49DB 2012     00203          JR      NZ,FBYTE2       ;NOT FOUND
49DD F5       00204          PUSH    AF
49DE C5       00205          PUSH    BC
49DF E5       00206          PUSH    HL              ;SAVE REGS
49E0 2B       00207          DEC     HL              ;POINT TO BYTE
49E1 22664D   00208          LD      (DISPTR),HL     ;SET DISPLAY ADDR
49E4 CD6F4C   00209          CALL    MEMDIS          ;DISPLAY 128 BYTES
49E7 CD4900   00210          CALL    GETCH           ;WAIT ANY KEY
49EA E1       00211          POP     HL
49EB C1       00212          POP     BC
49EC F1       00213          POP     AF
49ED 18EA     00214          JR      FBYTE1          ;MORE
49EF 2A364D   00215 FBYTE2   LD      HL,(BRKTMP)     ;ORIGINAL DISPTR
49F2 22664D   00216          LD      (DISPTR),HL
49F5 310043   00217          LD      SP,RENTRY       ;FLUSH SP
49F8 C35E43   00218          JP      MNLOOP
              00219
              00220 ;        FADDR   FIND THE ADDRESS OF THE TWO BYTE WORD
              00221
49FB CDA84A   00222 FADDR    CALL    WRCMD
49FE 46       00223          DEFM    'FIND ADDR,'
4A08 CD9E4A   00224          CALL    SETUP2          ;START-END-ADDR
4A0B CDBE4A   00225          CALL    WAITCR
4A0E 2A664D   00226          LD      HL,(DISPTR)
4A11 22364D   00227          LD      (BRKTMP),HL     ;SAVE OLD DISPTR
4A14 2A304D   00228          LD      HL,(START)
4A17 ED4B324D 00229          LD      BC,(COUNT)      ;BYTE COUNT
4A1B ED5B344D 00230          LD      DE,(NTRY)       ;ADDR
4A1F 7B       00231 FADDR1   LD      A,E
4A20 EDB1     00232          CPIR                    ;SEARCH FOR IT
4A22 20CB     00233          JR      NZ,FADDRX       ;NOPE - NOT FOUND
4A24 7A       00234          LD      A,D             ;TEST LSB
4A25 BE       00235          CP      (HL)
4A26 20F7     00236          JR      NZ,FADDR1       ;NO - TEST AGAINST MSB
4A28 E5       00237          PUSH    HL
4A29 D5       00238          PUSH    DE
4A2A C5       00239          PUSH    BC
4A2B 2B       00240          DEC     HL              ;POINT TO ADDR
4A2C 22664D   00241          LD      (DISPTR),HL     ;SET UP DISPLAY
4A2F CD6F4C   00242          CALL    MEMDIS
4A32 CD4900   00243          CALL    GETCH           ;WAIT ANY KEY
4A35 C1       00244          POP     BC
4A36 D1       00245          POP     DE
4A37 E1       00246          POP     HL
4A38 78       00247          LD      A,B             ;TEST FOR NO MORE
4A39 B1       00248          OR      C
4A3A 28B3     00249          JR      Z,FADDRX
4A3C 18E1     00250          JR      FADDR1          ;STILL SOME LEFT
49EF          00251 FADDRX   EQU     FBYTE2
              00252



              00253 ;        MOVE    MOVE A BLOCK OF MEMORY
              00254
4A3E CDA84A   00255 MOVE     CALL    WRCMD
4A41 4D       00256          DEFM    'MOVE,'
4A46 CD9E4A   00257          CALL    SETUP2          ;READ START-END-ADDR
4A49 CDBE4A   00258          CALL    WAITCR
4A4C 2A304D   00259          LD      HL,(START)
4A4F ED5B344D 00260          LD      DE,(NTRY)
4A53 ED4B324D 00261          LD      BC,(COUNT)
4A57 EDB0     00262          LDIR                    ;MOVE IT!!!
4A59 C35E43   00263          JP      MNLOOP
              00264
              00265 ;        BASIC TOGGLE
              00266
4A5C 3EC9     00267 BASIC    LD      A,0C9H          ;RETURN
4A5E 320C40   00268          LD      (400CH),A       ;BREAK VECTOR
4A61 CDC901   00269          CALL    CLS
4A64 C3191A   00270          JP      1A19H
              00271
              00272 ;        SETUP
              00273
4A67 CDEB4C   00274 SETUP    CALL    INHEX           ;READ ADDR
4A6A 22304D   00275          LD      (START),HL
4A6D 3E20     00276          LD      A,' '
4A6F CD3300   00277          CALL    DISPL
4A72 CDEB4C   00278          CALL    INHEX           ;READ ENDING ADDR
4A75 ED5B304D 00279          LD      DE,(START)      ;STARTING ADDR
4A79 B7       00280          OR      A               ;CLEAR CARRY
4A7A ED52     00281          SBC     HL,DE           ;END-START
4A7C DA894A   00282          JP      C,SETERR        ;START>END
4A7F 23       00283          INC     HL              ;BYTE COUNT
4A80 22324D   00284          LD      (COUNT),HL      ;SAVE   IT
4A83 3E20     00285          LD      A,' '
4A85 CD3300   00286          CALL    DISPL           ;DISPLAY AND RETURN
4A88 C9       00287          RET
4A89 310043   00288 SETERR   LD      SP,RENTRY       ;FLUSH  SP
4A8C C37543   00289          JP      MNERR
              00290
              00291 ;        SETUP1  HL=START, BC=BYTE COUNT, D=BYTE
              00292
4A8F CD674A   00293 SETUP1   CALL    SETUP
4A92 CDF44C   00294          CALL    HEXIN           ;READ BYTE
4A95 50       00295          LD      D,B             ;BYTE TO D
4A96 ED4B324D 00296          LD      BC,(COUNT)
4A9A 2A304D   00297          LD      HL,(START)
4A9D C9       00298          RET
              00299
              00300 ;        SETUP2  (START)=START ADDR, (COUNT)=BYTE COUNT,
```

Program continues

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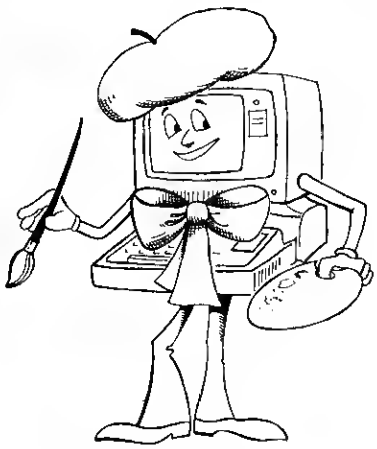
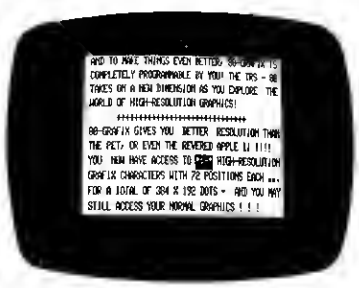
LOWER CASE
The 80-GRAFIX board includes two sets of lower case characters at no additional cost.





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The 80-GRAFIX board allows you to do inverse video to high-light your screen displays.

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The 80-GRAFIX board is supplied with a Character Generator software and several demonstration programs.

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80-GRAFIX gives the TRS-80 an effective screen of 384X192 pixels, versus the normal 127X192 for the TRS-80, 80X50 for the CBM/PET, or the 280X192 of an APPLE II. As an added feature, 80-GRAFIX offers you lower case characters at no additional cost. Of course, you can also create your own set of up to 64 original characters using the supplied Character Generator software.

The 80-GRAFIX board is simple to install (note that this voids your Radio Shack warranty), and programming is done through BASIC. 80-GRAFIX opens up a whole new realm of software development and excitement never dreamed of for the TRS-80!

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The supplied character generator software allows you to create your own character set of up to 64 original characters.

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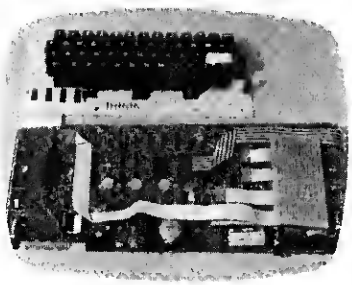
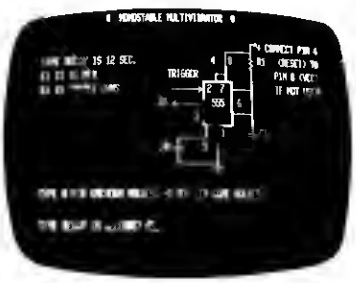
With the 80-GRAFIX board you can write exciting real-time games using BASIC.

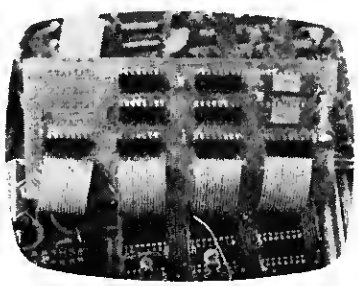


EASY INSTALLATION
The 80-GRAFIX board is simple to install and fits inside the TRS-80 case.

GRAPHICS GALORE
The 80-GRAFIX board and the supplied Character Generator allow you to become an artist.



ELECTRONIC OESIGN
The 80-GRAFIX board has unlimited application in Electronic design and Education.



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```
                00301 ;             (NTRY)= 16 BIT ADDR OR WORD
                00302
4A9E CD674A     00303 SETUP2  CALL    SETUP
4AA1 CDEB4C     00304         CALL    INHEX           ;GET ADDR
4AA4 22344D     00305         LD      (NTRY),HL
4AA7 C9         00306         RET
                00307
                00308
                00309 ;       ROM DEFINITIONS AND CONSTS
                00310
4020            00311 CURSOR  EQU     4020H
0049            00312 GETCH   EQU     0049H
0033            00313 DISPL   EQU     0033H
3C00            00314 VIDEO   EQU     3C00H
01C9            00315 CLS     EQU     01C9H
0E6C            00316 CVTBIN  EQU     0E6CH

0FBD            00317 CVTASC  EQU     0FBDH
0A7F            00318 CINT    EQU     0A7FH
0AB1            00319 CSNG    EQU     0AB1H
09A4            00320 PUSHAC  EQU     09A4H
0994            00321 TESTAC  EQU     0994H
0A9A            00322 HLACC   EQU     0A9AH
08A2            00323 FDIV    EQU     08A2H
0BF2            00324 MULT    EQU     0BF2H
0713            00325 FSUB    EQU     0713H
0716            00326 FADD    EQU     0716H
28A7            00327 OUTSTR  EQU     28A7H
                00328
                00329 ;       ZBUG SYSTEM DEFINITIONS
                00330
4AA8            00331 WRCMD   EQU     4AA8H+RL
4ABE            00332 WAITCR  EQU     4ABEH+RL
4D66            00333 DISPTR  EQU     4D66H+RL
4C6F            00334 MEMDIS  EQU     4C6FH+RL
4CCE            00335 HEXCV   EQU     4CCEH+RL
4CEB            00336 INHEX   EQU     4CEBH+RL
4CF4            00337 HEXIN   EQU     4CF4H+RL
4CC7            00338 STHL    EQU     4CC7H+RL
4C67            00339 FILL    EQU     4C67H+RL
4338            00340 ENTRY   EQU     4338H+RL
4300            00341 RENTRY  EQU     4300H+RL
435E            00342 MNLOOP  EQU     435EH+RL
4375            00343 MNERR   EQU     4375H+RL
4D32            00344 COUNT   EQU     4D32H+RL
4D30            00345 START   EQU     4D30H+RL
4D34            00346 NTRY    EQU     4D34H+RL
4D4E            00347 REGSTG  EQU     4D4EH+RL
4D36            00348 BRKTMP  EQU     4D36H+RL
                00349
4AA8            00350 LAST    EQU     $
                00351
4338            00352         END     ENTRY
00000 TOTAL ERRORS
```

Program Listing 1D. ZBUG

```
                00001 ;
                00002 ;       ZBUG PART 4
                00003
4300            00004 ORGN    DEFL    4300H
0000            00005 RL      DEFL    ORGN-4300H
                00006
4AA8            00007         ORG     4AA8H+RL
                00008
                00009 ;       GENERAL PURPOSE SUBROUTINES
                00010
                00011 ;       WRCMD   WRITE COMMAND NAME TO VIDEO
                00012
4AA8 E1         00013 WRCMD   POP     HL              ;GET STRING ADDR
4AA9 ED5B2040   00014         LD      DE,(CURSOR)
4AAD 7E         00015         LD      A,(HL)
4AAE 23         00016         INC     HL
4AAF FE2C       00017         CP      ','             ;TEST CHAR FOR ,
4AB1 2804       00018         JR      Z,WRC2          ;YES - QUIT
4AB3 12         00019         LD      (DE),A          ;WRITE TO VIDEO
4AB4 13         00020         INC     DE
4AB5 18F6       00021         JR      WRCMD+5
4AB7 E5         00022 WRC2    PUSH    HL              ;SAVE RETURN ADDR
4AB8 13         00023         INC     DE
4AB9 ED532040   00024         LD      (CURSOR),DE
4ABD C9         00025         RET
                00026
                00027 ;       WAITCR  WAIT FOR <ENTER> KEY TO BE PRESSED
                00028
4ABE CD4900     00029 WAITCR  CALL    GETCH           ;GET CHAR
4AC1 FE0D       00030         CP      13              ;TEST FOR CRLF
4AC3 C8         00031         RET     Z               ;YEP -- GO
4AC4 18F8       00032         JR      WAITCR
                00033
                00034 ;       LDSCRN  LOAD VIDEO SCREEN WITH ALL INFO
                00035
4AC6 CDC901     00036 LDSCRN  CALL    CLS
4AC9 11113C     00037         LD      DE,VIDEO+17
4ACC 21044E     00038         LD      HL,MNTTL
4ACF 011D00     00039         LD      BC,29
4AD2 EDB0       00040         LDIR                    ;TITLE
```

Program continues

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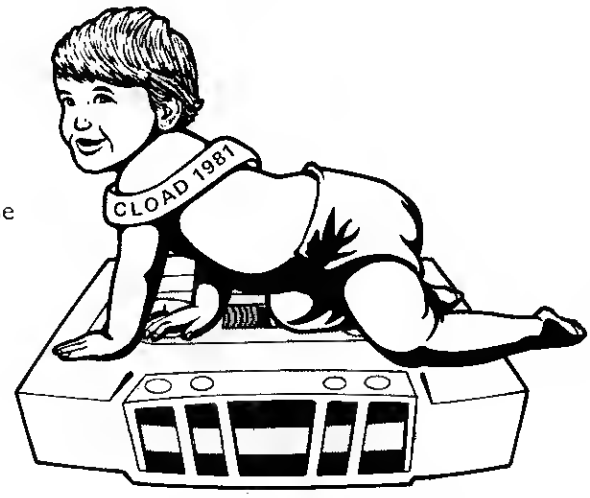

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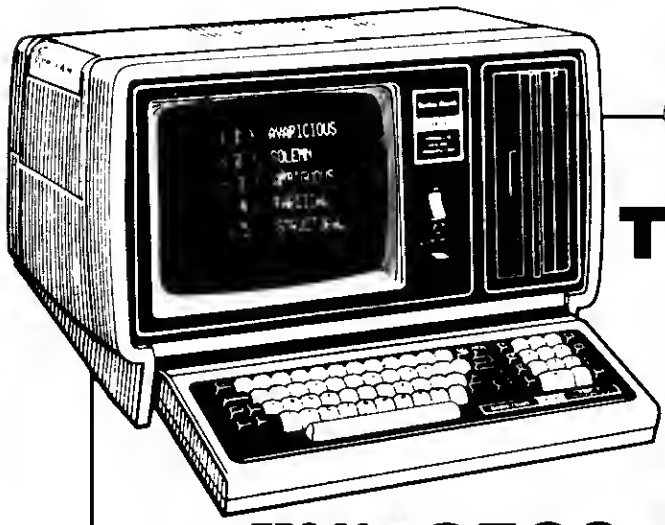

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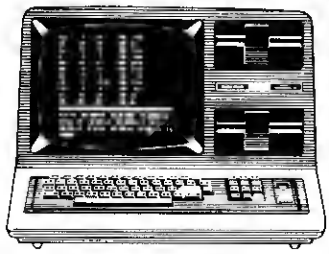

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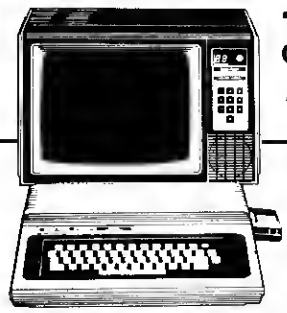

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```
4AD4 013000    00041          LD      BC,48
4AD7 21D44D    00042          LD      HL,TITLE
4ADA 11403C    00043          LD      DE,VIDEO+64      ;SUB-TITLE
4ADD EDB0      00044          LDIR
4ADF 010500    00045          LD      BC,5
4AE2 3A4D4D    00046          LD      A,(MODEFL)       ;TEST FOR ALPHA/HEX DISPL
4AE5 B7        00047          OR      A
4AE6 2005      00048          JR      NZ,LD1           ;ALPHA DISPLAY
4AE8 21CA4D    00049          LD      HL,HEX
4AEB 1803      00050          JR      LD2
4AED 21CF4D    00051 LD1      LD      HL,ALPHA
4AF0 EDB0      00052 LD2      LDIR                     ;MOVE CORRECT MESSAGE
               00053
4AF2 DD21BA4D  00054          LD      IX,REGCH         ;CHAR STRING
4AF6 FD214E4D  00055          LD      IY,REGSTG
4AFA 11803C    00056          LD      DE,VIDEO+128
4AFD 0604      00057          LD      B,4              ;NR. OF SECONDARY PAIRS
4AFF DD6E00    00058 LD3      LD      L,(IX)           ;GET REG PAIR NAME
4B02 DD6601    00059          LD      H,(IX+1)
4B05 CDC74C    00060          CALL    STHL             ;WRITE IT
4B08 DD23      00061          INC     IX
4B0A DD23      00062          INC     IX


4B0C 3E27      00063          LD      A,27H            ;QUOTE
4B0E 12        00064          LD      (DE),A           ;PRIMED REG NAME
4B0F 13        00065          INC     DE
4B10 13        00066          INC     DE
4B11 FD7E01    00067          LD      A,(IY+1)         ;FIRST REGISTER
4B14 CDCE4C    00068          CALL    HEXCV
4B17 CDC74C    00069          CALL    STHL
4B1A 13        00070          INC     DE
4B1B FD7E00    00071          LD      A,(IY)           ;SECOND REGISTER
4B1E CDCE4C    00072          CALL    HEXCV
4B21 CDC74C    00073          CALL    STHL
4B24 FD23      00074          INC     IY
4B26 FD23      00075          INC     IY
4B28 213700    00076          LD      HL,55            ;COUNT TO NEXT LINE
4B2B 19        00077          ADD     HL,DE
4B2C EB        00078          EX      DE,HL            ;BUMP PTR TO NEXT LINE
4B2D 10D0      00079          DJNZ    LD3              ;FINISH GROUP
               00080
4B2F 11C03D    00081          LD      DE,VIDEO+448
4B32 0604      00082          LD      B,4
4B34 DD21BA4D  00083          LD      IX,REGCH         ;SET UP PRIMARIES
4B38 DD6E00    00084 LD4      LD      L,(IX)           ;GET REG TITLE
4B3B DD6601    00085          LD      H,(IX+1)
4B3E CDC74C    00086          CALL    STHL             ;WRITE IT
4B41 DD23      00087          INC     IX
4B43 DD23      00088          INC     IX
4B45 13        00089          INC     DE
4B46 13        00090          INC     DE
4B47 FD7E01    00091          LD      A,(IY+1)         ;GET FIRST REG
4B4A CDCE4C    00092          CALL    HEXCV
4B4D CDC74C    00093          CALL    STHL
4B50 13        00094          INC     DE
4B51 FD7E00    00095          LD      A,(IY)           ;GET SECOND REG
4B54 CDCE4C    00096          CALL    HEXCV
4B57 CDC74C    00097          CALL    STHL
4B5A FD23      00098          INC     IY
4B5C FD23      00099          INC     IY
4B5E 213700    00100          LD      HL,55            ;COUNT TO END OF LINE
4B61 19        00101          ADD     HL,DE
4B62 EB        00102          EX      DE,HL            ;BUMP TO NEW LINE
4B63 10D3      00103          DJNZ    LD4
               00104
4B65 0604      00105          LD      B,4              ;SET UP FOR 16 BIT REGS
4B67 11003F    00106          LD      DE,VIDEO+768
4B6A DD21C24D  00107          LD      IX,REGCH2
4B6E DD6E00    00108 LD5      LD      L,(IX)           ;REG NAME
4B71 DD6601    00109          LD      H,(IX+1)
4B74 CDC74C    00110          CALL    STHL
4B77 DD23      00111          INC     IX
4B79 DD23      00112          INC     IX
4B7B 13        00113          INC     DE
4B7C 13        00114          INC     DE
4B7D FD7E01    00115          LD      A,(IY+1)         ;REG MSB VALUE
4B80 CDCE4C    00116          CALL    HEXCV
4B83 CDC74C    00117          CALL    STHL
4B86 FD7E00    00118          LD      A,(IY)           ;REG LSB VALUE
4B89 CDCE4C    00119          CALL    HEXCV
4B8C CDC74C    00120          CALL    STHL
4B8F FD23      00121          INC     IY
4B91 FD23      00122          INC     IY
4B93 213800    00123          LD      HL,56            ;COUNT TO END OF LINE
4B96 19        00124          ADD     HL,DE            ;BUMP LINE PTR
4B97 EB        00125          EX      DE,HL


4B98 10D4      00126          DJNZ    LD5              ;FINISH GROUP
               00127
4B9A CD6F4C    00128          CALL    MEMDIS           ;8 LINES X 16 BYTES
               00129
4B9D 11CB3E    00130          LD      DE,VIDEO+715
4BA0 DD2A644D  00131          LD      IX,(PCSAVE)      ;16 BYTES AT (PC)
4BA4 CD8B4C    00132          CALL    MEMOUT
4BA7 010400    00133          LD      BC,4
4BAA 214A4E    00134          LD      HL,M6
4BAD 11CB3E    00135          LD      DE,VIDEO+715     ;OVERWRITE ADDR WITH (PC)
4BB0 EDB0      00136          LDIR
               00137
```

Program continues

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(F) SUPER BRAIN QD
(G) STANDARD UNIMPLEMENTED

(M) Modified version available for use with CPM as implemented on Heath and TRS-80 Model I computers.

(T) For all (T) items listed above, the recommended system configuration consists of 48K CPM 2 full size disk drives, 24 x 80 CRT and 132 column printer.

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Stock No. #B26 — Price $25.00

```
4BB2 011100    00138          LD      BC,17
4BB5 110B3F    00139          LD      DE,VIDEO+779
4BB8 21394E    00140          LD      HL,M4
4BBB EDB0      00141          LDIR
4BBD 3A564D    00142          LD      A,(REGSTG+8)     ;GET F PRIMARY
4BC0 CD1A4C    00143          CALL    FLAGS            ;CONVERT BIT-BY-BIT
4BC3 010800    00144          LD      BC,8
4BC6 214E4E    00145          LD      HL,M7
4BC9 EDB0      00146          LDIR
4BCB 3A4E4D    00147          LD      A,(REGSTG)       ;GET F SECONDARY
4BCE CD1A4C    00148          CALL    FLAGS            ;CONVERT BIT-BY-BIT
               00149
4BD1 114B3F    00150          LD      DE,VIDEO+843
4BD4 21214E    00151          LD      HL,M1
4BD7 010D00    00152          LD      BC,13
4BDA EDB0      00153          LDIR
4BDC 0607      00154          LD      B,7              ;NUMBER OF BREAKPOINTS
4BDE DD21384D  00155          LD      IX,BRKAD
4BE2 13        00156 LD6      INC     DE               ;BUMP CURSOR
4BE3 DD7E00    00157          LD      A,(IX)           ;LSB
4BE6 DDB601    00158          OR      (IX+1)           ;MSB - TEST FOR ZERO
4BE9 2814      00159          JR      Z,LD7
4BEB DD7E01    00160          LD      A,(IX+1)         ;GET MSB AND CONVERT IT
4BEE CDCE4C    00161          CALL    HEXCV
4BF1 CDC74C    00162          CALL    STHL
4BF4 DD7E00    00163          LD      A,(IX)           ;GET LSB AND CONVERT IT
4BF7 CDCE4C    00164          CALL    HEXCV
4BFA CDC74C    00165          CALL    STHL
4BFD 1809      00166          JR      LD8
4BFF 2A374E    00167 LD7      LD      HL,(M3)          ;GET 'XX' CHARS
4C02 CDC74C    00168          CALL    STHL
4C05 CDC74C    00169          CALL    STHL
4C08 DD23      00170 LD8      INC     IX
4C0A DD23      00171          INC     IX               ;BRKPT TABLE POINTER
4C0C 10D4      00172          DJNZ    LD6
               00173
4C0E 010900    00174          LD      BC,9
4C11 118B3F    00175          LD      DE,VIDEO+907
4C14 212E4E    00176          LD      HL,M2
4C17 EDB0      00177          LDIR                     ;DISPLAY 'COMMAND:'
4C19 C9        00178          RET                      ;AND RETURN
               00179
4C1A 1B        00180 FLAGS    DEC     DE               ;GET PTR TO "-"
4C1B D5        00181          PUSH    DE
4C1C E1        00182          POP     HL
4C1D E5        00183          PUSH    HL
4C1E 13        00184          INC     DE
4C1F 010700    00185          LD      BC,7
4C22 EDB0      00186          LDIR                     ;PROPOGATE "-"
4C24 E1        00187          POP     HL               ;START ADDR
4C25 0653      00188          LD      B,'S'
4C27 CB7F      00189          BIT     7,A              ;SIGN BIT
4C29 2801      00190          JR      Z,$+3
4C2B 70        00191          LD      (HL),B
4C2C 23        00192          INC     HL
4C2D 065A      00193          LD      B,'Z'            ;ZERO BIT
4C2F CB77      00194          BIT     6,A
4C31 2801      00195          JR      Z,$+3
4C33 70        00196          LD      (HL),B
4C34 23        00197          INC     HL
4C35 0658      00198          LD      B,'X'            ;DON'T CARE
4C37 CB6F      00199          BIT     5,A
4C39 2801      00200          JR      Z,$+3
4C3B 70        00201          LD      (HL),B
4C3C 23        00202          INC     HL
4C3D 0648      00203          LD      B,'H'            ;HALF-CARRY
4C3F CB67      00204          BIT     4,A
4C41 2801      00205          JR      Z,$+3
4C43 70        00206          LD      (HL),B
4C44 23        00207          INC     HL
4C45 0658      00208          LD      B,'X'            ;DON'T CARE
4C47 CB5F      00209          BIT     3,A
4C49 2801      00210          JR      Z,$+3
4C4B 70        00211          LD      (HL),B
4C4C 23        00212          INC     HL
4C4D 0656      00213          LD      B,'V'            ;PARITY/OVERFLOW
4C4F CB57      00214          BIT     2,A
4C51 2801      00215          JR      Z,$+3
4C53 70        00216          LD      (HL),B
4C54 23        00217          INC     HL
4C55 064E      00218          LD      B,'N'            ;SUBTRACT FLAG
4C57 CB4F      00219          BIT     1,A
4C59 2801      00220          JR      Z,$+3
4C5B 70        00221          LD      (HL),B
4C5C 23        00222          INC     HL
4C5D 0643      00223          LD      B,'C'            ;CARRY FLAG
4C5F CB47      00224          BIT     0,A
4C61 2801      00225          JR      Z,$+3
4C63 70        00226          LD      (HL),B
4C64 23        00227          INC     HL
4C65 EB        00228          EX      DE,HL
4C66 C9        00229          RET
               00230
4C67 72        00231 FILL     LD      (HL),D           ;STORE D AT (HL)
4C68 23        00232          INC     HL
4C69 0B        00233          DEC     BC               ;DEC BYTE COUNT
4C6A 78        00234          LD      A,B
4C6B B1        00235          OR      C                ;TEST FOR DONE
4C6C 20F9      00236          JR      NZ,FILL
4C6E C9        00237          RET
               00238
4C6F DD2A664D  00239 MEMDIS   LD      IX,(DISPTR)      ;SET UP MEMORY DISPLAY
4C73 118B3C    00240          LD      DE,VIDEO+139     ;SET CURSOR
4C76 CD8B4C    00241          CALL    MEMOUT           ;ONE 16 BYTE LINE
4C79 CD8B4C    00242          CALL    MEMOUT
```

Program continues

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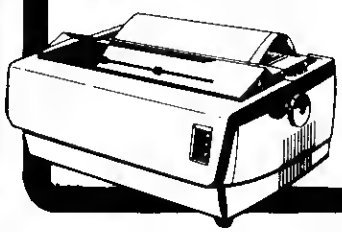

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```
4C7C CD8B4C   00243          CALL    MEMOUT
4C7F CD8B4C   00244          CALL    MEMOUT
4C82 CD8B4C   00245          CALL    MEMOUT
4C85 CD8B4C   00246          CALL    MEMOUT
4C88 CD8B4C   00247          CALL    MEMOUT          ;THIS IS 7 - FALL INTO 8
              00248
4C8B DDE5     00249 MEMOUT   PUSH    IX              ;SAVE MEM ADDR
4C8D C1       00250          POP     BC
4C8E 79       00251          LD      A,C             ;GET LSB FOR CONV


4C8F CDCE4C   00252          CALL    HEXCV
4C92 E5       00253          PUSH    HL
4C93 78       00254          LD      A,B             ;GET MSB FOR CONV
4C94 CDCE4C   00255          CALL    HEXCV
4C97 CDC74C   00256          CALL    STHL            ;STORE IT
4C9A E1       00257          POP     HL
4C9B CDC74C   00258          CALL    STHL            ;STORE LSB
4C9E 0610     00259          LD      B,16            ;BYTES PER LINE
4CA0 13       00260 MEM1     INC     DE
4CA1 3A4D4D   00261          LD      A,(MODEFL)      ;ALPHA/HEX
4CA4 B7       00262          OR      A
4CA5 2019     00263          JR      NZ,MEM2
4CA7 DD7E00   00264          LD      A,(IX)          ;GET BYTE
4CAA CDCE4C   00265          CALL    HEXCV
4CAD CDC74C   00266 MEM3     CALL    STHL
4CB0 DD23     00267          INC     IX
4CB2 3E09     00268          LD      A,9
4CB4 B8       00269          CP      B               ;TEST FOR 8 DONE
4CB5 2001     00270          JR      NZ,$+3
4CB7 13       00271          INC     DE
4CB8 10E6     00272          DJNZ    MEM1            ;LOOP FOR REST
4CBA 210B00   00273          LD      HL,11
4CBD 19       00274          ADD     HL,DE           ;POSITION NEW LINE
4CBE EB       00275          EX      DE,HL
4CBF C9       00276          RET
4CC0 DD6600   00277 MEM2     LD      H,(IX)          ;GET CHAR
4CC3 2E20     00278          LD      L,' '
4CC5 18E6     00279          JR      MEM3            ;STORE CHAR IN ALPHA
              00280
4CC7 EB       00281 STHL     EX      DE,HL           ;STORE HL AT (DE)
4CC8 72       00282          LD      (HL),D
4CC9 23       00283          INC     HL
4CCA 73       00284          LD      (HL),E
4CCB 23       00285          INC     HL
4CCC EB       00286          EX      DE,HL
4CCD C9       00287          RET
              00288
4CCE 4F       00289 HEXCV    LD      C,A             ;CONVERT HEX TO ASCII
4CCF CB3F     00290          SRL     A
4CD1 CB3F     00291          SRL     A
4CD3 CB3F     00292          SRL     A
4CD5 CB3F     00293          SRL     A               ;HIGH NYBBLE TO LOW
4CD7 CDE34C   00294          CALL    HEX1            ;CONVERT LEFT NYBBLE
4CDA 67       00295          LD      H,A
4CDB 79       00296          LD      A,C
4CDC E60F     00297          AND     0FH             ;GET LOW NYBBLE
4CDE CDE34C   00298          CALL    HEX1            ;CONVERT IT
4CE1 6F       00299          LD      L,A
4CE2 C9       00300          RET
4CE3 C630     00301 HEX1     ADD     A,'0'           ;ADD ASCII BIAS
4CE5 FE3A     00302          CP      '9'+1           ;TEST FOR A-F
4CE7 F8       00303          RET     M
4CE8 C607     00304          ADD     A,7             ;ADD MORE BIAS
4CEA C9       00305          RET
              00306
4CEB CDF44C   00307 INHEX    CALL    HEXIN           ;INPUT 16 BIT HEX VALUE
4CEE 60       00308          LD      H,B
4CEF CDF44C   00309          CALL    HEXIN
4CF2 68       00310          LD      L,B
4CF3 C9       00311          RET
              00312
4CF4 CD0E4D   00313 HEXIN    CALL    HEX2            ;GET 8 BIT HEX VALUE
4CF7 CB27     00314          SLA     A


4CF9 CB27     00315          SLA     A
4CFB CB27     00316          SLA     A
4CFD CB27     00317          SLA     A               ;MAKE LEFT NYBBLE
4CFF 47       00318          LD      B,A
4D00 79       00319          LD      A,C             ;SET UP DISPLAY
4D01 CD3300   00320          CALL    DISPL
4D04 CD0E4D   00321          CALL    HEX2
4D07 80       00322          ADD     A,B
4D08 47       00323          LD      B,A             ;8 BIT VALUE IN B
4D09 79       00324          LD      A,C             ;SET UP DISPL
4D0A CD3300   00325          CALL    DISPL           ;DISPLAY AND RETURN
4D0D C9       00326          RET
4D0E CD4900   00327 HEX2     CALL    GETCH           ;GET CHAR
4D11 4F       00328          LD      C,A             ;SAVE IT
4D12 D630     00329          SUB     '0'             ;REMOVE BIAS
4D14 FA0E4D   00330          JP      M,HEX2
4D17 FE0A     00331          CP      10              ;TEST FOR NUMERIC
4D19 F8       00332          RET     M
4D1A D607     00333          SUB     7               ;TEST FOR A-F
4D1C FA0E4D   00334          JP      M,HEX2
4D1F FE10     00335          CP      16
4D21 F8       00336          RET     M
4D22 18EA     00337          JR      HEX2
              00338
4D24 CD4900   00339 GETCH2   CALL    GETCH
4D27 C33300   00340          JP      DISPL
              00341
```

Program continues

PROGRAM LIKE THIS

```
5 '<<BEGINNING<<
10 //MENU LINE//$="1. ENTER NAMES":LINE #//=3:GOSUB>>PRINT LINE
20 //MENU LINE//$="2. PRINT NAMES":LINE #//=4:GOSUB>>PRINT LINE
30 INPUT"ENTER SELECTION";//SELECTION//
40 ON//SELECTION//GOSUB>>ENTER NAMES,>>PRINT NAMES
50 GOTO>>BEGINNING
60 '<<PRINT LINE<<
70 PRINT@(//LINE #//,0),//MENU LINE//$;
80 RETURN
90 '<<ENTER NAMES<<
100 'PROGRAM HERE
110 RETURN
120 '<<PRINT NAMES<<
130 'PROGRAM HERE
140 RETURN
```

OR PROGRAM LIKE THIS

```
DO UNTIL; SELECTION <> 0 AND SELECTION < 2
. CALL; DISPLAY-MENU
. CALL; ACCEPT-INPUT
. DO CASE;
. . WHEN SELECTION=1
. . .'PROGRAM HERE
. . ..END;
. . WHEN SELECTION=2
. . . 'PROGRAM HERE
. . ..END;
. ..END;
..END;
EXIT
PROC; DISPLAY-MENU
. LINE-NO=3
. TEXT-LINES="1. ENTER NAMES"
. CALL; PRINT-LINE
. LINE-NO=4
. TEXT-LINES="2. PRINT NAMES"
. CALL; PRINT-LINE
..END;
PROC; PRINT-LINE
. PRINT@(LINE-NO,0), TEXT-LINES
..END;
PROC; ACCEPT-INPUT
. INPUT "ENTER SELECTION"; SELECTION
..END;
```

SL/B

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```
                00342 ;         ROM SYSTEM DEFINITIONS
                00343
0049            00344 GETCH     EQU     49H
0033            00345 DISPL     EQU     33H
01C9            00346 CLS       EQU     1C9H
3C00            00347 VIDEO     EQU     3C00H
4020            00348 CURSOR    EQU     4020H
                00349
                00350 ;         STORAGE DEFINITION
                00351
4D2A 20         00352 NAME      DEFM    '      '
4D30 0000       00353 START     DEFW    0
4D32 0000       00354 COUNT     DEFW    0
4D34 0000       00355 NTRY      DEFW    0
4D36 0000       00356 BRKTMP    DEFW    0
4D38 0000       00357 BRKAD     DEFW    0
4D3A 0000       00358           DEFW    0
4D3C 0000       00359           DEFW    0
4D3E 0000       00360           DEFW    0
4D40 0000       00361           DEFW    0
4D42 0000       00362           DEFW    0
4D44 0000       00363           DEFW    0
4D46 0000       00364 BRKSV     DEFW    0
4D48 0000       00365           DEFW    0
4D4A 0000       00366           DEFW    0
4D4C 00         00367           DEFB    0
4D4D 00         00368 MODEFL    DEFB    0
4D4E            00369 REGSTG    EQU     $
0018            00370           DEFS    24
4D66            00371 REGPTR    EQU     $
4D62            00372 SPSAVE    EQU     $-4
4D64            00373 PCSAVE    EQU     $-2
4D66 0000       00374 DISPTR    DEFW    0
4D68 41         00375 CMDTAB    DEFM    'ABCDFGHIJLMQRSWXZ.,@*'
4D7D 5B         00376           DEFB    5BH
4D7E 0A         00377           DEFB    0AH
4D7F FB49       00378 CMDENT    DEFW    49FBH+RL        ;A-FADDR
4D81 1D44       00379           DEFW    441DH+RL        ;B-BRKPT
4D83 A443       00380           DEFW    43A4H+RL        ;C-CLR
4D85 9644       00381           DEFW    4406H+RL        ;D-DIS
4D87 D043       00382           DEFW    43D0H+RL        ;F-FIXUP
4D89 8644       00383           DEFW    4486H+RL        ;G-GO
4D8B 6849       00384           DEFW    4968H+RL        ;H-HEX
4D8D DE48       00385           DEFW    48DEH+RL        ;I-INT
4D8F 7344       00386           DEFW    4473H+RL        ;J-JUMP
4D91 3B45       00387           DEFW    453BH+RL        ;L-LOAD
4D93 3E4A       00388           DEFW    4A3EH+RL        ;M-MOVE
4D95 C249       00389           DEFW    49C2H+RL        ;Q-FBYTE
4D97 B144       00390           DEFW    44B1H+RL        ;R-REG
4D99 5948       00391           DEFW    4859H+RL        ;S-SET
4D9B 9645       00392           DEFW    4596H+RL        ;W-WRITE
4D9D A249       00393           DEFW    49A2H+RL        ;X-EXCHG
4D9F CE48       00394           DEFW    48CEH+RL        ;Z-ZAP
4DA1 4C46       00395           DEFW    464CH+RL        ;.-CATLOG
4DA3 4947       00396           DEFW    4749H+RL        ;,-CPYSYS
4DA5 6944       00397           DEFW    4469H+RL        ;@-MODE
4DA7 5C4A       00398           DEFW    4A5CH+RL        ;*-BASIC TOGGLE
4DA9 5C44       00399           DEFW    445CH+RL        ;UP ARROW
4DAB 5744       00400           DEFW    4457H+RL        ;DOWN ARROW
4DAD 2A         00401 EMSG      DEFM    '*INPUT ERROR*'
4DBA 46         00402 REGCH     DEFM    'FACBEDLH'
4DC2 58         00403 REGCH2    DEFM    'XIYIPSCP'
4DCA 48         00404 HEX       DEFM    'HEX  '
4DCF 41         00405 ALPHA     DEFM    'ALPHA'
4DD4 52         00406 TITLE     DEFM 'REGISTERS  ADDR MEMORY CONTENTS    MODE = '
4E04 2A         00407 MNTTL     DEFM    '* * * SUPER BUG MONITOR * * *'
4E21 42         00408 M1        DEFM    'BREAKPOINTS -'
4E2E 43         00409 M2        DEFM    'COMMAND: '
4E37 58         00410 M3        DEFM    'XX'
4E39 46         00411 M4        DEFM    'FLAGS SET   '
4E45 46         00412 M5        DEFM    'F = -'
4E4A 28         00413 M6        DEFM    '(PC)'
4E4E 20         00414 M7        DEFM    '   F'
4E52 27         00415           DEFB    27H
4E53 3D         00416           DEFM    '= -'
4E56 43         00417 CTITLE    DEFM    'CATALOGING - "'
4E64 0D         00418 P1        DEFB    13
4E65 42         00419           DEFM    'BLK NR ="'
4E6E 20         00420 P2        DEFM    '   BYTE CT ="'
4E7B 20         00421 P3        DEFM    '   LD ADDR = "'
4E89 0D         00422 P4        DEFB    13
4E8A 54         00423           DEFM    'TRA ADDR = "'
4E96 52         00424 MS1       DEFM    'READING - "'
4EA1 0D         00425 MS2       DEFB    13
4EA2 0D         00426           DEFB    13
4EA3 52         00427           DEFM    'READY NEW CASSETTE"'
4EB6 50         00428 MS3       DEFM    'PRESS @ TO RELIST, '
4EC9 50         00429 MS5       DEFM    'PRESS ANY KEY TO CONTINUE"'
4EE3 50         00430 MS4       DEFM    'PRESS @ TO REWRITE, ANY OTHER KEY TO RETURN"'
4F0F 57         00431 MS6       DEFM    'WRITING TAPE"'
                00432
                00433
4338            00434           END     4338H+RL
00000 TOTAL ERRORS
```

Program Listing 2.

```
                00001 ;         THIS IS A DOS TO LEVEL-II RE-BOOT
                00002 ;         WHICH WILL ALLOW ANY LEVEL-II
```

Program continues

puter.

In order to convert it, delete the duplicated ROM entry point definitions in the EQU section of each source module. Delete all of the ZBUG system entry point definitions in the EQU section of each. Delete every one of the END statements, but the last.

It may be necessary to delete the comment statements from the source modules to assemble it in a 32K system.

Delete the origin definition statements from parts two, three and four. The relocation scheme used in the program will still work.

Or, you can delete the definition of label RL in part one and all references to RL throughout the program. Change the entries in the CMDENT table to the label of the routine, if desired, in order to prevent problems with future user modification.

Once converted and reassembled, I would advise you to rewrite the system tape. Use ZBUG, because the largest record size written by Radio Shack's Editor/Assembler is 128 bytes.

A version assembled in high RAM addresses, such as for the disk, can be loaded in protected memory and used with a BASIC program. I have used this technique successfully to debug assembly routines linked to BASIC programs with the USR statement.

When allocating memory size, remember to allow enough room for the monitor, its stack (which starts just before the monitor) and any assembled routine loaded. ■

```
                    00003 ;       DEPENDENT ASSEMBLY PROGRAM TO RUN
                    00004 ;       UNDER THE DOS SYSTEM.  DOS MUST BE
                    00005 ;       COMPLETELY REINITIALIZED WHEN DONE.
                    00006
                    00007 ;       THIS CODE WAS EXTRACTED FROM THE ROM
                    00008 ;       CHIP STARTING AT ADDRESS X'0000' AND
                    00009 ;       FOLLOWING THE LOGIC IGNORING THE DISK
                    00010 ;       STATUS AND "MEMORY SIZE?" PROMPTS.
                    00011 ;       ADDRESS X'0000' IS WHERE YOU GO WHENEVER
                    00012 ;       YOU POWER UP THE COMPUTER
                    00013
                    00014
                    00015 ;*****************************************
                    00016 ;*ENTER YOUR ENTRY POINT ADDRESS IN "ORG" *
                    00017 ;*****************************************
                    00018
BF70                00019         ORG     0BF70H
BF70 F3             00020 INIT    DI                      ;DISABLE INTERRUPTS
BF71 AF             00021         XOR     A
BF72 21D206         00022         LD      HL,06D2H        ;VECTOR LOCATION IN ROM
BF75 114040         00023         LD      DE,4040H        ;VECTOR AREA
BF78 013600         00024         LD      BC,36H
BF7B EDB0           00025         LDIR                    ;SET VECTOR AREA
BF7D 3D             00026         DEC     A
BF7E 3D             00027         DEC     A
BF7F 20F1           00028         JR      NZ,INIT+2       ;WASTE TIME
BF81 0627           00029         LD      B,27H
BF83 12             00030 INIT2   LD      (DE),A          ;ZERO NEXT 39 BYTES
BF84 13             00031         INC     DE
BF85 10FC           00032         DJNZ    INIT2
BF87 118040         00033         LD      DE,4080H
BF8A 21F718         00034         LD      HL,18F7H
BF8D 012700         00035         LD      BC,27H
BF90 EDB0           00036         LDIR                    ;NEXT TRANSFER
BF92 21E541         00037         LD      HL,41E5H
BF95 363A           00038         LD      (HL),3AH
BF97 23             00039         INC     HL
BF98 70             00040         LD      (HL),B          ;STORE ZERO
BF99 23             00041         INC     HL
BF9A 362C           00042         LD      (HL),2CH
BF9C 23             00043         INC     HL
BF9D 22A740         00044         LD      (40A7H),HL
BFA0 112D01         00045         LD      DE,012DH        ;ADDRESS OF "?L3" ROUTINE
BFA3 061C           00046         LD      B,1CH           ;NR OF "DOS" BASIC CMDS
BFA5 215241         00047         LD      HL,4152H        ;START OF BASIC CMD LINKS
BFA8 36C3           00048 INIT3   LD      (HL),0C3H       ;"JUMP" OP-CODE
BFAA 23             00049         INC     HL
BFAB 73             00050         LD      (HL),E
BFAC 23             00051         INC     HL
BFAD 72             00052         LD      (HL),D          ;STORE ADDRESS OF "?L3"
BFAE 23             00053         INC     HL
BFAF 10F7           00054         DJNZ    INIT3
BFB1 0615           00055         LD      B,15H           ;NR OF EXTENSIONS LINKS
BFB3 36C9           00056 INIT4   LD      (HL),0C9H       ;"RETURN" OP-CODE
BFB5 23             00057         INC     HL
BFB6 23             00058         INC     HL
BFB7 23             00059         INC     HL
BFB8 10F9           00060         DJNZ    INIT4
BFBA 21E842         00061         LD      HL,42E8H
BFBD 70             00062         LD      (HL),B



BFBE 31F841         00063         LD      SP,41F8H
BFC1 CD8F1B         00064         CALL    1B8FH           ;"NEW"
                    00065
                    00066
                    00067 ;*****************************************
                    00068 ;*ENTER THE ENTRY POINT INTO YOUR ROUTINE *
                    00069 ;*     IN THE JUMP INSTRUCTION BELOW     *
                    00070 ;*****************************************
                    00071
BFC4 C338B3         00072         JP      0B338H
                    00073
BF70                00074         END     INIT
00000 TOTAL ERRORS
```

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BUSINESS 100 PROGRAM LIST

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	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQUOQ	Fixed quantity economic order quantity model

NAME	DESCRIPTION
53 FQEOWSH	As above but with shortages permitted
54 FQEOQPB	As above but with quantity price breaks
55 QUEUECB	Cost-benefit waiting line analysis
56 NCFANAL	Net cash-flow analysis for simple investment
57 PROFIND	Profitability index of a project
58 CAPI	Cap. Asset Pr. Model analysis of project
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	DOME 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 RRCONVBD	Investor's rate of return on convertable bond
100 PORTVAL9	Stock market portfolio storage-valuation program

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- SCHEDULE C TAX COMPUTATION

★ INCOME TAX PAC B
FOR LEVEL II with or without Printer, Cassette or Disk. Has all features of Income Tax A **PLUS,**
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- FORMATS FORM 1040 and 1040A FOR TRACTOR FEED FORMS
- SCHEDULE C INCOME FROM A PERSONALLY OWNED BUSINESS
- FORM 2106 EMPLOYEE BUSINESS EXPENSE

★ ★ PROFESSIONAL ★ ★ INCOME TAX PAC C

- FORM 1040 (LONG FORM)
- FORM 1040A (SHORT FORM)
- FORM 2106 EMPLOYEE BUSINESS EXPENSE
- FORM 2440 DISABILITY INCOME EXCLUSION
- FORM 2441 CREDIT FOR CHILD AND DEPENDENT CARE EXPENSES
- FORMS 3903 MOVING EXPENSE ADJUSTMENT
- FORM 4797 SUPPLEMENTAL SCHEDULE OF GAINS AND LOSSES
- SCHEDULE A ITEMIZED DEDUCTIONS
- SCHEDULE B INTEREST AND DIVIDENDS
- SCHEDULE C PROFIT (OR LOSS) FROM BUSINESS OR PROFESSION
- SCHEDULE D CAPITAL GAINS AND LOSSES
- SCHEDULE E SUPPLEMENTAL INCOME SCHEDULE
- SCHEDULE G INCOME AVERAGING
- SCHEDULES R & RP-CREDIT FOR THE ELDERLY
- SCHEDULE SE-COMPUTATION OF SOCIAL SECURITY SELF-EMPLOYMENT TAX
- SCHEDULE TC TAX COMPUTATION
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PAYROLL

Payroll invoices many complex calculations and the production of reports and documents, many of which are required by government agencies. It is an ideal candidate for the computer. With this Payroll system in-house, you can promptly and accurately pay your employees and generate accruate documents/reports to management, employees, and appropriate government agencies concerning earnings, taxes, and other deductions. The package has been converted to the TRS-80™ and is now a well documented, op-line, interactive, micro-computer system with the capabilities of (or exceeding) many larger systems.

CAPABILITIES:

- ★ performs all necessary payroll tasks including:
  - file maintenance, pay data entry and verification
  - computation of pay and deduction amounts
  - printing of reports and checks
- ★ can handle salaried and hourly employees
- ★ employees can receive:
  - hourly or salary wage
  - vacation pay
  - holiday pay
  - piecework pay
  - overtime pay
- ★ employees can be paid using any combination of pay types (except, hourly cannot receive salary and salary cannot receive hourly)
- ★ special non-taxable or taxable lump sums can be paid regularly or one time (bonus, reimbursements, etc)
- ★ health and welfare deductions can be automatically calculated for each employee
- ★ earnings-to-date are accumulated and added to permanent records; taxes are computed and deducted: US income tax, Social Security tax, state income tax, other deductions (regular or one time)
- ★ paychecks are printed; computer checks with your company letterhead can be purchased from SBSG
- ★ calculations are accumulated for; employee pay history, 941A report, W-2 report, insurance report, absentee report
- ★ fully linked to General Ledger. Each employee's payroll information can be distributed to as many as (12) twelve different GL accounts; system automatically posts to cash account

INVENTORY CONTROL/INVOICING

- ★ **ISAM** (Indexed Sequential Access Method) eliminates the necessity for time consuming sort.
- ★ Pre-Allocated Files for IMMEDIATE update and inquiry capabilities.
- ★ Fast Disk storage and retrieval.
- ★ Inventory Master Record includes...class...SKU...Division...Retail...Cost...Beginning Balance...Period Sale Units...Period Receipts...On Order...On Hand...Minimum Reorder Point...Recommended Reorder Amount...Vendor Number...Period Sale Dollars...YTD Sale Units...YTD Sale Dollars.
- ★ Calculated and Displayed Formulas include...Gross Margin ($)...Gross Margin (%)...Gross Margin ROI (%)...Average Inventory Retail ($)...Average Inventory Cost ($)...Turn-Over (%).
- ★ Reports Generated include...Master File Listing...Class Description Listing...Transaction Audit Trail...Minimum Reorder Point by Vendor...Retail Price List...Retail & Cost Price List...Period Sales Report ...Year to Date Sales Report...Stock Status (Screen or printer output) ...Commission Report (for salesmen and buyers).
- ★ Transaction Types include...Sales, Vendor Receipts...Vendor Orders...Customer Returns...Vendor Returns...Transfer Stock.

GENERAL LEDGER

The General Ledger accounting system consolidates financial data from other accounting subsystems (A/R, A/P, Payroll, direct posting) in an accurate and timely manner. Major reports include the Income Statement and Balance Sheet and a "special" report designed by management. The beauty of this General Ledger system is that it is completely user formatted. You "customize" the account numbers, descriptions, and report formats to suit particular business requirements. These programs were developed 5 years ago for the Wang micro-computer and have been tested in many environments since then. The package has been converted to the TRS-80™ and is now a well documented, on-line, interactive micro-computer system with the capabilities of (or exceeding) many larger systems.

CAPABILITIES:

- ★ more than 200 chart of accounts can be handled
- ★ account number structure is user defined and controlled
- ★ more than 1,750 transactions may be entered via:
  - direct posting; done by hand; validated against the account file before acceptance
  - external posting; generated by A/R, A/P, Payroll or any other user source
- ★ data is maintained and reported by:
  - month
  - quarter
  - year
  - previous three quarters
- ★ reports (samples on back) include:
  - trial balances
  - income statement
  - balance sheet
  - special accounts reports and more.....
- ★ user formats reports with the following designated as you wish:
  - titles
  - headings
  - account numbers
  - descriptions
  - subtotals
  - totals
  - skip lines
  - skip pages
- ★ up to eight levels of totals - fully user designated
- ★ menu driven; easy to use; full screen prompting and cursor control

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MICROSOFT BASIC COMPILER

With TRS-80™ BASIC Compiler, your Level II programs will run at record speeds! Compiled programs execute an average of 3-10 times faster than programs run under Level II. Make extensive use of integer operations, and get speeds 20-30 times faster than the interpreter.

Best of all, BASIC Compiler does it with BASIC, the language you already know. By compiling the same source code that your current BASIC interprets, BASIC Compiler adds speed with a minimum of effort.

And you get more BASIC features to program with, since features of Microsoft's Version 5.0 BASIC interpreter are included in the package. Features like the WHILE...WEND statement, long variable names, variable length records, and the CALL statement make programming easier. An exclusive BASIC Compiler feature lets you call FORTRAN and machine language subroutines much more easily than in Level II.

Simply type in and debug your program as usual, using the BASIC interpreter. Then enter a command line telling the computer what to compile and what options to use.

Voila! Highly optimized, Z-80 machine code that your computer executes in a flash! Run it now or save it for later. Your compiled program can be saved on disk for direct execution every time.

Want to market your programs? Compiled versions are ideal for distribution. You distribute only the object code, not the source, so your genius stays fully protected.

BASIC Compiler runs on your TRS-80™ Model I with 48K and disk drive. The package includes BASIC Compiler, linking loader and BASIC library with complete documentation **$195.00**

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Does Form 1040 and 1040A
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- Schedule B interest and dividends
- Output to video display
- Schedule TC tax computation

INCOME TAX PAC B ..... **$49.95...Cassette or Diskette)**
For Level II 16K with or without printer...cassette or disk has all features of Income Tax Pac A **Plus** works with or without line printer.
- Formats Form 1040 and 1040A for standard tax forms
- Schedule C income from a personally owned business
- Form 2106 employee business expense

PROFESSIONAL INCOME TAX PAC C ..... **$99.95...Diskette**
For Level II 32K with disk and printer (optional)
Has all features of Income Tax Pac B **Plus** automatic memory storage for income tax preparers.
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- Can be used with any Apple II Computer.
- 100% money back guarantee (returned for any reason).
- Uses 4 factors (speed rating, track variant, distance of the present race, distance of the last race).
- Using the above factors, the Horse Selector calculates the estimated odds. BET on horses whose actual payoff (from the Tote Board or Morning Lines) is higher than payoff based on estimated odds.
- Using the above factors, the Horse Selector calculates the estimated odds. BET on any selected horse with an estimated payoff (based on Tote Board or Morning Lines) higher than calculated payoff (based on Horse Selector II).
- Source listing for the TRS-80™, TI-59, HP-67, HP-41, Apple and BASIC Computers.
- No computer or calculator necessary (although a calculator would be helpful for the simple division used to calculate estimated odds).

FREE Dutching Tables allows betting on 2 or more horses with a guaranteed profit.

NEWDOS/80

A **New** enhanced NEWDOS for TRS-80™ Model I for the 1980's

Apparat Inc., announces the most powerful Disk Operating System for the TRS-80™. It has been designed for the sophisticated user and professional programmer who demands the ultimate in disk operating systems.

NEWDOS/80 is not meant to replace the present version of NEWDOS 2. 1 which satisfies most users, but is a carefully planned upward enhancement, which significantly extends NEWDOS 2. 1's capabilities. This new member to the Apparat NEWDOS' family is upward compatible with present NEWDOS 2. 1 and is supplied on Diskette, complete with enhanced NEWDOS + utility programs and documentation. Some of the NEWDOS/80 features are:
- New BASIC commands that supports with variable record lengths up to 4095 Bytes long.
- New BASIC commands that supports with variable record lengths up to 4095 Bytes long.
- Mix or match disk drives. Supports any track count from 18 to 80. Use 35, 40 or 77 track 5" mini disk drives or 8" disk drives, or any combination.
- A security boot-up for BASIC or machine code application programs. User never sees "DOSREADY" or "READY" and is unable to "BREAK", clear screen, or issue any direct BASIC statement including "LIST."
- New editing commands that allow program lines to be deleted from one location and moved to another or to allow the duplication of a program line with the deletion of the original.
- Enhanced and improved RENUMBER that allows relocation of subroutines.
- Powerful program chaining.
- Device hanging for routing to display and printer simultaneously.
- CDE function; simultaneous striking of the C, D and E keys will allow user to enter a mini-DOS to perform some DOS commands without disturbing the resident program.
- Upward compatible with NEWDOS 2. 1 and TRSDOS 2.3.
- Includes Superzap 3.0 and all Apparat 2.1 utilities.

..... **$149.00**

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1. The system is designed for the active "trader" not the "long term" investor, as the system is "technically" oriented.
2. For the TRS-80™ Model I, Level II, 16K or more. Available in both disk and tape versions.
3. Tracks user selected issues, in a technical system that reflects the issue's performance against the overall market.
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5. Daily issue data, "high", "low", "close" and "volume" are input from any newspaper containing this information.
6. Daily overall market, "volume" and "closing Dow" are also provided from a newspaper.
7. Volume and price changes of an issue, as they compare to volume an price changes of the overall market, are the basis of this system's analysis of the given issue.
8. Comparisons of the issue against itself are also done. This may allow the user to spot "unusual" activity on this issue.
9. Clear indications are given as to whether the issue is "out performing", "under performing" or "performing" with the market.
10. Complete video and printed output is provided.
11. This program is intended to be a guide to indications, and is not to be used as a sole recommendation to buy, sell or hold an issue. These decisions are the responsibility of the user and his brokerage.

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(2) GENERAL LEDGER, ACCOUNTS RECEIVABLE, ACCOUNTS PAYABLE, INVENTORY CONTROL, INVOICING AND PAYROLL (Small Business Systems Group)...an extensive business system for the serious user...can be used one module at a time or as a co-ordinated system...$225...per module. $1299 for the complete system.

(3) GENERAL LEDGER, ACCOUNTS RECEIVABLE, ACCOUNTS PAYABLE, INVENTORY CONTROL AND PAYROLL (Compumax) a complete user oriented business system...can be used one module at a time or as a coordinated system...$140 per module... $995 for the complete system.

(4) MOD-II UTILITY PACKAGE (Racet Computes)... adds important utilities to TRSDOS ..copy files selectively...faster and more accurate file copying... repair bad directories ..displays sorted directory of all files on 1 to 4 disk drives...SUPERZAP...change disk ID ..and more. $150.

(5) ADVENTURE #1-#9 (Scott Adams - Adventure International) .a series of games formally only available on the large computers...your goal is to work your way through a maze of obstacles in order to recover a secret treasure or complete a mission .the package includes all 9 Adventures written by Scott Adams...$99.95

(6) GSF (Racet Computers). Generalized Subroutine Facility...a series of super fast machine language utilities that can be called from a BASIC program (no machine language knowledge required)...sorts 1000 items in under 5 seconds...allows PEEK and POKE statements...move data blocks...compress and un-compress data...works under TRSDOS.. $50

(7) DSM (Racet Computes)...Disk Sort Merge.. sorts and merges large multiple diskette files on a 1 to 4 drive system .NOT AN IN MEMORY SORT...can actually alphabetize (or any other type of sort) 4 disk drives worth of data..sorts one complete disk of information in 10 minutes...information is provided to use DSM with the RS MAILING PROGRAM works under TRSDOS.. $150.

(8) RSM (Small Systems Software)...a machine language monitor and disassembler...can be used to see and modify memory or disk sectors...contains all the commands found on the Model-I version plus some additional commands for the MOD-II...works under TRSDOS...$39.95.

(9) BLINK BASIC LINK FACILITY (Racet Computes).. Link from one BASIC program to another saving all variables...chain programs without losing variables ...$50.

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Sooner or later, programmers may feel that their BASIC interpreters are not quite powerful enough.

For TRS-80 owners, however, the day may approach when there will be more interpreters available than ever hoped for.

At Racet Computes In Orange, California, a program called Infinite BASIC has originated. Actually, it's a series of programs.

Infinite BASIC comes on cassette, with tape and disk versions. The tape version contains four modules, IBLOAD, MREL, SREL and XREL. A special version of IBLOAD is provided for disk. This is the Infinite BASIC loader program, used to load all the relocatable modules. In addition, another program, RELOAD, is contained on the disk version. This is used for initial loading of the application modules to disk.

Thirty matrix and more than 50 string functions are contained in Infinite BASIC. The Business Module, which costs an extra $29.95 and comes on a separate tape, requires the main program for utilization. It has another 20 functions oriented toward business use.

Each function may be selected either individually or as a group of functions.

Assembling

Let's go through the mechanics of assembling an application module. Following an example in the user documentation, we will load the following modules: &SRTV, a multivariable sort function; &SRV$, a random string generation; &MSHP, a matrix redimension and deletion. (All functions, when used in a BASIC program, start with the character &. When being assembled into the application module by IBLOAD, however, they must be prefixed by @@).

&SRTV and &SRV$ are contained in the string module SREL and &MSHP is in the matrix module MREL. Other routines in XREL will be required to complete the application module. XREL must be scanned last.

This particular example will explain how to assemble a load module from tape; disk operation is similar and complete instructions are contained in the manual. Load the tape version of the cassette into the recorder, positioned to the first file on the tape. Enter the following:

```
SYSTEM (ENTER)
IBLOAD (ENTER)
/ (ENTER) in answer to the prompt after IBLOAD is loaded.
```

The prompt message ENTER SUBROUTINE NAMES REQUIRED? should now appear on the screen. Respond with the function names required, one at a time. Precede each name with @@ as in the following:

```
ENTER SUBROUTINE NAMES REQUIRED?
@@SRTV (ENTER
? @@SRV$ (ENTER)
? @@MSHP (ENTER)
? (ENTER)
```

Now memory size parameters must be specified, and there are two ways. Using the L option, a minimum low address somewhere below the top of memory may be specified. Succeeding components will be placed in progressively higher locations. Alternatively, a maximum high address may be specified by using the H option. Each component will then be placed in a progressively lower memory location.

I have found it easier to use the H option. This way, if I want to include another program, for example KBFIX, which resides in the top of memory, I need only specify a starting address below the beginning of the other program and Infinite BASIC will build down from there.

Following the example from the user's manual, we will start from the top of memory in a 16K system. High address is 32767 In decimal or 7FFFH. Answer the prompting messages as follows:

```
HIGH/LOW MEMORY ALLOCATION(H/L)?
H (ENTER)
ENTER STARTING ADDRESS? 32767
(ENTER)
```

The starting address may be expressed in either decimal or hex. Remember to include H after the number when using hex.

Response to the next prompt should be T for tape users:

```
DISK/TAPE INPUT(D/T)? T (ENTER)
READY CASSETTE PRESS (ENTER)
```

IBLOAD will now scan MREL, selecting @@MSHP in the process, then will list a number of entries not found. User specified modules will be identified by two @@ symbols. All others

are system entries which are contained in XREL. @@SRTV and @@SRV$ will be found in our list, the only two user entries.

READY CASSETTE will appear twice more. Press the ENTER key each time to scan SREL and XREL.

After scanning, memory usage values will be displayed as follows:

MEMORY START = X'ssss',END = X'eeee',TRA = X'402D',DEFUSR = X'DDDD' ssss = Starting location of load module in hex. eeee = Ending location of load module in hex. 402D = DOS return (not used in tape system). dddd = Starting execution address in hex.

Values of ssss and eeee should be within the area to be specified as protected memory, and memory size must be protected before using the module. The value of dddd will automatically be placed at the USR transfer location 16526.

The next prompting message is: DUMP MEMORY TO TAPE (Y/N)? Y (ENTER) Responding with Y will initiate dumping of the load module to tape. Rather than going through all the preceding steps, you will be able to load the module from its own tape more quickly. Before responding to the READY CASSETTE message, load a fresh tape into the recorder, press the PLAY and RECORD buttons, then press ENTER.

The above load module tape may be reloaded in the following manner:

- Type SYSTEM, press ENTER
- Type IB, press ENTER. At the next prompt, type / followed by ENTER. Then type ?USR (1).

A 1 should now appear on the screen, indicating that the program has been initialized. After one or two actual sessions, you should have the procedure down pat.

Now that you know how to create and load a module, what can you do with Infinite BASIC? The permutations and combinations seem endless.

Operations

Several short program listings are given in the manual to illustrate some of the operations available. Most are concerned with matrix manipulation and matrix mathematics, including the solving of simultaneous equations by two different methods.

Among other matrix demos is a program which illustrates inputting and outputting of matrix data to and from tape. Ideal for moving large amounts of data tape, the routines permit reading and writing entire blocks of data, with block checksums to insure that the data read is correct. Block ID numbers are provided to allow automatic selection of data to be read.

Another short program demonstrates the matrix shape function, MSHP. This function modifies the size and number of dimensions of any array under program control. The size of an array may be increased or decreased, or deleted to free up memory for other uses. The demo, a program of only 11 lines, initializes a single-dimensioned array, reshapes it to a two-dimensional array for processing, then deletes it.

Among the string function demos is one which performs a character by character translation of one string into another, including translating from upper and lowercase.

Other demos illustrate string compression and decompression, string count and search functions and screen control functions. The latter are used for drawing, erasing and scrolling lines on the CRT.

Demos are also provided for a fast string sort and a disk sort routine.

Starting with string functions, a partial listing of what is available includes Compress Bytes to 4, 5, 6 or 7-Bit Packed Format and Decompress, Convert from Upper to Lower and from Lower to Uppercase, String Count, Compress String, String Matrix Copy, Draw and Erase Horizontal or Vertical Lines, Decompress String, Delete Substring.

Also, String Invert, Left Justify, String Left Shift, String Right or Left Rotate and Truncate, Character String Sort, Multivariable Sort, Scroll Screen up and down, left and right; String Text Center, String Insert, String Text Justify, String Text Pack, String Verify and others.

Implementation is short. For example, the following line of BASIC, 100 J = &SSCL(8) will scroll everything on the screen eight spaces left, providing, of course, that you have the proper module in memory.

Now on to the matrix functions, which include Matrix Add, Divide, Multiply or Subtract in order by index, Matrix Copy, Matrix Element Add, Divide, Multiply or Subtract in sequential order, Matrix Read Restore, Matrix Read Tape, Matrix Scalar Add, Multiply, Subtract and Divide, Matrix Transpose, Matrix Write Tape, and Deactivate Infinite BASIC.

This is a partial listing of matrix functions. Two more functions included in the MREL module deserve mention. They are &PLUG and &PLUK. Similar to POKE and PEEK, they differ in that, rather than one byte, a two-byte word is operated on.

This is among the applications which come to mind for Infinite BASIC. By combining some of the string manipulation functions from SREL with Infinite Business, it should be possible to write a super word-processor in BASIC.

Gripes

In addition to the good things, I can't end without adding one or two gripes.

The manuals are not easy, I believe that if Racet had explained the functions of Infinite BASIC more thoroughly it would have helped. While an advanced programmer should have no trouble understanding the various functions, I would not recommend this package to the beginner or moderately experienced.

I am looking forward to future releases in this series, one of which should be a promising graphics module.

Now you know why it's called Infinite BASIC. There may be no end! ■

Hardware care for cassette I/O problems.

Audio Interface

Howard F. Batie W7BBX
12002 Cheviot Drive
Herndon, VA 22070

Many useful additions are available both commercially and as do-it-yourself construction projects that make the TRS-80 even more enjoyable. The combination of hardware and software described for this Audio Interface offer the following features:

- Data conditioning for accurate CLOADs
- Cassette dubbing
- Aural and visual monitoring
- TRS-80 internal cassette relay protection
- Manual control of the cassette recorder without having to unplug the MIC plug
- Keystroke debouncing
- Audio "beep" with each keystroke
- Automatic keystroke repeat

Data Conditioning

The first and most important function of the TRS-80 Audio Interface is to condition the analog data read from the cassette into clean pulses for loading. When performing its second function—saving data—these pulses should be recorded as a digital stream (square waves), instead of analog variations. Unfortunately this is not easy to do unless you have an expensive digital recorder.

The CTR-41 and CTR-80 do not fall into this category, but the cassette recordings can be squared-up with an external circuit. This allows your tapes to be accurately loaded into the TRS-80 without being overly sensitive to a particular volume setting. And as long as the data stream is being processed between the recorder and computer, it's quite easy to tap into the appropriate spot and incorporate the capability to dub from one recorder to another without having to CLOAD the program into the computer and then CSAVE it onto a second tape.

Two basically different approaches have been described.

Typical of the first approach is the E-Z Loader described in *73 Magazine*, September, 1979; and typical of the second is the Data Dubber by The Peripheral People, as described in *80 Microcomputing* February, 1980. The basic difference between the two is that, in the E-Z Loader design, the incoming audio signal from the cassette triggers a

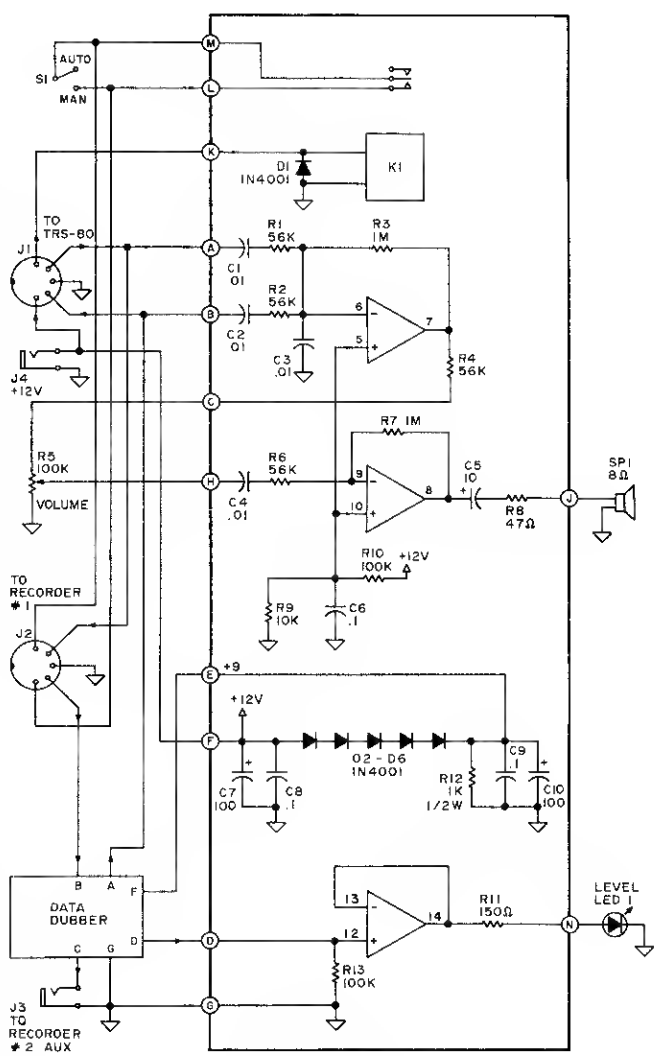

Fig. 1. TRS-80 Audio Interface

monostable multivibrator (one-shot) to generate digital pulses, whereas the Data Dubber (Fig. 2) uses a signal-shaping technique to condition the recorded analog signal into a digital signal stream.

Although either could be used as the basis for the interface I had in mind, I opted for the latter. I sent for the Dubber in PC board form and designed the TRS-80 Audio Interface around it. Fig. 1 shows the complete schematic of the Audio Interface.

When the Dubber arrived, I was pleased with the high quality of the PC board provided (even solder masked!); it worked perfectly the first time power was applied.

Several improvements have been made to the basic circuit since it was first published, so the complete up-to-date schematic is given in Fig. 3.

Audio Interface

The TRS-80 Audio Interface consists of a single integrated circuit, the LM-324, which is a very versatile quad op amp selling for about $1.50 at Radio Shack. This IC runs on a single 3-30-volt power supply, draws only two to three milliamperes at 12 volts and tracks input voltages right down to parts of a millivolt above ground.

In addition, each op amp can sink up to five milliamperes or source up to 25 milliamperes dc. R1C1 and R2C2 form a resistive audio mixer for the data lines to and from the TRS-80, so that either the computer input or output can be monitored without having to manually switch between the two signal lines. However, only one line will be active at any one time.

The audio amp can handle an input signal from one millivolt RMS to well over 10 volts RMS.

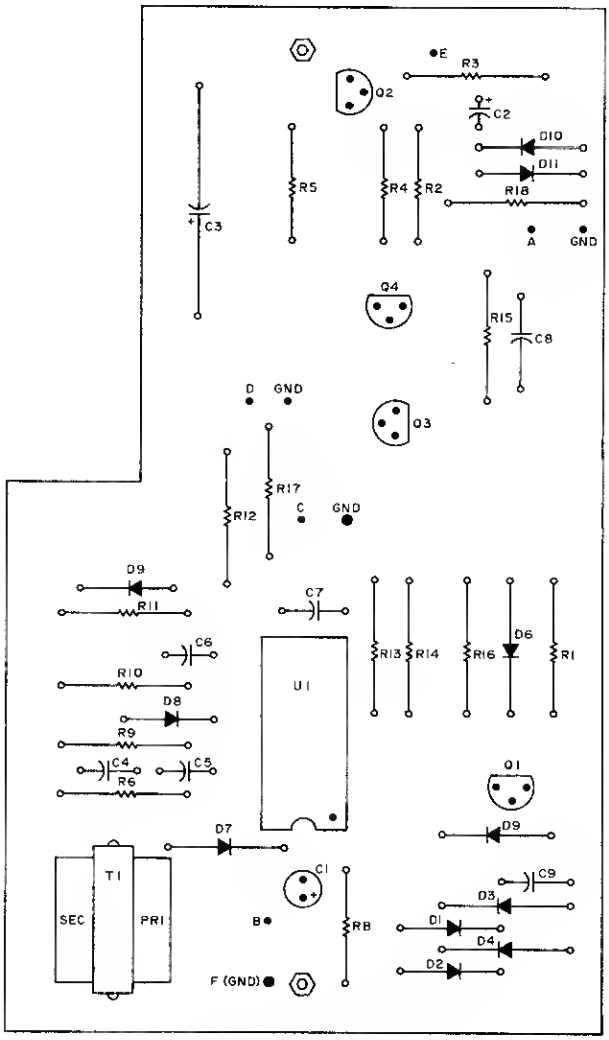

Fig. 2. Data Dubber Parts Layout

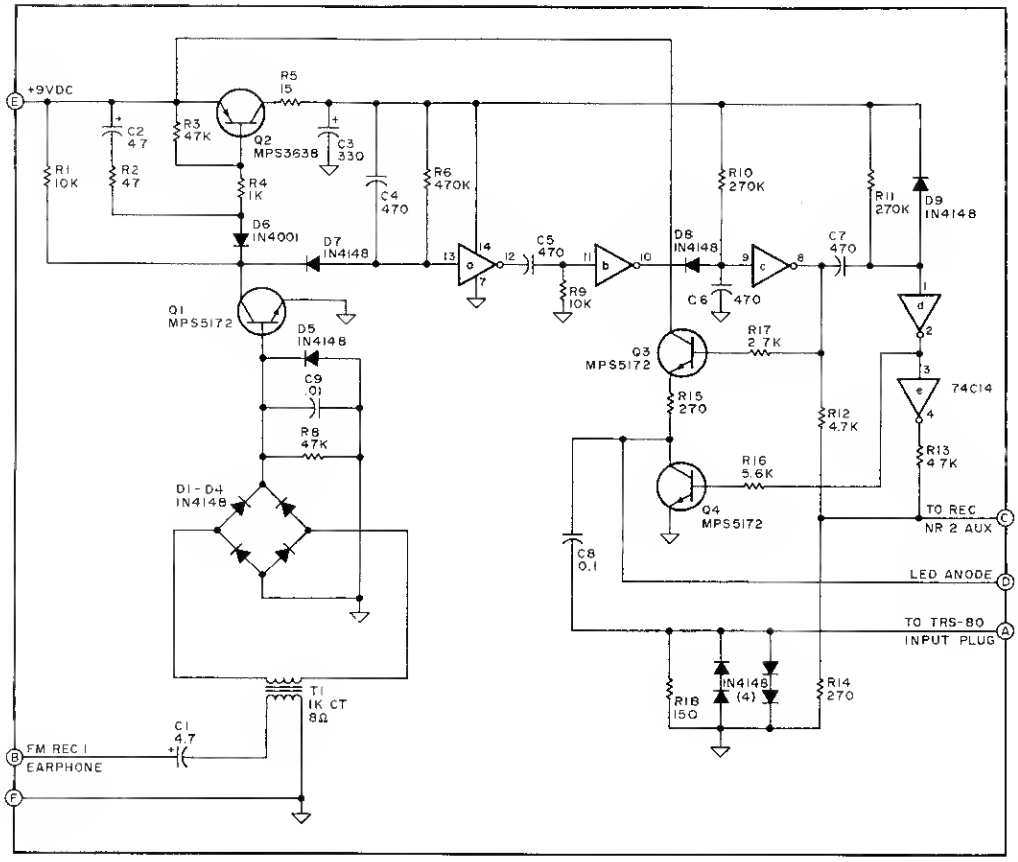

Fig. 3. Data Dubber Schematic

Since the op amp output impedance is very low, a current-limiting resistor (R8) is used in series with the eight-ohm speaker. A roomful of sound can be had with this handy little building block, yet it draws only about 8-10 mA at full volume. A third section of the LM-324 is used as a voltage follower to provide sufficient current to drive the LED while isolating it from the Dubber output signal line.

An additional 12 V dc relay is included in the TRS-80 Audio Interface so that the DIP relay in the TRS-80 does not have to switch the cassette recorder motor current. The coil current of relay K1 is about 10 mA. S1 allows manual operation of the recorder without having to unplug the cassette MIC plug. See also Fig. 4.

The Data Dubber is designed to operate from a nine-volt battery. Although it is fairly tolerant of some supply voltage variation, the diode string D2-D6 is included to drop the Audio Interface 12-volt supply down to nine volts. R12 provides a constant

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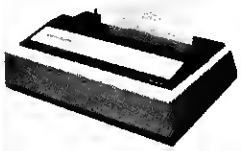

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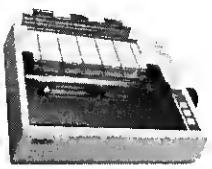

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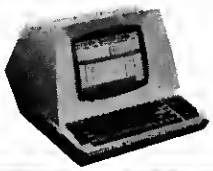

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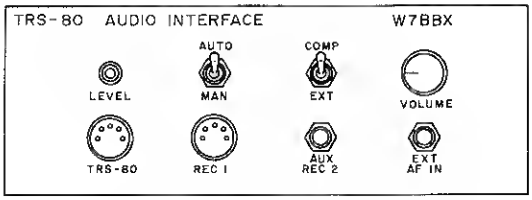

Fig. 4. Front Panel Layout Template

current drain through the diode string and therefore, a constant nine-volt output from the diode string. Above a few milliamps of current, the voltage drop across each silicon diode is fairly constant at about 0.6 volts no matter how much current is drawn. Without this load resistor, the Dubber would see 12 volts when off and nine volts when on (no current, no voltage drop, right?).

The TRS-80 Audio Interface shown in Fig. 1 was built into a separate cabinet (LMB ME-583) for cosmetic purposes and also to protect the audio circuits from ac power supply hum. A home-made PC board was used in the prototype for all parts shown within the heavy solid outline.

The interface PC board and the Dubber PC board were then mounted side by side in the cabinet on one-inch bolts to provide spacing from the chassis. Another identical cabinet houses the 12-volt power supply for the Interface and Dubber, and also provides for a single ac switch to turn on the TRS-80, cassette recorder, video display and Audio Interface simultaneously. (See Fig. 5.)

The 110 V ac jacks can be mounted on the rear panel, for a neater appearance. A third small cabinet houses a four-inch, eight-ohm speaker; however, a smaller speaker could easily be housed inside the Audio Interface cabinet.

Interconnection between the TRS-80, cassette recorder, Audio Interface and power supply is shown in Fig. 6. Due to the physical size of the DIN plug furnished with the TRS-80, it had to be replaced with a slightly thinner metal sleeve (RS #274-003) to fit into the DIN jack on the Audio Interface cabinet. A standard male-DIN-to-male-DIN cable (RS #42-2151) is used between the TRS-80 and the Audio Interface cabinet. The original cable furnished with the TRS-80 is then used between the cassette recorder and the Audio Interface.

With the TRS-80 Audio Interface in the line, CLOADing and CSAVEing are not changed, except that they are much more reliable. No change in the cassette recorder volume setting is needed between CLOAD and CSAVE.

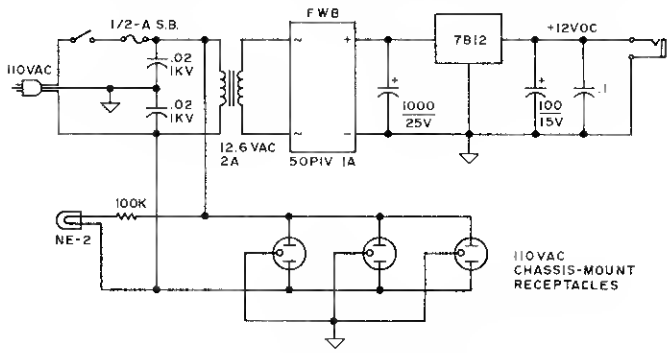

Fig. 5. Power Supply Schematic

KBEEPFIX

Now that the hardware's ready, what's available in the way of software to make the TRS-80 and Audio Interface really fun to use?

Perhaps the single, most aggravating thing about the TRS-80 is the key bounce. A

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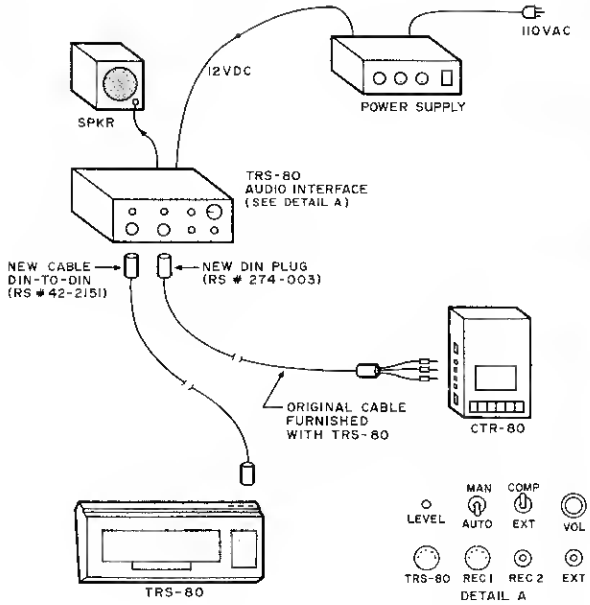

Fig. 6. Interface: TRS-80/Recorder Interconnections

number of software fixes for this are available, including Radio Shack's KBFIX, but I prefer the simple KBEEPFIX machine language subroutine. It is found in *80 Microcomputing*, February, 1980 (page 14), and repeated here in Program Listing 1.

I used the BASIC version for simple and easy CLOADs. The program eliminates keybounce, will repeat any displayed letter or figure (including space and cursor) if the key is depressed for more than half a second, and provides a crisp audio "beep" each time a character is keyed.

Load KBEEPFIX when you power up. When you get the MEMORY SIZE? prompt, enter 32655 if you have a 16K system; CLOAD the KBEEPFIX listing; run it and then type NEW.

NEW will erase the BASIC program from low memory (actually, the program pointers are reset so you can't LIST anything). The machine language subroutine which does all the work, however, will remain in high memory (32655-32767). If you have a 4K system, enter 20367 in response to the MEMORY SIZE? prompt, and then CLOAD KBEEPFIX (4K version), run it and type NEW.

The ability to monitor the TRS-80 output data line opens up all kinds of new possibilities, such as sound effects and music generation.

Generating an audio tone is really not mysterious, though. It's simply a matter of turning the data output line on and off at a specific rate. The trick is to turn it on and off at the right time, and at the right number of times per second.

There are two ways of doing this—in BASIC or in assembly language (machine code). With BASIC, the commands are OUT 255,2 to turn the output data line (cassette AUX plug) ON (logic 1); and OUT 255,0 to turn it OFF

```
10 FOR I=32655 TO 32767: READ A: POKE I,A: NEXT
20 POKE 16526,143: POKE 16527,127: M=USR(0)
30 DATA 33,152,127,34,22,64,195,25,26,33,54,64,1,1,56,22,0
40 DATA 10,95,163,32,26,119,20,44,203,1,121,214,128,32,241,126
50 DATA 6,7,45,134,16,252,254,0,62,0,192,50,26,64,201,166
60 DATA 40,16,58,26,64,60,50,26,64,254,255,32,217,61,50,26
70 DATA 64,123,115,197,1,0,2,205,96,0,193,10,163,200,197,229
80 DATA 245,6,64,58,61,64,230,253,103,246,2,111,125,211,255,124
90 DATA 211,255,197,6,64,16,254,193,16,242,241,225,193,195,251,3
Note: For a 4K TRS-80, substitute the following:
10 FOR I=20367 TO 20479: READ A: POKE I,A: NEXT
20 POKE 16526,143: POKE 16527,79: M=USR(0)
Line 30, third value: change 127 to 79
```

Program Listing 1. KBEEPFIX (16K) by Dennis Kitsz

(logic 0). These commands can be embedded in a FOR-NEXT loop, with a specified length such as FOR I = 1 TO 1000: OUT 255,2: OUT 255,0: NEXT I. This will give 1000 alternations from logic 1 to logic 0 on the data output line. Due, however, to the slowness of BASIC, it will take about 9.6 seconds to complete the loop. Therefore, the maximum audio frequency of a BASIC-generated tone is only about 104 hertz. This is not good enough. For any real flexibility, we must use assembly language to generate tones or sound effects over a reasonable range of audio frequencies.

For an excellent sound effects demonstration, see Dennis Kitsz's "BABYBEEP" in the April, 1980, *80 Microcomputing*.

For applications like games, it would be nice to be able to generate sound-effects while the computer is processing the main BASIC program. I haven't yet found a way for the TRS-80 to do this, since the BASIC program would have to call the assembly language sound-effects subroutine with the USR function; then it would have to return to the BASIC program when finished generating sound.

For those who prefer one-stop shopping, completely wired and tested PC boards for the Data Dubber are available for under $30 from The Peripheral People, Mercer Island, WA. ■

Component	Description	RS No.
R1, R2, R4, R6	56 k, 1/4 W, five percent carbon resistor	271-1344
R3, R7	1 meg, 1/4 W, five percent carbon resistor	271-1356
R5	100 k Audio Taper potentiometer	271-1722
R8	47 Ohm, 1/4 W, five percent carbon resistor	271-1307
R9	10 k, 1/4 W, five percent carbon resistor	271-1355
R10, R13	100 k, 1/4 W, five percent carbon resistor	271-1347
R11	150 Ohm, 1/4 W, five percent carbon resistor	271-1312
R12	1 k, 1/2 W, five percent carbon resistor	271-023
C1-C4	.01 uF disc capacitor	272-131
C5	10 uF electrolytic capacitor	272-1025
C6, C8, C9	0.1 uF disc capacitor	272-135
C7, C10	100 uF electrolytic capacitor	272-1028
D1-D6	1N4001 Silicon 1 A rectifier diode	276-1101
LED-1	Red LED	276-041
J1, J2	5-pin DIN Audio jack	274-005
J3, J4	Miniature Phone jack	274-297
K1	12 volt dc Relay	275-003
S1	SPDT Toggle Switch	275-613
U1	LM-324 Integrated Circuit	276-1711
In addition, the following parts will be required for connection to the TRS-80:		
	DIN Plug	274-003
	DIN-to-DIN Cable	42-2151

Parts List. TRS-80 Audio Interface

FOR TRS-80*

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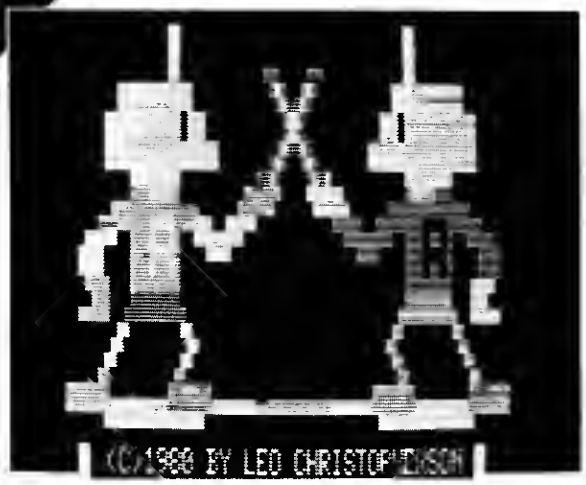

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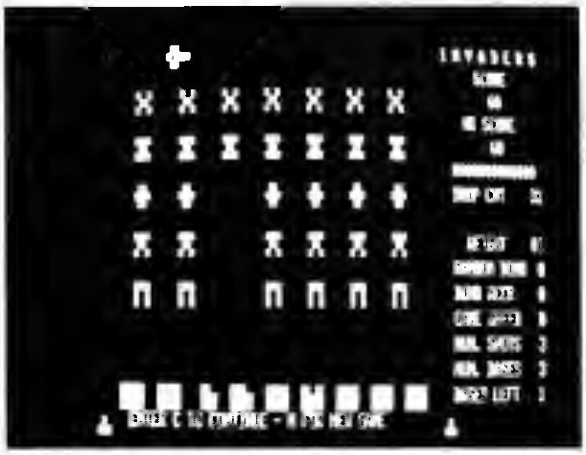

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A Perspective on Cubes

Paul Gerhardt
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My interest in TRS-80 graphics began when I first started writing my own educational software. From the perspective of a ninth grade science teacher, most of the educational software I have seen seemed rather dull; most of it cannot hold the interest of a junior high school student for long. Extensive use of graphics adds both interest and clarity to my educational programs, and I'm sure it can enhance your own.

Cubes are a natural starting point for beginning graphics users for two reasons. They are made up of straight lines—horizontal, vertical, and diagonal; and they introduce the beginner to the video display worksheet.

Now, it's true that you could draw anything on your worksheet and reproduce it by setting each graphics block, but that is like planting a lawn one blade of grass at a time. There is a much better way, but it requires a little planning.

Plan the Cube

Draw a cube on the video worksheet. First draw the face of the cube, then extend the diagonal lines back as far as you like. For now restrict yourself to only one type of diagonal line, going up one block and one block toward the left (Fig. 1). All three diagonals extended equal distances from the face establish the rear edges of the cube.

That is limiting, and makes the cube look funny because it lacks linear perspective. I will explain how to put perspective into cubes later in this article.

Now, you're ready to program.

FOR-NEXT loops are used to draw the lines, but we do not need nine loops to draw nine lines! All lines of equal lengths (in graphic blocks) can be drawn using one loop. For this cube we'll need three loops: one for the three horizontal lines, one for the three vertical lines, and one for the three diagonal lines (Program Listing 1).

Line 20 sets the length of the horizontal lines, in this case, 41 blocks. Zero counts as a step in the loop. Line 30 draws all three

```
5 CLS
10 REM----------------DRAWS HORIZONTAL LINES----------
    --------
20 FOR N=0 TO 40
30      SET(N+20,6): SET(N+35,21): SET(N+35,32)
40      NEXT N
50 REM----------------DRAWS VERTICAL LINES------------
    ---------
60 FOR N=0 TO 11
70      SET(20,N+6): SET(35,N+21): SET(75,N+21)
80      NEXT N
90 REM----------------DRAWS DIAGONAL LINES------------
    ---------
100 FOR N=0 TO 15
110     SET(N+20,N+17): SET(N+20,N+6): SET(N+60,N+6)
120     NEXT N
130 GOTO 130
```

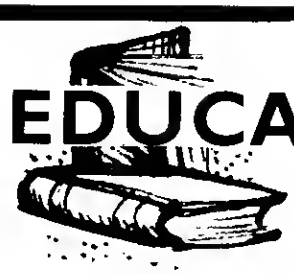
Program Listing 1

```
5 CLS
10 REM-----------DRAWS A CUBE USING ONLY ONE LOOP------
    --------
20 FOR N=0 TO 20
30      SET(N+40,3): SET(N+60,23): SET(N+60,43)
40      SET(40,N+3): SET(60,N+23): SET(80,N+23)
50      SET(N+40,N+3): SET(N+60,N+3): SET(N+40,N+23)
60      NEXT N
70 GOTO 70
```

Program Listing 2

```
5 CLS
10 REM----------------------DIAGONALS-----------------
    --------
20 FOR P=1 TO 100
30    FOR X=1 TO 127
40       Y=X*P/20
50       IF Y>46 THEN 70
55       SET(X,Y)
60    NEXT X
70 NEXT P
80 GOTO 80
```

Program Listing 3



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Money Master tutors the young child in the use of money. The child is allowed to wander freely by paying tolls or buying objects. The tutoring screen depicts money graphically, and interactively instructs in the use of coins. This includes making payments and receiving change. New mazes are generated for each game. Graphic obstacles are randomly chosen from a library of several dozen. An average game lasts 20-30 minutes. Recommended for early readers through adult.

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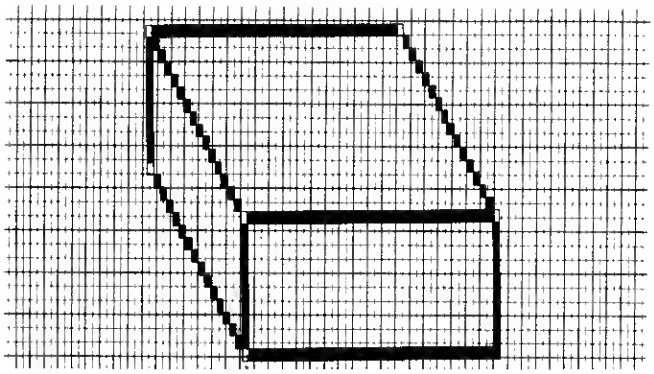

Fig. 1.

horizontal lines, using the following form: SET(N + A,B) where N is the loop variable, A is the X value of the starting point of the line, and B is the Y value of the line. By starting point, I mean the point with the lowest X value (closest to the left edge of the screen). For horizontal lines, the Y values do not change.

The video screen is divided into 6144 graphic blocks, each block locatable by means of an X coordinate (0-127) and a Y coordinate (0-47). Block (0,0) is at the upper left hand corner and block (127,47) is at the lower right hand corner. As we increase the X value, we move toward the right, and, as we increase the Y value, we move toward the bottom of the screen.

On the first pass of the FOR-NEXT loop, N is set at 0 in line 20. Line 30 then lights up three graphic blocks: (20,6), (35,21) and (35,32). These are the starting points of the three horizontal lines (Fig. 1). On the next pass N is set at 1, and then the next three blocks are lit: (21,6), (36,21) and (36,32). This extends our three horizontal lines one graphics block toward the right. With each pass of the loop our lines continue to extend toward the right until the final value of N is reached.

Line 60 sets the length of the vertical lines, using the following form: SET(A,N + B) where N is again the loop variable. A is the X value of each line.

The X values do not change for vertical lines. B is the Y value of the starting point of the vertical lines (the point with the lowest Y value).

Line 100 sets the length of the diagonal lines, using the following form: SET(N + A,N + B), where N is still the loop variable. This time both the X and Y values change as the line is drawn. A and B represent the X and Y values for the starting

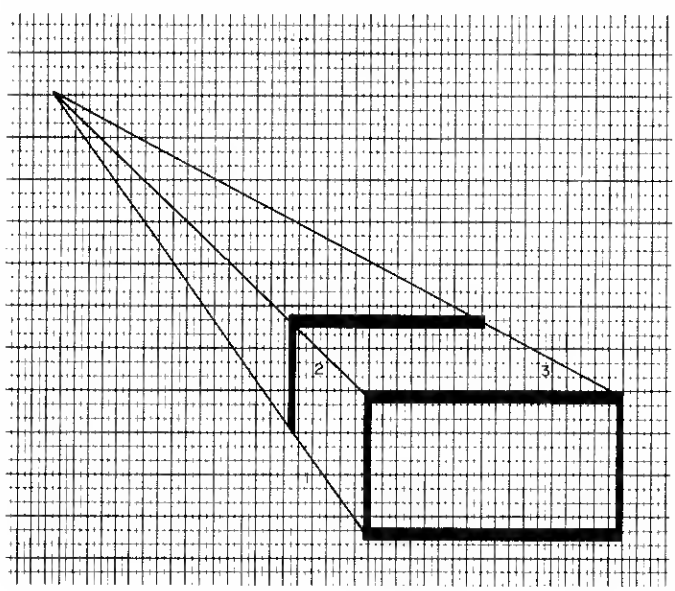

Fig. 2. Cube with Linear Perspective.

points of the diagonal lines.

Wait a minute! If any number of lines of equal length can be drawn in the same loop, is it possible to draw an entire cube using only one loop?

Sure, Program Listing 2 does exactly that.

Adding Perspective

Let's remove that swollen appearance from our cube. The back of the blocks appear swollen because of a logic problem, not in the program, but in our brains.

Our brains store millions of pieces of information concerning the visual world, including the perception that objects appear smaller as they move farther away, and that the rear edge of a cube is farther away from the viewer than the front edge.

These two relationships combine to form the illusion of our swollen cube. The rear edge of our cube appears to be the same length as the front (because it is), but our brain knows that the rear edge is farther away and, therefore, should appear smaller. To avoid this problem, parallel lines that move away from the viewer must be drawn to converge. This is called linear perspective.

The TRS-80 can provide this perspective, but it takes a little planning. On a video work sheet draw the face of a cube (Fig. 2). The three diagonal lines must show perspective. Using a straight edge, draw from the corners of the face of the block to the upper left hand corner of the screen (point 0,0). The rear edges of the block can be drawn anywhere along these diagonals.

In this cube we have three different diagonal lines, each at a different angle, each with a different slope. Ah! remember those old math classes. No; well don't worry, your TRS-80 will do most of the work for you.

Program Listing 3 will let your TRS-80 draw dozens of diagonal lines with different slopes.

Programming Slope

The formula for a straight line that passes through point (0,0) can be written as $Y = X \times P$, where the value of P determines the slope. The smaller the P value the shallower the slope (closer to horizontal); the higher the P value the steeper the slope (closer to vertical).

Line 20 sets the various values for P. The first value used is .05, so that the first line drawn will have a shallow slope. Line 30 sets values for X. Line 40 uses the formula to determine the corresponding Y values, which is then tested to make sure it will fit on the screen. Finally, the block is SET.

Lines 60 and 70 simply complete the two FOR-NEXT loops. To view each line individually, insert a CLS between lines 60 and 70.

Program Listing 4 will draw a cube with linear perspective. First, the face of the cube is drawn. Line 30 sets up the loop to draw the two horizontal lines. Line 60 begins the loop that draws the two vertical lines. Next the rear edges are drawn. Since the two lines have unequal lengths they each have their own FOR-NEXT loop. Line 90 draws the vertical edge and line 100 the horizontal edge.

Diagonals number one and number two (Fig. 2) share common X values, and can therefore be drawn using one FOR-NEXT loop. Line 120 sets the range of X values, line 130 finds the corresponding Y values, and, again, the formula $Y = X \times P$ is used.

We find the correct values (slope) for P as follows: If $Y = X \times P$, then $P = Y/X$, where X and Y are the X and Y values of any point on that line. Diagonal number one ran right through the middle of block (10,7) and so I used 7/10 as a slope. Diagonal number two ran through block (25,12) and so the value of P became 12/25. The (X,Y) values of any point on each diagonal would work as well.

Line 140 lights up the graphic blocks for each diagonal and line 150 closes the loop. Lines 170-200 simply draw the last diagonal using the same technique.

That's all there is to it. ■

"The back of the blocks appear swollen because of a logic problem, not in the program, but in our brains."

```
5 CLS
10 REM-----------------PERSPECTIVE CUBE----------------
   --------
20 REM----------------DRAWS FRONT FACE OF CUBE---------
   -------
30 FOR N=0 TO 40
40       SET(N+50,24): SET(N+50,35)
50       NEXT N
60 FOR N=0 TO 11
70       SET(50,N+24): SET(90,N+24)
80       NEXT N
85 REM-------------DRAWS REAR EDGES OF CUBE------------
   -------
90 FOR X=38 TO 68: Y=18: SET(X,Y): NEXT X
100 FOR Y=18 TO 26: X=38: SET(X,Y): NEXT Y
110 REM--------------DRAWS DIAGONAL LINES #1 AND #2----
   --------
120 FOR X=38 TO 50
130      Y1=X*7/10: Y2=X*12/25
140      SET(X,Y1): SET(X,Y2)
150      NEXT X
160 REM----------------DRAWS DIAGONAL LINE #3----------
   -------
170 FOR X=68 TO 90
180      Y3=X*4/15
190      SET(X,Y3)
200      NEXT X
```

Program Listing 4

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How would you like your TRS-80 to emit gunshots? Sound sirens? Ring out musical notes? Or even the Star Trek red alert?

This article describes just how to do it—build the interface circuitry to connect the General Instrument AY-3-8910 programmable sound generator (PSG) via the interface connector.

An expansion interface is not required. The PSG's principle of operation is described so that you can write your own sound generation software.

The PSG produces a variety of sounds under complete software control. No change in external connections or passive components, such as resistors and capacitors, is required. The PSG works without the attention of the TRS-80, making it suitable for interactive programs, like games. This allows the TRS-80 to do other things while the PSG cranks out sound.

PSG

The PSG consists of three programmable tone generators, a noise generator, three mixers, fixed and variable amplitude controllers, an envelope generator and three digital-to-analog (D/A) converters. Additionally, the PSG has two 8-bit I/O ports which have nothing to do with the production of sound. These ports can be used for sensing switch closures, driving LEDs, and turning motors on and off (through an appropriate buffer, as required).

Communication between the TRS-80 and PSG is done using the IN and OUT lines from the TRS-80. These are activated using the BASIC INP and OUT commands or through the assembly language IN and OUT commands. Control commands are issued to the PSG by writing to the appropriate PSG internal register (there are 16). Each of these registers is also readable to determine the present state of any register.

The register array is shown in Table 1. The basic blocks in the PSG which produce the programmed sounds follow:

Tone generators produce the basic square wave tone frequencies for each channel (A, B, C).

The noise generator produces a frequency-modulated random pulse-width square wave.

		B7	B6	B5	B4	B3	B2	B1	B0
R0	Channel A Tone Period	8-bit Fine Tune A							
R1		4-bit Coarse Tune A							
R2	Channel B Tone Period	8-bit Fine Tune B							
R3		4-bit Coarse Tune B							
R4	Channel C Tone Period	8-bit Fine Tune C							
R5		4-bit Coarse Tune C							
R6	Noise Period	5-bit Period Control							
R7	Enable	IN/OUT		Noise			Tone		
		IOB	IOA	C	B	A	C	B	A
R8	Channel A Amplitude			M	L3	L2	L1	L0	
R9	Channel B Amplitude			M	L3	L2	L1	L0	
R10	Channel C Amplitude			M	L3	L2	L1	L0	
R11	Envelope Period	8-bit Fine Tune E							
R12		8-bit Coarse Tune E							
R13	Envelope Shape/Cycle					CONT	ATT.	ALT.	HOLD
R14	I/O Port A Data Store	8-bit Parallel I/O on A							
R15	I/O Port B Data Store	8-bit Parallel I/O on B							

Table 1. PSG Register Array

Mixers combine the outputs of the tone generators and the noise generator. There is one for each channel (A, B, C).

Amplitude control provides the D/A converters with either a fixed or a variable amplitude pattern. The fixed amplitude is under direct control of the TRS-80; the variable amplitude is accomplished by using the output of the envelope generator.

The envelope generator produces an envelope pattern which can be used to amplitude modulate the output of each mixer.

D/A converters: Each produce up to a 16-level output as determined by the amplitude control.

The pin assignments for the AY-3-8910 are shown in Fig. 1. GI also makes a 28-pin version, the AY-3-8912, which has only one I/O port. The pins of the –8910 are explained as follows:

DA7-DA0: these eight lines comprise the eight-bit bi-directional bus used to send both address and data over. In the address mode, DA7-DA4 must be zero and DA3-DA0 select the register (0 to 15). In the data mode, D7-DA0 correspond to

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register array bits B7-B0.

A8, $\overline{A9}$: additional chip select lines. They must be tied to +5 V and gnd, respectively, to enable the PSG.

$\overline{RESET}$: on powerup or pressing reset on the TRS-80, this signal sets all registers to zero. It is connected to $\overline{SYSRES}$ on the TRS-80.

CLOCK supplies timing reference for the PSG. Normally at 1.78 MHz. It can be anywhere from one to two MHz, but varying the frequency varies the output of the PSG.

BDIR, BC1, BC2: these bus control signals control the bus operations as follows:

BDIR	BC1	BC2	PSG function
0	1	0	Inactive
0	1	1	Read from PSG
1	1	0	Write to PSG
1	1	1	Latch PSG address

TEST 1, 2: not connected.

IOA7-IOA0, IOB7-IOB0: each of these parallel I/O ports provides eight bits of data to or from the TRS-80. Each bit has an internal pullup resistor, so that in the input mode, all pins will read high, unless grounded.

Vcc is the nominal +5 V power supply @100 mA.

Vss is the ground reference for the PSG.

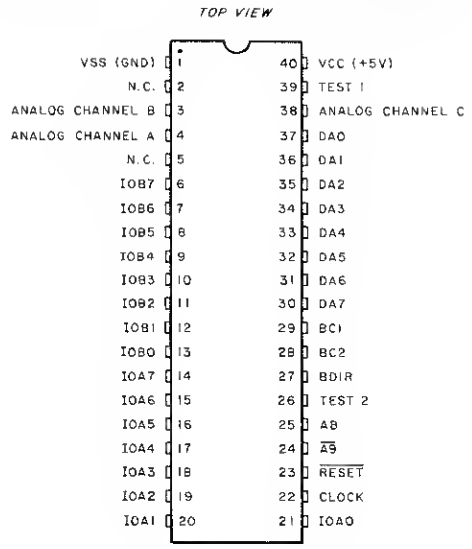


Fig. 1. Pin Assignments

Interfacing to the TRS-80

The schematic showing the interface between the TRS-80 and the PSG is shown in Fig. 2.

The eight-bit data bus from the TRS-80 connects directly to DA7-DA0. The lower eight address lines, along with the $\overline{IN}$ and $\overline{OUT}$ signals are decoded by a few NAND gates to generate the proper bus timing signals for the PSG. A CMOS 4049 and a TTL 74LS74 are used along with a common 3.58 MHz color TV crystal to generate the 1.789 MHz square wave clock signal for the PSG. An LM386 is used to amplify the sound output to drive a small PM speaker directly. If you already have an audio amplifier, just ac-couple it to the output of the PSG as shown. In either case leave in the 1k ohm resistor.

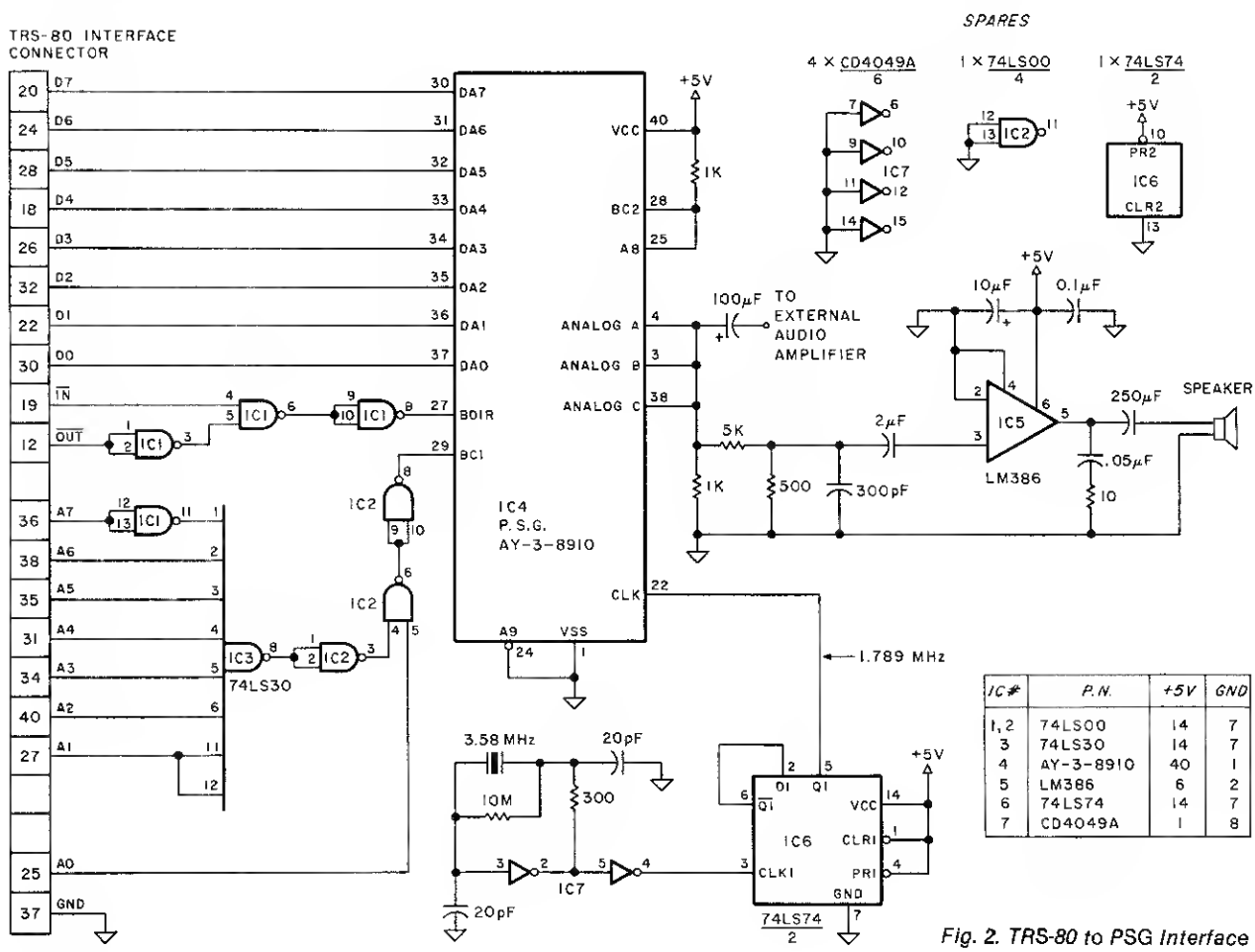
Construction

I built my test circuit on a solderless breadboard. You can build your circuit similarly or you can use wirewrap, printed circuit, or whatever construction method you like.

The TRS-80 can not supply enough external power for the PSG and the support circuitry, so I used a lab supply for power. A simple power supply quite capable of generating the 100 mA @ 5 V required is shown in Fig. 3.

Operation

All control of the PSG is achieved by using a series of OUT and IN commands. The port assignments for the circuit I built are as follows:



IC#	P.N.	+5V	GND
1,2	74LS00	14	7
3	74LS30	14	7
4	AY-3-8910	40	1
5	LM386	6	2
6	74LS74	14	7
7	CD4049A	1	8

Fig. 2. TRS-80 to PSG Interface

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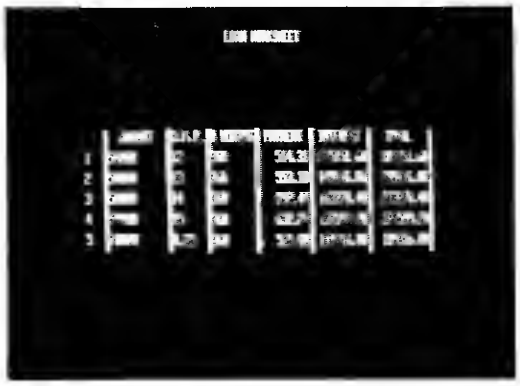

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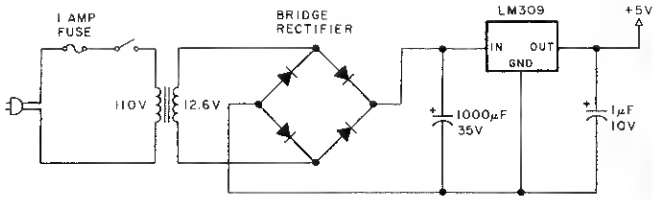

Fig. 3. Simple 5-V Power Supply

Instruction	Function
OUT 127, reg #	Latch register address
INP (127)	Read the PSG
OUT 126, data	Write to the PSG

The proper sequence of operation is to first latch the address of a particular PSG register and then write or read it, as required.

Tone Generator Control

The output frequency of the three tone generators is obtained by dividing the input clock by 16 and by further counting down by the programmed 12-bit tone period value. Each 12-bit value is obtained by combining the relative coarse & fine tune registers, with coarse the most significant. Note that the 12-bit value is a period value—the higher the registers, the lower the resultant tone frequency.

Noise Generator Control

The frequency of the noise generator is determined as follows:

$$f_N = f_{CLOCK}/16NP_{10}$$

where f_N is the desired noise frequency; f_{CLOCK} is the input clock frequency; and NP_{10} is the decimal equivalent of the noise generator register.

Mixer Control—I/O Eneble

Register 7 controls the three noise/tone mixers and the two general purpose I/O ports. Table 1 shows how these are enabled. Disabling noise and tone does *not* turn off a channel—only the amplitude control register does that.

Amplitude Control

The amplitude of each of the three channels is controlled by R8, R9, & R10 and shown in Table 1. If M = 0, then the fixed amplitude is determined by D3-D0 (0 to 15). If M = 1, the amplitude is determined by the envelope

```
10  OUT 127,0          'Select R0
20  OUT 126,125        'Set Chan A tone period to 1 ms (a kHz)
30  OUT 127,7          'Select R7
40  OUT 126,62         'Enable tone only on Chan A only
50  OUT 127,8          'Select R8
60  OUT 126,15         'Set max amplitude on Chan A
70  GOTO 70            'Keeps tone output going
```

Program Listing 1. PSG test routine

```
10  OUT 127,6          'Select R6
20  OUT 126,15         'Set noise period to mid-value
30  OUT 127,7          'Select R7
40  OUT 126,7          'Enable noise only on Chan A, B, C
50  OUT 127,8          'Select R8
60  OUT 126,16         'Select full-amplitude via envelope
70  OUT 127,9          'generator on A, B, C
80  OUT 126,16
90  OUT 127,10
100 OUT 126,16
110 OUT 127,12         'Select R12
120 OUT 126,16         'Set envelope period to 0.586 s
130 OUT 127,13         'Select R13
140 OUT 126,0          'Select envelope decay for one cycle
150 END
```

Program Listing 2. Gunshot Sound Effect

✓ Reader Service—see page 242

pattern as defined by the envelope generator.

Envelope Generator Control

The envelope period control is determined by R10 & R11, with R10 being coarse and R11 being fine tune. The frequency is obtained by dividing the input clock by 256 and then dividing it by the 16-bit period value. Note that here, too, the higher the register value, the lower the resultant frequency.

The shape/cycle control of the envelope is provided by R13 as shown in Table 1. The definition of each function follows:

HOLD — When a 1, limits the envelope to one cycle.

ALTERNATE — When a 1, reverses the envelope counter after each cycle.

ATTACK — When a 1, envelope counter counts up. When a 0, envelope counter counts down.

CONTINUE — When a 1, the cycle pattern will be defined by hold bit

Applications

The PSG can apply to music and sound generation. To try your hardware, you might want to use the program in Program Listing 1 which outputs a constant 1000 Hertz tone. In all following examples, any PSG register unused should have a zero written in, either by power-up or software.

"Disabling noise and tone does not turn off a channel—only the amplitude control register does that."

A gunshot can easily be done by using the noise generator tied to the decaying envelope generator. This is shown in Program Listing 2.

The European siren sound effect demonstrates two distinct frequencies sequentially produced. Program Listing 3 lists the software for this.

```
10  OUT 127,0                       'Select R0
20  OUT 126,254                     'Siren low frequency
30  OUT 127,1                       'Select R1
40  OUT 126,0                       'Set coarse freq. to zero
50  OUT 127,7                       'Select R7
60  OUT 126,62                      'Tone on A only
70  OUT 127,8                       'Select R8
80  OUT 126,15                      'Max amp on A
90  FOR I= 1 TO 175 : NEXT          'Wait 350 ms
100 OUT 127,0                       'Select R0
110 OUT 126,6                       'Higher frequency
120 OUT 127,1                       'Select R1
130 OUT 126,1                       'Set coarse freq. to one
140 FOR I=1 TO 175 : NEXT           'Wait 350 ms
150 GOTO 10
```

Program Listing 3. European Siren

```
10  FOR N=1 TO 5                    'Star Trek Red Alert
20  OUT 127,7                       'Select R7
30  OUT 126,62                      'Tone on A only
40  OUT 127,8                       'Select R8
50  OUT 126,15                      'Max amp on A
60  OUT 127,0                       'Select A for tone period
70  FOR R0=250 TO 150 STEP -2       'Freq. loop
80  FOR I=1 TO 2 : NEXT             '4 ms delay
90  OUT 126,R0
100 NEXT R0
110 OUT 127,8                       'Shut it down
120 OUT 126,0
130 FOR I=1 TO 100 : NEXT           '200 ms delay
140 NEXT N
150 END
```

Program Listing 4. Star Trek Red Alert

```
10  OUT 127,7                       'Select R7 register
20  OUT 126,62                      'Tone on A only
30  OUT 127,8                       'Select R8
40  OUT 126,15                      'Max amp on A
50  OUT 127,0                       'Select R0 for tone period
60  A$=INKEY$                       'Get the keyboard input
70  IF A$="A" THEN GOTO 200         'Test for which
80  IF A$="S" THEN GOTO 300         'key was pressed
90  IF A$="D" THEN GOTO 400         'of the 8.
100 IF A$="F" THEN GOTO 500
110 IF A$="J" THEN GOTO 600
120 IF A$="K" THEN GOTO 700
130 IF A$="L" THEN GOTO 800
140 IF A$=";" THEN GOTO 900
150 GOTO 50                         'Get another keyboard entry
200 OUT 126,115                     'The "A" was pressed so
210 OUT 127,1                       'output 46 Hz
220 OUT 126,9
230 GOTO 50
300 OUT 126,185                     'The "S" was pressed so
310 OUT 127,1                       'output 92 Hz
320 OUT 126,4
330 GOTO 50
400 OUT 126,129                     'The "D" was pressed so
410 OUT 127,1                       'output 174 Hz
420 OUT 126,2
430 GOTO 50
500 OUT 126,68                      'The "F" was pressed so
510 OUT 127,1                       'output 350 Hz
520 OUT 126,1
530 GOTO 50
600 OUT 126,160                     'The "J" was pressed so
610 OUT 127,1                       'output 700 Hz
620 OUT 126,0
630 GOTO 50
700 OUT 126,80                      'The "K" was pressed so
710 OUT 127,1                       'output 1400 Hz
720 OUT 126,0
730 GOTO 50
800 OUT 126,38                      'The "L" was pressed so
810 OUT 127,1                       'output 3000 Hz
820 OUT 126,0
830 GOTO 50
900 OUT 126,21                      'The ";" was pressed so
910 OUT 127,1                       'output 5000 Hz
920 OUT 126,0
930 GOTO 50
```

Program Listing 5. Electronic Organ Simulator

```
10 OUT 127,6     'WOLF WHISTLE  SET R6
20 OUT 126,1     'MINIMUM NOISE
30 OUT 127,7     'TONE ON  A,  NOISE ON B
40 OUT 126,46
50 OUT 127,8    'MAX AMP ON A
60 OUT 126,15
70 OUT 127,9
80 OUT 126,9
85 OUT 127,0
90 FOR I=64 TO 48 STEP -1
95 FOR X=1 TO 6 : NEXT
100 OUT 126,I
110 NEXT
120 FOR I=1 TO 75 :NEXT    'WAIT 150 MS
130 FOR I=64 TO 48 STEP -1
140 OUT 126,I
142 FOR X= 1 TO 12 :NEXT
145 NEXT
150 FOR I=48 TO 104
160 OUT 126,I
170 FOR X=1 TO 6 : NEXT
180 NEXT
190 OUT 127,8    'SHUT IT DOWN
200 OUT 126,0
210 OUT 127,9
220 OUT 126,0
230 FOR  I=1 TO 1500: NEXT
240 GOTO 10
```

Program Listing 6. GI Chip Demonstration

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The famous Star Trek red alert is a variation of the siren and the software is in Program Listing 4.

To generate music, the program in Program Listing 5 outputs a frequency corresponding to a key closure. By playing around with this effect and using more than just eight keys as I did, you can play your own music. By expanding this program (and with some musical knowledge, which I lack), you can get your TRS-80 to simulate an electronic organ. By having the TRS-80 keep track of your input pattern, you can record and playback the music.

I hope that this article has given you some insight into the PSG and how to easily connect it to your TRS-80. One idea would be to write some assembly language programs for control. Adding sound is really easy and it opens up a new field of applications.

The PSG is available postpaid from the author.■

```
1 FOR R=0 TO 15
2 OUT 127,R
3 OUT 126,0
4 NEXT
10 OUT 127,6            'GUNSHOT  @ R6 SET NOISE PERIOD
20 OUT 126,15     'NOISE PERIOD AT MID-VALUE
30 OUT 127,7          'ADDRESS R7 FOR NOISE ENABLE
40 OUT 126,7        'NOISE ENABLE ON CHAN A,B, & C
50 OUT 127,8        'ADDRESS R8
60 OUT 126,16      'LET AMLPITUDE BE CONTROLLED
70 OUT 127,9       'BY THE ENVELOPE GENERATOR
80 OUT 126,16
90 OUT 127,10
100 OUT 126,16
110 OUT 127,12          'SET ENVELOPE PERIOD TO
120 OUT 126,16          '.586 SECONDS
130 OUT 127,13          'SELECT ENVELOPE DECAY
140 OUT 126,0           'FOR ONE CYCLE ONLY
150 FOR I=1 TO 1000 : NEXT   'WAIT BEFORE GOING TO NEXT
    EFFECT
200 FOR R=0 TO 15
210 OUT 127,R
220 OUT 126,0    'SET ALL REGISTERS TO 0
230 NEXT
240 OUT 127,7               'EXPLOSION SOUND EFFECT
250 OUT 126,7           'ENABLE NOISE ONLY ON CHAN A,B,C
260 OUT 127,8           'SELECT FULL AMPLITUDE RANGE
270 OUT 126,16          'UNDER CONTROL OF ENVELOPE GENER
    ATOR
280 OUT 127,9
290 OUT 126,16
300 OUT 127,10
310 OUT 126,16
320 OUT 127,12          'SET ENVELOPE PERIOD
330 OUT 126,56         'TO 2.05 SECONDS
340 OUT 127,13        'SELECT ENVELOPE DECAY
350 OUT 126,0        'FOR ONE CYCLE ONLY
360 FOR I=11 TO 1000: NEXT     'WAIT A BIT INBETWEEN
1000 FOR N=1 TO 5      'STAR TREK RED ALERT
1005 OUT 127,7
1010 OUT 126,62          'TONE ON A
1020 OUT 127,8
1030 OUT 126,15          'MAX AMP
1040 OUT 127,0
1050 FOR R0=250 TO 150 STEP -2
1055 FOR I=1 TO 2 : NEXT
1060 OUT 126,R0          'FREQ SWEEP
1070 NEXT
1080 OUT 127,8
1090 OUT  126,0          'SHUT IT OFF
1095 NEXT N
1100 FOR I=1TO 500 :NEXT
1200 FOR N=1 TO 5     'SIREN
1205 OUT 127,0
1210 OUT 126,254      'SET CHAN A TONE PERIOD TO 2.27 MS
1220 OUT 127,1
1230 OUT 126,0
1240 OUT 127,7
1250 OUT 126,62       'ENABLE TONE ONLY ON CHAN A
1260 OUT 127,8
1270 OUT 126,15       'SET MAX AMP ON CHAN A
1280 FOR I=1 TO 175 : NEXT  'WAIT ABOUT 350 MS
1290 OUT 127,0
1300 OUT 126,86   'SET TONE ON CHAN A TO 5.346 MS
1310 OUT 127,1
1320 OUT 126,1
1330 FOR I=1 TO 175 : NEXT    'WAIT ABOUT 350 MS
1332  OUT 127, 8      'SHUT IT OFF
1333  OUT  126,0
1334 NEXT N
1335  FOR I=1 TO 500 : NEXT
1340 GOTO 1      '  DON'T STOP UNTIL BREAK IS PRESSED
```

Program Listing 7. Sound-effects Program Demonstration

✓ Reader Service—see page 242

A Disk BASIC to Level II conversion utility.

The DB to LII Converter

Bryan Mumford
Box 435
Summerland, CA 93067

One of the things computers do best is make a little time seem like forever. A 60-second wait for CLOADing seems intolerable. So, you get disks. But you quickly become aware of the fact that Disk BASIC is different from Level II BASIC.

Many Level II programs will no longer run in a disk system.

In most cases, you would want to upgrade those programs to make them more flexible (you did, after all, spend a substantial chunk of money on those disk drives and interface). But there are some programs you might not want to bother with. Or you may not know enough to modify them. If you are in the business of writing software for Level II BASIC but have a disk system yourself, what a convenience it would be to quickly load your programs into Level II from disk as they develop for testing. As it turns out, it is possible to do so, and the source listing in Program Listing 1 will do just that.

Reconfiguration

It seems that the only way Level II has of loading data is from tape. Well, not quite. We can also sneak programs in with machine code. Since the way programs are stored (in RAM) in Level II and the way they are stored in Disk BASIC is the same, it seems like a simple enough project to move a memory image of the program in Disk BASIC down to the locations that a Level II program normally occupies, and run it.

The only problem is that the system needs to be re-configured for Level II. In addition, the program would over-write the disk operating system and crash the computer. Finally, while the format of BASIC text in RAM is the same in both languages, each line contains a pointer to the beginning of the next line, and to simply move a program from one area to another means that the program would immediately direct itself back to its original location.

It becomes apparent that this simple idea may not be so easy to implement. A program such as this reveals a lot of useful information about how the TRS-80 handles BASIC, however, and it might be instructive to examine how such a trick can be pulled off.

There are two useful pointers in RAM for dealing with BASIC text. One, at 40A4H, gives us the start address of any resident BASIC program. The other, at 40F9H, gives the end address of the BASIC text. By subtracting these, we can find the length of the program. If we want to be able to use this program on a 32K machine, the BASIC program text must be longer than about 3C00H bytes. We can easily test for this condition by comparing the program length with 3C00H, and the CALL to ROM address 0A39H in line 430 does just that. If it turns out to be too long, we can jump to the ABORT routine at line 790 which will display an appropriate message and exit to DOS.

It is now necessary to modify the BASIC text so that it will run once it is moved down to Level II. Each line of a BASIC program begins with a two-byte pointer to the location of the next program line. These bytes are followed by a two-byte representation of the current line number. After this comes the actual text of the program line, in compressed format. That is, most words are compressed into a single-byte token which represents the particular function. This is followed by a single byte of zero, which signifies the end of the line. The BASIC interpreter knows when it has read the last line of text by storing zeros as the next line pointer. To make this more intelligible, see Table 1.

Before we can move the text down to the Level II area, we need to redefine the first two bytes to point to the next line where it will be after we move it. This can be accomplished by knowing how far we will need to move it, which is the distance from where Disk BASIC starts to 42E9H, where Level II BASIC starts. Program lines 460 to 500 calculate this displacement and store it at location DIFF. We then load HL with the address of the first line of text and call the subroutine at line 910.

This routine is a little confusing, since it uses self-modifying code. But the idea is that we subtract the previously calculated offset from each line pointer until we get to a line pointer of 0000, which signifies the end of program text.

We now have the whole program text modified to run in a Level II machine. It is still sitting where Disk BASIC put it, however, and that means the stack of a 16K machine will be right in the middle of it. Lines 550 to 610

XX (least significant byte)	ADDRESS OF NEXT PROGRAM LINE
XX (most significant byte)	(00 00 IF END OF TEXT)
XX (least significant byte)	LINE NUMBER OF PRESENT PROGRAM LINE
XX (most significant byte)	
XX XX XX XX	TEXT OF PROGRAM LINE
00	SIGNIFIES END OF LINE

Table 1

will move the whole text to a safe location above the 16K boundary. Before we load Level II, a short message will be displayed reminding us of the proper procedure to get this monster to run. Lines 670 to 690 wait for the ENTER key to be pressed before surrendering control to the Level II monitor.

We could easily enough enter Level II by returning to DOS and typing BASIC2. But being programmers, we are lazy, and we can get the computer to do this for us. The DOS command buffer starts at address 4318H. All commands, including BASIC2, are stored here, interpreted, and then executed. All we need to do is load this buffer with our command, point the HL register at it, load A with B3H, and do a RST 40D. This is accomplished in lines 710 to 770. At this point the screen will display MEMORY SIZE?, and you will enter Level II BASIC.

Our program text is still stored in its relocated form in the top of memory, and the first thing we need to do is pull it down into Level II. This is most easily accomplished by jumping back into our program, which will block move the text down to where we need it. The entry point for this routine is at line number 1390, and I have been careful to arrange this to be located at an address that is easy to remember, namely 49000. Since we will need to enter this program once again later to restore the Level II program to Disk BASIC, this routine tests the address in the start of text pointer at 40A4H to see which way we want to move it. That way, we only need to remember the one address to perform both operations.

Lines 1430 to 1480 move the text down into the Level II area. But we still need to tell Level II that it has arrived.

You will remember that the start of a resident BASIC program is stored at memory location 40AFH. This location will already contain the appropriate address, which is 42E9H. I'm sure you haven't forgotten that the end of a resident BASIC program is stored at location 40F9H. Line 1500 loads this pointer with the value of DE left over from the block move instruction.

Before we run the program, we have one more detail to take care of. If we make any changes in the program while in Level II it would be nice to be able to store them on disk, so we may as well plan on a way to return to Disk Basic with our Level II program intact. One of the things Level II does is disable all Disk BASIC commands. Actually, it re-directs them to an error message display, and we can also re-direct them. Lines 1520 and 1530 store a jump to our program in the address which is called when CMD is typed in Level II. This is the setup for our exit back to the disk system. When CMD"S" is typed, just as in Disk BASIC, we will return to DOS READY, with a little necessary housekeeping performed before we go.

Level II is now able to accept this program. We could return to BASIC and type RUN, but the computer can do that for us. This is accomplished with the short routine in lines 1540 to 1560. If you do not make any changes in the BASIC program you can return to DOS by just hitting the RESET button. If you need to store a modified Level II program on disk, however, we can do that too. Type CMD"S", which will transfer control to line 1580 of the program.

We now need to relocate the program text to run in the Disk BASIC area, move it to a safe place, and return to DOS. The routine at line 910, which we previously used to subtract a displacement from each line pointer, can now be used to add the same diplacement. This is accomplished by replacing the SUBTRACT code in line 990 with the single byte ADD code and a NOP. This is what lines 1580 and 1590 are for. We then call the routine and change all the line pointers. The length of the current program is then calculated and stored, and line 1710 moves it up to 8000H, which is an adequate temporary storage area. Finally, a jump to 0000 is performed, and the system re-boots to DOS READY.

Continued to p. 206

✓ Reader Service—see page 242

Program Listing 1. Source Code Listing

```
00120 ; FUNCTION: TO LOAD A LEVEL II PROGRAM INTO DISK BASIC
00130 ; FROM DISK, LOAD LEVEL II BASIC AND PATCH THE PROGRAM
00140 ; INTO IT SO IT WILL RUN. THEN TO RESTORE DISK BASIC
00150 ; AND LOAD THE SAME PROGRAM, IF MODIFIED, INTO DISK
00160 ; BASIC FROM WHERE IT MAY BE STORED ON DISK.
00170 ; SEQUENCE OF OPERATIONS:
00180 ; 1) LOAD DISK BASIC
00190 ; 2) LOAD LEVEL II PROGRAM FROM DISK
00200 ; 3) RETURN TO DOS WITH CMD"S"
00210 ; 4) RUN 'LEVEL2/CMD' - SPECIFY 32767 AS MEMORY SIZE
00220 ; 5) ENTER SYSTEM COMMAND IN LEVEL II
00230 ; 6) EXECUTE PROGRAM AT 49000
00240 ; 7) TYPE CMD"S" IN LEVEL II TO RETURN TO DOS
00250 ; 8) LOAD DISK BASIC - SPECIFY 48000 AS MEMORY SIZE
00260 ; 9) ENTER SYSTEM COMMAND IN DISK BASIC
00270 ; 10) EXECUTE PROGRAM AT 49000
00280
00290          ORG     0BC09H
00300
00310 ENTER:   LD      HL,(40A4H)      ;START OF BASIC POINTER
00320          LD      (START),HL      ;STORE START ADDRESS
00330          EX      DE,HL           ;SAVE IN DE
00340          LD      HL,(40F9H)      ;END OF BASIC POINTER
00350          LD      (END),HL        ;STORE END
00360          OR      A               ;CLEAR CARRY
00370          SBC     HL,DE           ;SUBTRACT START FROM END
00380          INC     HL
00390          LD      (LEN),HL        ;STORE LENGTH
00400
00410          EX      DE,HL           ;PUT LENGTH IN DE
00420          LD      HL,3C00H        ;MAXIMUM PROGRAM LENGTH
00430          CALL    0A39H           ;ROM COMPARISON ROUTINE
00440          JR      C,ABORT         ;JUMP IF TOO BIG
00450
00460          LD      HL,(40A4H)      ;GET START ADDRESS
00470          LD      DE,42E9H        ;LEVEL 2 ADDRESS
00480          OR      A
00490          SBC     HL,DE           ;FIND DISPLACEMENT
00500          LD      (DIFF),HL       ;STORE DISPLACEMENT
00510
00520          LD      HL,(40A4H)      ;GET START ADDRESS
00530          CALL    ADJUST          ;REDUCE ALL LINE POINTERS
00540
00550          LD      HL,(END)        ;GET END ADDRESS
00560          LD      DE,0BC00H       ;SAFE ADDRESS FOR STORAGE
00570          LD      BC,(LEN)        ;LENGTH OF PROGRAM
00580          LDDR                    ;BLOCK MOVE OUT OF 16K
00590          INC     DE              ;STEP BACK UP
00600          EX      DE,HL           ;START OF PROGRAM
00610          LD      (START),HL      ;UPDATE START POINTER
00620
00630          CALL    01C9H           ;CLEAR SCREEN
00640          LD      HL,MESAG1       ;LOCATION OF MESSAGE
00650          CALL    DSP             ;DISPLAY MESSAGE
00660
00670 INPUT:   CALL    0049H           ;LOOK AT KEYBOARD
00680          CP      13              ;ENTER KEY
00690          JR      NZ,INPUT        ;LOOK AGAIN IF NOT ENTER
00700
00710          LD      DE,4318H        ;DOS COMMAND BUFFER
00720          LD      HL,BASIC2       ;ADDRESS OF BASIC2 COMMAND
00730          LD      BC,7            ;LENGTH OF STRING
00740          LDIR                    ;MOVE COMMAND INTO BUFFER
00750          LD      HL,4318H        ;POINT HL AT COMMAND
00760          LD      A,0B3H          ;DON'T ASK, JUST DO IT
00770          RST     40              ;LOAD LEVEL II
00780
00790 ABORT:   CALL    01C9H           ;CLS
00800          LD      HL,ABMES        ;ABORT MESSAGE
00810          CALL    DSP             ;DISPLAY MESSAGE
00820          JP      402DH           ;RETURN TO DOS
00830
00840 DSP:     LD      A,(HL)          ;GET CHARACTER
00850          OR      A               ;ZERO?
00860          RET     Z               ;RETURN IF END
00870          CALL    033AH           ;VIDEO ROUTINE
00880          INC     HL              ;POINT TO NEXT CHARACTER
00890          JR      DSP             ;LOOP
00900
00910 ADJUST:  LD      (CLINE),HL      ;STORE CURRENT LINE ADD
00920          LD      E,(HL)          ;GET LSB
00930          INC     HL              ;POINT TO NEXT BYTE
00940          LD      D,(HL)          ;GET MSB
00950          EX      DE,HL           ;GET VALUE INTO HL
00960          LD      (NLINE),HL      ;SAVE NEXT LINE ADDRESS
00970          LD      DE,(DIFF)       ;GET DISPLACEMENT VALUE
00980          OR      A
00990 SUB:     SBC     HL,DE           ;CALCULATE NEW POINTER
01000          DEFB    22H             ;CODE FOR  LD (NN),HL
01010 CLINE:   DEFW    0000            ;STORAGE FOR ADDRESS
01020          DEFB    21H             ;CODE FOR  LD HL,NN
01030 NLINE:   DEFW    0000            ;STORAGE FOR NEXT LINE
01040          LD      A,(HL)          ;GET LSB OF POINTER
01050          INC     HL              ;POINT TO MSB OF POINTER
01060          LD      B,(HL)          ;GET MSB
01070          OR      B               ;IS POINTER 0000?
01080          RET     Z               ;RET IF YES
01090          DEC     HL              ;STEP BACK TO ADD.
01100          JR      ADJUST          ;PROCESS NEXT POINTER
01110
01120 BASIC2:  DEFM    'BASIC2'        ;BASIC2 COMMAND TEXT
01130          DEFB    0DH             ;CARRIAGE RETURN
01140 START:   DEFW    0               ;START OF DISK BASIC
01150 END:     DEFW    0               ;END OF DISK BASIC
01160 LEN:     DEFW    0               ;LENGTH OF PROGRAM
01170 DIFF:    DEFW    0               ;AMOUNT OF DISPLACEMENT
01180
01190 MESAG1:  DEFW    0D0DH           ;CARRIAGE RETURNS
01200          DEFM    'IN A MOMENT, YOU WILL ENTER LEVEL II BASIC AND BE ASKED TO ENTER'
01210          DEFM    'A MEMORY SIZE. YOU SHOULD ENTER "32767", WHICH IS STANDARD FOR  '
01220          DEFM    'A 16K LEVEL II.  WHEN THE "READY" MESSAGE IS DISPLATED, TYPE    '
01230          DEFM    '"SYSTEM" AND HIT <ENTER>. THE COMPUTER WILL RESPOND WITH "*?".  '
01240          DEFM    'AT THIS POINT YOU SHOULD TYPE "/49000" AND HIT <ENTER>.         '
01250          DEFM    'THE PROGRAM WILL BEGIN EXECUTION IN LEVEL II IMMEDIATELY.'
01260          DEFM    0D0DH           ;CARRIAGE RETURNS
01270          DEFM    'TO RETURN TO DISK BASIC, TYPE CMD"S". THIS WILL MOVE YOUR TEXT  '
01280          DEFM    'OUT OF THE WAY AND RE-BOOT. THEN ENTER DISK BASIC WITH A MEMORY '
01290          DEFM    'SIZE OF 48000. TYPE "SYSTEM" AND "/49000". THE PROGRAM WILL THEN'
01300          DEFM    'PATCH INTO BASIC FROM WHERE IT MAY BE STORED ON DISK.           '
01310          DEFB    0DH             ;CARRIAGE RETURN
01320          DEFM    'HIT <ENTER> TO PROCEED.....'
01330          DEFB    00              ;END OF TEXT MARKER
01340 ABMES:   DEFB    0DH             ;CARRIAGE RETURN
01350          DEFM    '***  PROGRAM IS TOO LONG  ***'
01360          DEFW    0D0DH
01370
01380
01390 BASIC:   LD      A,(40A5H)       ;GET PAGE OF BASIC
01400          CP      42H             ;COMPARE WITH LEVEL II
01410          JR      NZ,DISK         ;JUMP IF GOING TO DISK
01420
01430 LEVEL2:  LD      HL,(LEN)        ;GET LENGTH OF PROGRAM
01440          PUSH    HL              ;SIT ON IT
01450          POP     BC              ;GET IT OUT AGAIN
01460          LD      DE,42E9H        ;START OF LEVEL II BASIC
01470          LD      HL,(START)      ;LOCATION THE TEXT IS SLASHED AT
01480          LDIR                    ;MOVE BASIC TEXT
01490          EX      DE,HL           ;END OF PROGRAM
01500          LD      (40F9H),HL      ;STORE IT
01510
01520          LD      HL,CMD          ;"CMD" ENTRY POINT
01530          LD      (4174H),HL      ;STORE IT IN RAM
01540          LD      HL,1D1EH        ;DON'T ASK, JUST DO IT
01550          PUSH    HL              ;SAVE IT ANYWAY
01560          JP      1B5DH           ;RUN LEVEL II
01570
01580 CMD:     LD      HL,0019H        ;CODE FOR 'ADD HL,DE'
01590          LD      (SUB),HL        ;REPLACE SUBTRACT CODE
01600          LD      HL,42E9H        ;START OF TEXT
01610          CALL    ADJUST          ;RESTORE LINE POINTERS
01620          LD      DE,42E9H        ;START OF TEXT
01630          LD      HL,(40F9H)      ;END OF TEXT
01640          OR      A               ;CLEAR CARRY
01650          SBC     HL,DE           ;FIND DIFFERENCE
01660          LD      (LEN),HL        ;STORE LENGTH OF PROGRAM
01670          PUSH    HL              ;STASH LENGTH
01680          POP     BC              ;GET IS OUT AGAIN
01690          LD      DE,8000H        ;TEMPORARY STORAGE
01700          LD      HL,42E9H        ;START OF TEXT
01710          LDIR
01720          JP      0               ;RE-BOOT SYSTEM
01730
01740 DISK:    LD      HL,8000H        ;WHERE TEXT IS STORED
01750          LD      DE,(40A4H)      ;GET START OF DISK BASIC
01760          LD      BC,(LEN)        ;GET LENGTH
01770          LDIR                    ;MOVE TEXT INTO BASIC
01780          EX      DE,HL
01790          DEC     HL              ;SET IO END OF TEXT
01800          LD      (40F9H),HL      ;STORE FOR BASIC
01810          LD      HL,(40E8H)      ;STACK POINTER
01820          LD      SP,HL           ;RESTORE IT
01830          XOR     A               ;WILL PREVENT AN ERROR MESSAGE
01840          JP      2B2EH           ;LISI ROUTINE
01850
01860          DEFM    ' WRITTEN BY DRYAN MUMFORD - MUMFORD MICRO SYSTEMS '
01870          END     ENTER
```


✓Reader Service—see page 242

To get the program back into Disk BASIC, first load BASIC. You will need to put the stack in a location that won't conflict with the stored program text. A MEMORY SIZE of 48000 will accomplish this. Surely you have not yet forgotten our entry point of 49000. Type SYSTEM, and enter /49000.

We will enter the program at line 1390, but now that Disk BASIC has an address larger than 42E9H stored in 40A4H, control will transfer to line 1740, where the program text is moved down to the Disk BASIC area and the end of text pointer is set in line 1800. Our entry to Disk BASIC is a little more awkward than entering Level II; we first need to restore the stack pointer. The SYSTEM command automatically resets the stack to location 4288H, and if we leave it there we will get an error message upon return to BASIC.

Fortunately, the previous location of the stack is stored at address 40E8H. Lines 1810 and 1820 restore the stack to this location. Since we can't run a Level II program in Disk BASIC (that's why we went to all this trouble in the first place) there is no point in entering BASIC in the RUN mode.

It would be nice to know that everything is in order, however, so we may as well choose a useful and dramatic entry point. This is the LIST routine, which is at ROM address 2B2EH. Setting A to zero first will prevent an error message, and we will finally enter Disk BASIC with the program being listed. At this point you may SAVE the program on disk again as if it were a normal BASIC program, which it is.

If this sounds like a lot of work to go to just to get disk access to Level II, it's just because we have had to view it on the machine level. In practice, the procedure is quite simple:

1) Load Disk BASIC.

2) Load the Level II program from disk.

3) Return to DOS READY with CMD"S".

4) Execute this program by typing LEVEL2.

5) Answer MEMORY SIZE? with 32767.

6) Type SYSTEM, and answer the prompt with /49000.

To return to Disk BASIC:

1) Type CMD"S".

2) Load BASIC with a MEMORY SIZE of 48000.

3) Type SYSTEM, and answer the prompt with /49000.

If you have 48K in you machine, there is no need to specify a MEMORY SIZE when entering either Level II or Disk BASIC since the default value will not interfere with our program. ■

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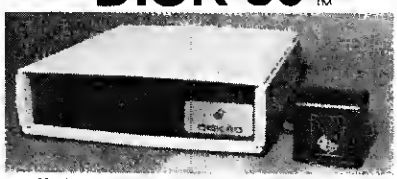

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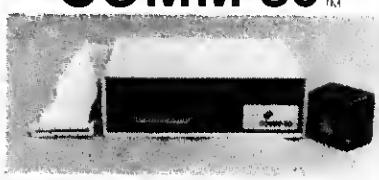

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Doodlebug

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When the first issue of *80 Microcomputing* arrived at my door, I had already owned a TRS-80 Level II 16K for a little more than a year. I was a skeptic. What could this new magazine do for me?

I certainly was mistaken.

I'd begun studying assembly language the summer before and this issue opened up whole new areas for me. I would like to recount just one project which was stimulated by this first issue.

Features INKEY$

An article by Daniel Lovy reminded me of a BASIC program I'd written shortly after the arrival of my TRS-80, designed to let me draw on the CRT with computer graphics.

Its central feature was the INKEY$. Typically, a single keystroke initiated an action (for example, drawing a horizontal line from left to right). Another stroke (S, for example) would stop that action. How much more realistic it would be to have the action take place while a key was depressed and to cease when the key was released.

I selected the four arrows on the keyboard to control upward, downward, left and right movement of a point which traced out the drawing. By examining the value of PEEK(14400), you can determine which key is pressed.

Table 1 summarizes the effects of pressing one of these arrows on the point (X,Y) on the screen.

I found I could move the point diagonally by holding down two keys at once as long as I made the right adjustments in the value of PEEK(14400).

You can't do this with INKEY$, since it resolved any simultaneity by giving only one of the two keys pressed. Table 2 summarizes the relationships I then needed.

Key Pressed	PEEK(14400)	Effect on (X,Y) and drawing
↑	8	decrease Y (move up screen)
↓	16	increase Y (move down screen)
←	32	decrease X (move left screen)
→	64	increase X (move right screen)

Table 1

Keys Pressed	PEEK(14400)	Effect on (X,Y)
←,↑	40	decrease X, decrease Y
→,↑	72	increase X, decrease Y
←,↓	48	decrease X, increase Y
→,↓	80	increase X, increase Y

Table 2

Value of N	Action of USR(N)
0	reverse the video
1	return value for DX
2	return value for DY
3	return value for erase flag E

Table 3

Next, I wanted to erase any part of my drawing by RESETting (X,Y) as the point (X,Y) moved along the screen. I wanted to do this by holding down one more key. I chose the space bar because it could be detected by examining PEEK(14400), just as with the arrows, and, if you were already holding down two keys, it was an easy reach to the space bar. If you held down the space bar alone, PEEK(14400) had the value 128. If you held down the space bar plus any combination of arrows, the number 128 is added to the combination of those arrows.

In BASIC, then, you would calculate A = PEEK(14400) repeatedly in a loop which moves the point (X,Y), and use the value A to compute values for the distance changes DX and DY. Thus, the execution of the expressions X = X + DX and Y = Y + DY gave the new location of the point in the drawing.

If the value of A exceeded 128, then the space bar was pressed

to set the erase flag (a variable E) to 0. Then, I executed A = A – 128, so that the desired movement could be computed according to the tables.

Reverse Video

One final feature I wanted was a "reverse" video, that is, dark lines drawn on a bright background.

By now I felt that holding down more than three keys was too much. Besides, you are likely to want reverse video to stay rather than be transitory, so it seemed a natural job for INKEY$.

I determined that testing INKEY$ against "R" wouldn't interfere with PEEK(14400), so this became my trigger for reversing the screen. To do this in BASIC, I executed the statement:

```
IF POINT(X,Y) THEN RESET(X,Y) ELSE SET(X,Y)
```

for each location on the screen. The program appears in Program Listing 1.

Those of you who've tried this will immediately recognize its major problem, speed—or more exactly—the lack of it.

The subroutine which reverses the video was the worst offender because it required one and a half minutes plus to complete the task. Since a point which is SET corresponded to a one somewhere in video memory, and one RESET to a 0, the reverse video is almost the same as a one's complement of video memory.

Since this BASIC program had to test a large number of cases to determine the values for DX, DY, and E, I incorporated the computations into a machine language program called by USR(N). I used the argument passed to the program to indicate which action was desired by a particular calling statement in the machine language program. Because the USR(N) statement can return a result to any point in a BASIC expression, I replaced the computation X = X + DX by X = X + USR(1). Table 3 shows how USR(N) works.

The assembly language program for this subroutine appears, along with the hexadecimal machine codes, in Program Listing 2. The modified BASIC program which calls it is in Program Listing 3.

In order to work properly, the MEMORY SIZE? at power-up had to be answered by 32684 (or a smaller number if you want to protect more memory), because the machine language program occupied locations 32685 to 32767. The machine code could be relocated.

When I tried this second version of the program, it was extremely fast. I couldn't even time the reverse video execution with my wristwatch.

I also found that the moving spot which draws and erases, moved about 50 percent faster. In both versions, the keys behaved identically.

Improvements

Few programs are ever beyond improvement and this one is no exception. Among the hoped for improvements are: copying the screen contents so it can be restored later in that session or on tape (or disk); superimposing a previous copy of the screen on the current contents; drawing or erasing a line between any two points on the screen; and drawing or erasing certain standard geometric shapes.

Some of these might better be done in machine language, some in BASIC. It is helpful to do it in BASIC first. If the BASIC version is fast enough, use it. Don't be afraid to mix the two—they go well together. ■

```
10 DEFINTA-Z:INPUT"START X,Y";X,Y:CLS:AD=14400:B$="("+S
   TRING$(9,32)+")"
20 IF X>127 THEN X=0 ELSE IF X<0 THEN X=127
22 IFY>47 THEN Y=0 ELSE IF Y<0 THEN Y=47
25 DX=0:DY=0:E=-1:A$=INKEY$:IF A$="R" GOSUB 100
30 SET(X,Y):A=PEEK(AD):RESET(X,Y):IFA>=128THENE=0:A=A-1
   28
35 IFA=32ORA=40ORA=48THENDX=-1ELSEIFA=64ORA=72ORA=80THE
   NDX=1
40 IFA=8ORA=40ORA=72THENDY=-1ELSEIFA=16ORA=48ORA=80THEN
   DY=1
50 PRINT@0,B$;:PRINT@1,X;",";Y;:IFETHENSET(X,Y)
60 X=X+DX:Y=Y+DY:GOTO20
100 FORI=0TO127:FORJ=0TO47
105 IF POINT(I,J) THEN RESET(I,J) ELSE SET(I,J)
110 NEXTJ,I:RETURN
```

Program Listing 1

```
5 CLEAR100
10 DEFINTA-Z:POKE16526,173:POKE16527,127
20 CLS:X=63:Y=22:INPUT"START X,Y";X,Y:B$="("+STRING$(10
   ,128)+")"
25 FORI=0TO896STEP64:PRINT@I,STRING$(64,128);:NEXTI:PRI
   NT@960,STRING$(63,128);:POKE16383,128
30 IFX>127THENX=0ELSEIFX<0THENX=127
32 IFY>47THENY=0ELSEIFY<0THENY=47
40 SET(X,Y):RESET(X,Y):IFINKEY$="R"THENZ=USR(0)
50 PRINT@0,B$;:PRINT@1,X;",";Y;:IFUSR(3)SET(X,Y)
60 X=X+USR(1):Y=Y+USR(2):GOTO30
```

Program Listing 3

```
7FAD            00100          ORG     32685
7FAD CD7F0A     00110          CALL    0A7FH   ;PUT N FROM USR(N) IN HL
7FB0 7D         00120          LD      A,L     ;EXAMINE N
7FB1 B7         00130          OR      A       ;IF THIS IS USR(0)
7FB2 2814       00140          JR      Z,RVID  ;   THEN REVERSE VIDEO
7FB4 DD214038   00150          LD      IX,14400 ;  ELSE COPY BYTE FROM
7FB8 DD4600     00160          LD      B,(IX)  ;   KEYBOARD MEMORY
7FBB 21FFFF     00170          LD      HL,-1   ;   GET A RESULT READY
7FBE FE03       00180          CP      3       ;IF THIS IS USR(3)
7FC0 2838       00190          JR      Z,FINDE ;   THEN COMPUTE ERASE FLAG
7FC2 FE01       00200          CP      1       ;ELSE IF THIS IS USR(1)
7FC4 2816       00210          JR      Z,FINDDX ;        THEN COMPUTE DX
7FC6 1825       00220          JR      FINDDY  ;        ELSE COMPUTE DY
7FC8 010004     00230 RVID     LD      BC,1024 ;1024 BYTES IN VIDEO MEMORY
7FCB 21FF3B     00240          LD      HL,3BFFH ;GET POINTER READY
7FCE 23         00250 LOOP     INC     HL      ;POINT TO NEXT BYTE IN VIDEO
7FCF 7E         00260          LD      A,(HL)  ;GET BYTE FROM VIDEO
7FD0 2F         00270          CPL             ;REVERSE 0'S AND 1'S
7FD1 CBFF       00280          SET     7,A     ;MAKE SURE YOU HAVE
7FD3 CBB7       00290          RES     6,A     ;A GRAPHICS BYTE
7FD5 77         00300          LD      (HL),A  ;WRITE REVERSED BYTE TO VIDEO
7FD6 0B         00310          DEC     BC      ;COUNT DOWN - ONE MORE DONE
7FD7 78         00320          LD      A,B     ;
7FD8 B1         00330          OR      C       ;ARE ANY BYTES LEFT?
7FD9 20F3       00340          JR      NZ,LOOP ;IF SO THEN DO IT AGAIN
7FDB C9         00350          RET             ;        ELSE RETURN
7FDC CB68       00360 FINDDX   BIT     5,B     ;IF LEFT ARROW IS PRESSED
7FDE 200A       00370          JR      NZ,BACK ;        THEN DX=-1
7FE0 210100     00380          LD      HL,1    ; ELSE GET 1 READY AS RESULT
7FE3 CB70       00390          BIT     6,B     ;IF RIGHT ARROW IS PRESSED
7FE5 2003       00400          JR      NZ,BACK ;        THEN DX=1
7FE7 210000     00410 ZERO     LD      HL,0    ; ELSE RESULT IS 0
7FEA C39A0A     00420 BACK     JP      2714    ;SEND RESULT BACK
7FED CB58       00430 FINDDY   BIT     3,B     ;IF UP ARROW IS PRESSED
7FEF 20F9       00440          JR      NZ,BACK ;        THEN DY=-1
7FF1 210100     00450          LD      HL,1    ; ELSE GET 1 READY AS RESULT
7FF4 CB60       00460          BIT     4,B     ;IF DOWN ARROW IS PRESSED
7FF6 20F2       00470          JR      NZ,BACK ;        THEN DY=1
7FF8 18ED       00480          JR      ZERO    ;        ELSE DY=0
7FFA CB78       00490 FINDE    BIT     7,B     ;IF SPACE BAR IS UP
7FFC 28EC       00500          JR      Z,BACK  ;  THEN ERASE FLAG IS -1
7FFE 18E7       00510          JR      ZERO    ;ELSE IT IS 0
0000            00520          END
00000 TOTAL ERRORS
```

Program Listing 2

Complete LNW Expansion Interfaces

The LNW System Expansion offers one of the best alternatives to the Radio Shack interface, and now with a complete kit from COMPUTEX it's even better. We studied the I/O market for three months and averaged the cost of procurring components for the LNW board. We found that by shopping for the best prices from over 10 vendors, the LNW board could be assembled for an average parts cost of $ 253.00 not including shipping cost. COMPUTEX saves you time and money by offering a complete LNW system expansion kit for $ 219.00 (less RAM and Cassette Relay). We even include all IC Sockets. Not only is the LNW/COMPUTEX expansion interface better electrically, we've made it the best TRS80(tm*) expansion interface by designing and building a custom cabinet for it.

*TRS80 is a trademark of Tandy Corp

The CPT Cabinets for the LNW interfaces are made of quality birch wood, custom finished in a light walnut color then trimmed around the front by aluminum molding. Two cabinets are available.

The CPT1000 cabinet will hold the LNW Board, and power supplies for both keyboard and the LNW system expansion. Measurements 15" wide x 13¼" deep x 5¼" tall . . . . **$ 89.95**

The CPT2000 cabinet has all of the features of the CPT1000 but will hold up to two disk drives, power supplies, and even has a cut out for a muffin fan. The CPT2000 has a removeable front panel that comes with cutouts for 1 or 2 disk drives or with no cutouts. The CPT2000 measures 15¾" wide x 13¾" deep x 3½" tall. . . . . **$ 99.95**

LNW System Expansion Kit	$ 249.00
(Assembled)	349.00
CPT1000 Cabinet	89.95
CPT2000 Cabinet	99.95
LNW System Expansion Board	69.00
T1 (Radio Shack) Transformer for LNW	21.95
Keyboard to I/O Cable	19.95
Muffin Fan for CPT2000	14.95
(Individual components available also)	

Disk Drives

COMPUTEX reviewed all major disk drives available on the market prior to becoming a dealer for anyone. The drive we selected to market is the Tandon TM 100 Series. Compare their specifications and features and we think you'll agree that the Tandon TM 100 Series of Disk Drives are the best available.

- Tandon is the leading designer and supplier of read/write heads for most other disk drive manufacturers
- Track to Track access time of 5 milliseconds
- No head load time required, most others take 35 M S
- Read / write head guaranteed for 20,000 hours
- Quieter than most other disk drives
- First successful manufacturer of double headed drives

Model	Description	Base Price	With Supply Case
TM100-1	40 Track Single Headed	$225.00	$299.95
TM100-2	40 Track Double Headed	325.00	399.95
TM100-3	80 Track Single Headed	375.00	449.00
TM100-4	80 Track Double Headed	475.00	549.00

All above drives will operate single or double density

For those that still insist on MPI and Shugart

	Basic Unit	With Supply Case
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MPIB52-40 Track Double Sided	375.00	449.00
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Computex carries or can supply most any TRS80 System or peripherals. (Call for quotes)

VARIOUS OTHER SPECIALS!

Novation / Cat Modem	$ 179.00
Verbatim / Scotch diskettes (Box 10)	24.95
16 K RAM Chips	8 / 54.95
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Level II - 16K RAM	$ 700.00
Level II - 4 K RAM	595.00
Model II 64K System	3,500.00
OK Expansion Interface	$ 259.00
16K Expansion Interface (our RAM)	339.00
32K Expansion Interface (our RAM)	419.00
Software	
Newdos 80	$ 149.00
Dosplus	99.95
Electric Pencil(model I disk)	$ 150.00
Electric Pencil(model I cassette)	100.00

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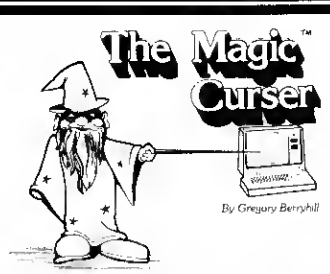

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- right justify text within a block on the screen

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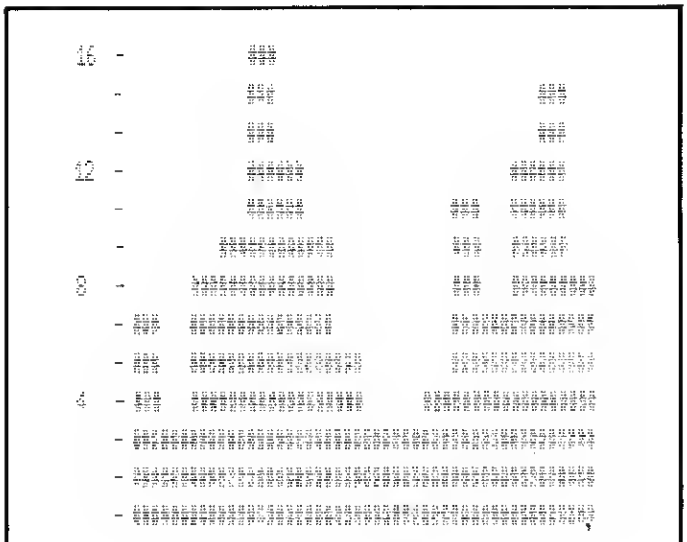
Data in the form of a mass of numbers is sometimes not the clearest way to present results, especially if you are looking for trends. One way to present a large amount of data clearly is to use a bar graph or histogram.

Here is a subroutine that will generate histograms. When it's called, variable GR must contain the number of divisions or bars that will be drawn. The elements of the array HIST must contain the data to be graphed. Each value in that array will be translated into a bar of a length proportional to the rest of the data in the array.

The subroutine finds the largest value in the array automatically and uses it to set the scale along the side and to calculate the proportions for the rest of the data.

It can also output the graph to a printer. This is done by converting the graphics blocks to #s. It takes a little while, so do not panic if nothing happens right away.

Lines 1-40 are merely an input routine that can be used to enter the data directly from the keyboard. These lines could be replaced by the program that actually generates the data.■



Sample Data Graph.

```
1 CLS:DEFINTZ
5 CLEAR 1000
10 DIM HIST(125),A$(15)
15 INPUT"ENTER THE NUMBER OF DIVISIONS";GR
20 FORZ=1 TO GR:INPUT HIST(Z):NEXT
30 GOSUB 1000
40 END
1000 '************* HISTOGRAM ***************
1010 CLS
1020 MAX=HIST(1):FOR ZA=1 TO GR:IF HIST(ZA) > MAX THEN
     MAX=HIST(ZA):NEXT ELSE NEXT
1030 PRINT@ 69,MAX:PRINT@ 453,MAX/2:PRINT@ 645,MAX/4:PR
     INT@ 261,MAX*(3/4)
1040 GOSUB 1160
1050 K=0
1060 SI=MAX/35
1070 LE=INT(101/GR)
1080 FORZX=25 TO 125 STEP LE
1090 K=K+1
1100 SI=MAX/35
1110 FORZY=39 TO (39-HIST(K)/SI) STEP-1
1120 IF ZX+LE>125 THEN 1140
1130 FOR ZQ=ZX TO ZX+LE-1:SET(ZQ,ZY):NEXTZQ:NEXTZY:NEXT
     ZX
1140 PRINT@ 896,"DO YOU WANT A PRINT OUT";:INPUT AN$
1150 IF LEFT$(AN$,1)="N" THEN RETURN ELSE GOSUB 1190:RE
     TURN
1160 FOR ZA=74 TO 843 STEP 64
1170 PRINT@ZA,"-       ";:NEXT
1180 RETURN
1190 '************ PRINT **************
1200 VID=15360
1210 FOR Z=1 TO 13
1220 A$(Z)=""
1230 FOR ZP=VID+5+Z*64 TO VID+5+Z*64+6
1240 A$(Z)=A$(Z)+CHR$(PEEK(ZP))
1250 NEXT ZP
1260 FOR ZP=25 TO 125 STEP2
1270 IF Z>2 THEN ST=0 ELSE ST=1
1280 IF POINT(ZP,Z*3+ST)=-1 THEN A$(Z)=A$(Z)+"#" ELSE A
     $(Z)=A$(Z)+" "
1290 NEXT ZP
1300 NEXT Z
1310 FOR Z=1 TO 14:LPRINT A$(Z):NEXT Z
1320 RETURN
```

Program Listing for Histogram.

A variable cross-reference listing, just like a mainframe's, can be ours at last.

CROSSREF

D. N. Ewart
121 Woodhaven Drive
Scotia, NY 12302

A variable cross-reference listing such as those used on the big mainframe computers is certainly useful. Alas, none is available for the TRS-80!

Until recently, I couldn't see a way to write one. I, myself, tend to write long, complex programs for my TRS-80, and don't even spend the time I should documenting them. I probably use more variable names than are really necessary, and I run the risk of re-using names and asking for it—a program bug.

Then I remembered that programs are stored in computer memory starting at location 17128, and I began to POKE around to see what format is used. There is a pattern to the way the TRS-80 stores programs. It's possible to unravel the code and pick out the variable names along with the line numbers in which they appear.

After a long weekend session, where I wrote the rudiments of my CROSSREF, it does just what I want. Further embellishment allows me to pick up subroutine calls as well as variable names, and has given me a valuable programming aid. The amazing thing to me is that the programming can be done in BASIC itself!

My system consists of a 16K Level II with a cassette and a Line Printer II. As you will see, the printer is desirable, but not required for CROSSREF.

CROSSREF is two programs, which I call Part A (Program Listing 1) and Part B (Program Listing 2). Part A should be appended to your program after it is loaded using the PEEK and POKE method summarized in Table 1.

I used the highest line numbers in TRS-80 BASIC, so it is unlikely that your program line numbers will interfere. Part A goes through your program, picks out the variable names, subroutine calls and associated line numbers. Then, it generates a tape.

Part B reads the tape and generates the report.

How to Do It

After appending Part A type RUN 65500 and hit ENTER. You will be presented with three options. If you touch 1, the program will execute line 65502, which displays your program in TRS-80 code, one byte at a time. Freeze the display by touching SHIFT and @, and see if you can figure out the code. It is not difficult. In Table 2, I have illustrated a simple two-line program and how to interpret the code.

Touch BREAK to stop the display when you have seen enough. RUN 65500 again. Touch 2 and you will be asked to prepare a tape. Put a fresh one in your recorder, prepare to record, then touch any key. The program will ask you for a title. Type your program name followed by ENTER. Part A will start to analyze your program line by line. You will see line numbers appearing on your

```
65500 CLS:PRINT@256,"WHAT FUNCTION?":PRINT"1 MEMORY SCA
     N":PRINT"2 SUBROUTINE AND VARIABLE SEARCH":PRINT"3
      READ TAPE"  'CROSSREF PART A  D.N.EWART 121 WOODH
     AVEN DR. SCOTIA NY 12302    6/14/80
65501 GOSUB65524:ONVAL(A$)GOTO65502,65504,65503
65502 FORI=17128TO32767:PRINTPEEK(I);:NEXT:STOP
65503 CLEAR600:GOSUB65525:INPUT#-1,D$:IFD$="END"THENSTO
     PELSEPRINTD$;:GOTO65503
65504 CLEAR800:DIMB(15),B$(30):I=17127:FORK=0TO15:B(K)=
     INT(2[K+.5):NEXT:GOSUB65525:INPUT"TITLE";A$:PRINT#
     -1,A$
65505 I=I+1:D=PEEK(I):IFD>64ANDD<91THENJ=1:GOTO65507
65506 IFJ=0THEN65508ELSEIFD>47ANDD<58ORD>34ANDD<38ORD=3
     3THEN65507ELSEGOSUB65516:GOTO65508
65507 A$=A$+CHR$(D):GOTO65505
65508 A$="":IFD<>145THEN65511
65509 I=I+1:D=PEEK(I):IFD>47ANDD<58THENA$=A$+CHR$(D):GO
     TO65509
65510 IFD=32THEN65509ELSEGOSUB65517:IFD<>44THEN65511ELS
     EA$="":GOTO65509
65511 J=0:A$="":IFD=0THENB$(0)="":M=0:GOSUB65520:IFLN=6
     5500THEN65515ELSEPRINT:PRINTLN;:PRINTTAB(8)"";:I=I
     +4:C$=STR$(LN):C$="/"+RIGHT$(C$,LEN(C$)-1):GOSUB65
     518:GOTO65505
65512 IFD=147ORD=136THEN65513ELSEIFD=34THEN65514ELSE655
     05
65513 D=PEEK(I+1):IFD=0THEN65505ELSEI=I+1:GOTO65513
65514 IFD=0THEN65505ELSEI=I+1:D=PEEK(I):IFD=34THEN65505
     ELSE65514
65515 PRINT#-1,D$:PRINT#-1,"END":STOP
65516 IFD=40A$=A$+"("
65517 FORLN=0TOM:IFA$=B$(LN)THENRETURNELSENEXT:PRINTA$;
     ".";:C$=" "+A$:GOSUB65518:M=M+1:B$(M)=A$:RETURN
65518 IFLEN(D$+C$)<245THEND$=D$+C$ELSEPRINT#-1,D$:D$=C$
65519 RETURN
65520 K=-1:LN=0:D=PEEK(I+3)
65521 K=K+1:E=D/2:F=INT(E):IFF-E<0THENLN=LN+B(K)
65522 IFK=7THEND=PEEK(I+4):GOTO65521
65523 IFK=15RETURNELSED=F:GOTO65521
65524 A$=INKEY$:IFA$=""THEN65524ELSECLS:RETURN
65525 PRINT@524,"PREPARE TAPE - HIT ANY KEY WHEN READY"
     :GOSUB65524:RETURN
```

Program Listing 1. Part A CROSSREF

```
65451 CLS:CLEAR10000:DIMV$(200),LN$(200),L1$(20),N(200)
      :MAX=-1:GOSUB65488:INPUT#-1,TI$:PRINTTI$
65452 FORJ=0TOMAX:PRINTJ+1;:PRINTTAB(4)V$(J);:PRINTTAB(
      12)LN$(J):NEXT:INPUT#-1,D$:IFD$="END"THEN65468ELSE
      L=LEN(D$):I=1:S=0:GOSUB65486:IFB$>="A"ANDB$=<"Z"OR
      B$>"0"ANDB$<="9"THEN65453ELSEIFB$="/"THEN65454ELSE
      I=I+1:GOTO65456
65453 V$="":V$=V$+B$:GOTO65457
65454 PRINT@1000,"      ";:PRINT@1000,LN$;:LN$="":K(0)=
      K(0)+1
65455 GOSUB65486:IFB$=" "THEN65456ELSEIFB$="/"THEN65454
      ELSELN$=LN$+B$:IFS=1THEN65452ELSE65455
65456 V$=""
65457 GOSUB65486:IFB$=" "ORB$="/"THEN65458ELSEV$=V$+B$:
      IFS=1THEN65458ELSE65457
65458 A$=LEFT$(V$,1):IFA$<"1"ORA$>"9"THEN65459ELSELN=LE
      N(V$):V$=STRING$(5-LN," ")+V$
65459 FORJ=0TOMAX:IFV$=V$(J)THEN65460ELSENEXT:MAX=MAX+1
      :V$(MAX)=V$:N(MAX)=MAX:LN=LEN(LN$):LN$=STRING$(6-L
      N," ")+LN$:LN$(MAX)=LN$:GOTO65467
65460 LN=LEN(LN$):LN$=STRING$(6-LN," ")+LN$:IFLEN(LN$(J
      ))>250THEN65461ELSELN$(J)=LN$(J)+LN$:GOTO65467
65461 IFRIGHT$(LN$(J),1)<>"+"THENGOSUB65484:LN$(J)=LN$(
      J)+A$:Y=X:GOTO65466
65462 Y=VAL(MID$(LN$(J),253,2))
65463 IFLEN(L1$(Y))<=250THEN65466ELSEIFRIGHT$(L1$(Y),1)
      <>"+"THEN65465
65464 Y=VAL(MID$(L1$(Y),253,2)):GOTO65463
65465 GOSUB65484:L1$(Y)=L1$(Y)+A$:Y=X
65466 L1$(Y)=L1$(Y)+LN$
65467 IFS=1THEN65452ELSEIFB$="/"THEN65454ELSE65456
65468 CLS:PRINT@540,"SORTING":M=MAX
65469 M=INT(M/2):IFM=0THEN65473ELSEJ=0:K=MAX-M
65470 I=J
65471 L=I+M:IFV$(I)<=V$(L)THEN65472ELSEPRINT@606,M;:T$=
      V$(I):T=N(I):V$(I)=V$(L):N(I)=N(L):V$(L)=T$:N(L)=T
      :I=I-M:IFI=>0THEN65471
65472 J=J+1:IFJ>KTHEN65469ELSE65470
65473 CLS:PRINT@525,"TOUCH P TO PRINT ELSE ANY OTHER KE
      Y"
65474 GOSUB65487:IFA$<>"P"THENSTOP
65475 CLS:J=0:LPRINT"SUBROUTINE AND VARIABLE CROSS-REFE
      RENCE TABLE":LPRINTSTRING$(1,138):LPRINT"TITLE  ";
      TI$:LPRINTSTRING$(3,138):IFLEFT$(V$(0),1)<"A"THENL
      PRINT"SUBROUTINE    CALLED FROM LINE(S)"ELSE65477
65476 IFLEFT$(V$(J),1)<"A"THENGOSUB65479:K(1)=K(1)+1:GO
      TO65476
65477 LPRINTSTRING$(3,138):LPRINT"VARIABLE      USED IN
      LINE(S)"
65478 GOSUB65479:GOTO65478
65479 LPRINTTAB(3)V$(J);:LN$=LN$(N(J)):L=LEN(LN$):GOSUB
      65480:IFJ=MAXTHEN65483ELSEJ=J+1:RETURN
65480 K=66:IFL>KTHEN65482ELSEIFRIGHT$(LN$,1)="+"THEN654
      81ELSELPRINTTAB(12)LN$:RETURN
65481 Y=VAL(MID$(LN$,L-2,2)):LPRINTTAB(12)LEFT$(LN$,L-3
      ):LN$=L1$(Y):L=LEN(LN$):GOTO65480
65482 N$=LEFT$(LN$,66):LPRINTTAB(12)N$:LN$=RIGHT$(LN$,L
      -K):L=LEN(LN$):GOTO65480
65483 LPRINTSTRING$(3,138):LPRINT"PROGRAM HAS ";K(0);"
      NUMBERED BASIC STATEMENTS, ";K(1);" CALLED SUBROUT
      INES,":LPRINT"AND ";MAX+1-K(1);" VARIABLES.":LPRIN
      TSTRING$(3,138):STOP
65484 X=X+1:A$=STR$(X):IFX<10THENA$=" "+A$
65485 A$=A$+"+":A$=RIGHT$(A$,3):RETURN
65486 B$=MID$(D$,I,1):I=I+1:IFI<=LTHENRETURNELSES=1:RET
      URN
65487 A$=INKEY$:IFA$=""THEN65487ELSERETURN
65488 PRINT@524,"PREPARE TAPE - HIT ANY KEY WHEN READY"
      :GOSUB65487:CLS:RETURN
```

Program Listing 2. Part B CROSSREF

STEP 1: "CLOAD" your program, then "PRINTPEEK (16633)"

STEP 2: If the contents of 16633 are 2 or greater than "POKE16548, PEEK (16633)-2" and "POKE16549, PEEK (16634)"

then go to STEP 4

STEP 3: If the contents of 16633 is 0 or 1 then "POKE16548, PEEK (16633) + 254" and POKE 16549, PEEK (16634) – 1"

then go to STEP 4

STEP 4: "CLOAD" Part A from the cassette recorder then "POKE16548, 233" and POKE16549, 66"

STEP 5: Now "RUN 65500"

Table 1. Appending Part A to Your Program

screen, followed by the variable names and subroutine calls in each line. Part A discards duplicate variables or subroutine references appearing in any line so, for example, if you had a program line:

```
200 COW = COW + 1:GOSUB1000:DOG = 5
```

you would see on your screen:

```
200 COW.1000.DOG
```

Notice that the variable COW appears only once on the screen, although you used it twice in line 200. You will also observe that a subscripted variable is identified by the array name, and not by the specific element in the array. For example:

```
300 V(I) = V(J):V(J) = K
```

would appear on your screen as:

```
300 V( ),I,J,K,
```

Every so often the program will stop and write a record on tape. The routine which does this is found on lines 65518–65519.

After Part A has run through your program (This can take awhile for a long program, but you can monitor its every step.), it will stop at line 65515. It does this when it encounters line number 65500, the starting line of Part A.

To see if you have a valid tape, rewind it. Type RUN 65500. Select option 3. Prepare your recorder for play and touch any key. The contents of the tape should be displayed on your screen and you can be sure of a valid run. If you read garbage on the tape, or find nothing, stop. Go through option 2 again. Check that you are properly set up for recording.

Three Sections

After you get a valid tape, you are ready for Part B. Type NEW. CLOAD Part B, and type RUN. The tape you made with Part A should be rewound and your cassette recorder set up for play.

Part B consists of three sections. Section 1, in lines 65450–

ADDRESS	CONTENTS	CHARACTER OR KEYWORD	
17128	0		(ALWAYS ZERO; START OF FIRST STATEMENT.)
17129	3		(READ AS 067,003. CONVERTS TO 17155,
17130	67		THE ADDRESS OF THE NEXT POINTER)
17131	200		(READ AS 000,200. CONVERTS TO 200,
17132	0		THE LINE NUMBER.)
17133	67	C	
17134	79	O	
17135	87	W	
17136	213	=	
17137	67	C	
17138	79	O	
17139	87	W	
17140	205	+	
17141	49	1	
17142	58	:	
17143	145	GOSUB	
17144	49	1	
17145	48	0	
17146	48	0	
17147	48	0	
17148	58	:	
17149	68	D	
17150	79	O	
17151	71	G	
17152	213	=	
17153	53	5	
17154	0		(STARTS A NEW NUMBERED LINE.)
17155	24		(READ AS 067,024. CONVERTS TO 17176,
17156	67		THE ADDRESS OF THE NEXT POINTER.)
17157	44		(READ AS 001,044. CONVERTS TO 300,
17158	1		THE LINE NUMBER.)
17159	86	V	
17160	40	(	
17161	73	I	
17162	41	)	
17163	213	=	
17164	86	V	
17165	40	(	
17166	74	J	
17167	41	)	
17168	58	:	
17169	86	V	
17170	40	(	
17171	74	J	
17172	41	)	
17173	213	=	
17174	75	K	
17175	0		(STARTS THE NEXT NUMBERED LINE.)

YOU WOULD SEE THE NUMBERS SHOWN IN COLUMN 2
IF YOU ENTERED THE PROGRAM:
200 COW=COW+1:GOSUB1000:DOG=5
300 V(I)=V(J):V(J)=K
AND USED OPTION 1 OF PART A.

Table 2. Illustration of TRS-80 Code

65467, reads the tape and makes a table of variable names and subroutines. Each is followed by the line numbers in which they appear. You will see this table updated each time a tape record has been read. The routines place variable names and subroutines in the order of appearance on the tape, and therefore in your program. You will see the line number being analyzed appear at the bottom of your screen.

After the last record has been read, Section 2 is entered, line numbers 65468-65472. Section 2 is simply a sort. Following the sort, the table will be reorganized with subroutines coming first in numerical order, followed by variable names in alphabetical order. You will be asked to touch key P to begin printing the final table.

This is now done in Section 3, line numbers 65473-65483. Touching any other key besides P stops the program at line 65474, without printing the table. If you accidently touch another key and get a BREAK message, type GOTO 65475 and hit ENTER.

When you touch P, be sure your printer is set up to print. For those without a printer, change all "LPRINTs" to "PRINTs" in lines 65475, 65477, 65479, 65480, 65481, 65482 and 65483—a total of 15 places. You will see the cross-reference list appear on your screen. Use SHIFT @ to freeze the display so you can transcribe the output.

Table 3 is a sample of the output obtained from CROSSREF. For my illustration, I chose Part B of CROSSREF. Compare this cross-reference listing with the program on Listing 2. I have used CROSSREF to analyze large programs. For example, Bridge Challenger from Personal Software contains 392 BASIC statements and uses 30 subroutines and 87 variables. One of my programs has 280 lines and uses 54 subroutines and 112 variables.

In TRS-80 BASIC, only the first two characters in a variable name are considered. Thus the variable COW and the variable COT are considered the same. CROSSREF, however, considers these as separate variables. The cross-reference listing may help you to identify variable names.

Using a cross reference listing certainly makes the program mod easier. Good luck! ■

```
SUBROUTINE AND VARIABLE CROSS-REFERENCE TABLE

TITLE  ANALYSIS OF PART B


SUBROUTINE     CALLED FROM LINE(S)
   65479       65476 65478
   65480       65479
   65484       65461 65465
   65486       65452 65455 65457
   65487       65474 65488
   65488       65451


VARIABLE       USED IN LINE(S)
   A$          65458 65461 65465 65474 65484 65485 65487
   B$          65452 65453 65455 65457 65467 65486
   D$          65452 65486
   I           65452 65470 65471 65486
   J           65452 65459 65460 65461 65462 65469 65470 65472 65475
               65476 65479
   K           65469 65472 65480 65482
   K()         65454 65476 65483
   L           65452 65471 65479 65480 65481 65482 65486
   L1$()       65451 65463 65464 65465 65466 65481
   LN          65458 65459 65460
   LN$         65454 65455 65459 65460 65466 65479 65480 65481 65482
   LN$()       65451 65452 65459 65460 65461 65462 65479
   M           65468 65469 65471
   MAX         65451 65452 65459 65468 65469 65479 65483
   N$          65482
   N()         65451 65459 65471 65479
   S           65452 65455 65457 65467 65486
   T           65471
   T$          65471
   TI$         65451 65475
   V$          65453 65456 65457 65458 65459
   V$()        65451 65452 65459 65471 65475 65476 65479
   X           65461 65465 65484
   Y           65461 65462 65463 65464 65465 65466 65481


PROGRAM HAS  39  NUMBERED BASIC STATEMENTS,  12  CALLED SUBROUTINES,
AND  18  VARIABLES.
```

Table 3. CROSSREF Output

Halve the hassle of handling cassette data files.

Efficient Cassette I/O

Gerald A. Sabin
6022 Sage Drive
Orlando, FL 32807

This article is dedicated to TRS-80 users (Level II BASIC) who regularly use their cassette tape recorders for inputting and outputting data files into their programs. If you are not this type of user, I'm afraid this article isn't for you.

Even now, the regular users of cassette-oriented systems outnumber disk users. So, read on—you will probably find something that may simplify and improve your cassette I/O.

The applications for data files on cassette tapes are numerous. As we scan through recent literature, we find the following applications: mailing lists, personal information systems, financial record-keeping, and many others. Applications are limited only by the imagination of the system user.

The Data File

A typical file is created by the repeated use of the PRINT #-1 command, and is followed by a list of variables to be transmitted from memory onto tape. In reverse, the file is read back into the program later by the INPUT #-1 command, and followed by the same list of variables.

In most applications programming dealing with cassette I/O operations, the program must have both the INPUT #-1 and PRINT #-1 commands.

In the general scheme of things, the program is responsible for reading an existing file, updating it in some fashion, and recording the updated file onto the tape.

In order to meet other requirements imposed by the Level II system, the PRINT #-1 statements turn out to be exceptionally long, usually running to three or more lines of text on the screen. Why are they so long? The answer lies in the established format for recording data on tape.

Each burst of data is separated by a long leader that ensures that the tape is up to speed (and stabilized) when the data is being read (or while it is being written). If we should write the data in short bursts, we would have many stretches of leader code to separate them.

Therefore, to keep the overall length of the tape file down to a reasonable value, the user needs to pack as much data as possible into each burst, subject to an absolute maximum of 255 bytes per burst. This results in the very long list of variables mentioned above.

But how can we enhance cassette I/O?

Method

What we propose to do is to simplify the program by letting one statement do the INPUT #-1, variables list and PRINT #-1, variables list. The variables list is the same for INPUT #-1 and PRINT #-1, so all that we need do now is to change the PRINT token (=178) by the INPUT token (=137) when reading tape, and vice versa for writing tape. This is done by POKEing a specific address with 178 or 137 as needed. It accomplishes our stated purpose of letting one BASIC statement serve both I/Os.

There is a definite advantage in placing the single tape I/O statement as early as possible in the program. This keeps the address where the PRINT/INPUT token resides as a fixed address, even if the program is edited later—provided, of course, that the editing occurs in statements that follow the tape I/O statement. If you do edit ahead of the tape I/O statement, and either insert or delete any characters, the address of the token will be shifted. It must be accounted for by POKEing the modified address of the token.

Example

This example is taken from a recent business application. We deal with a file of up to 500 accounts (in a 16K machine with Level II). Each account contains six items of data that don't have to be identified here, except to point out that two are elements in integer arrays. The other four are part of single-precision arrays. We won't present the entire program because it is long; instead, we will discuss those parts relating directly to our method. These parts appear in Program Listings 1, 2 and 3.

Program Listing 1 is the beginning and early part of the program. The I/O statement is a subroutine. Also, notice the jump around this subroutine with the statement 110 GOTO 160. The statement 120 POKE 17197, I6: POKE 17218, I6 will change the I/O token in lines 130 and 140. Note that I6 is defined later in the program when we call for reading or writing tape. Each pass through statement 140 processes five sets of data, hence STEP 5 in the FOR loop of line 1060. NL is the actual number of accounts and is written into the cassette tape file. NL is defined elsewhere in the program and is not shown in the listings.

Program Listing 2 controls, or calls for, tape I/O. If we want to write to tape, we need GOTO 700

somewhere in the program, and GOTO 750 if we want to read tape. Either option returns to a MENU selection (not shown in the listings).

Program Listing 3 shows the subroutine that calls the I/O statement.

Final Comments

We've discussed the applications programming for creating and using files on cassette tape. We haven't shown a complete program, just the pertinent coding for the cassette I/O. The reader can use these listings to produce his or her own custom programs.

The advantages for our method are:

1) Simplicity in cassette I/O coding; (2) saving 200 or more bytes; (3) simplicity in future maintenance or modification of the program; (4) absolute certainty that the read statement will have the same format as the write statement, thus eliminating possibility for error.

There is a supplementary method for storing the data on the tape. For this, we dump onto tape that part of the RAM holding the program and its data. However, the appropriate commands are not available in BASIC.

The most suitable way to do this is to use T-BUG that has been relocated to high memory for compatibility with BASIC. In a 16K machine the relocated T-BUG resides at 31230-32767. With relocated T-BUG, the 16K of memory (TEXT and DATA) may be written onto tape in about 40 feet of tape (just over four minutes). By way of comparison, we see that some of the conventional cassette tape files by the PRINT # command can run to 15 minutes or more.

Please note that in any case you still need your conventional PRINT # file if you want to present the file to a modified program. ■

```
100 REM R79A 03/10/80 REV B.9
110 GOTO 160
120 POKE 17197,I6:POKE 17218,I6
130 INPUT#-1,NL: PRINT NL: RETURN
140 INPUT#-1,N(I),O(I),P(I),NM(I),Q(I),R(I)
N(I+1),O(I+1),P(I+1),NM(I+1),Q(I+1),R(I+1)
N(I+2),O(I+2),P(I+2),NM(I+2),Q(I+2),R(I+2)
N(I+3),O(I+3),P(I+3),NM(I+3),Q(I+3),R(I+3)
N(I+4),O(I+4),P(I+4),NM(I+4),Q(I+4),R(I+4)
150 RETURN
160 DEFINT I-K,N
170 DIM N(500),O(500),P(500),NM(500),Q(500),R(500)
180 REM WHATEVER FOLLOWS . . .
```

Program Listing 1. Beginning and Early Part of Sample Program. Line 140 has been modified slightly for convenience in LISTing. The comma that normally follows R (I), R (I + 1), R (I + 2), R (I + 3) has been replaced by a line feed character (down-arrow). For RUNning the program it must be reset back to a comma.

```
690 REM PROGRAM CONTINUES HERE . . .
700 REM WRITE TAPE ROUTINE
710 GOSUB1030: PRINT"WRITING . . .
720 I6=178: GOSUB1040: GOTO 780
750 REM READ TAPE ROUTINE
760 GOSUB1030: PRINT"READING . . .
770 I6=137: GOSUB1040
780 PRINT"COMPLETE - NOTE TAPE LOCATION
790 GOTO --- (BACK TO MENU SELECTION)
800 REM WHATEVER FOLLOWS . . .
```

Program Listing 2.

```
1030 CLS:INPUT"CASSETTE READY? - PRESS ENTER";NX: RETUR
     N
1040 GOSUB 120
1050 REM NL IS THE NUMBER OF ACCOUNTS
1060 FOR J=1 TO NL STEP 5
1070 GOSUB 140
1080 PRINT J,: NEXT J: RETURN
1090 REM OTHER PARTS OF PROGRAM FOLLOW . . .
```

Program Listing 3.

↙Reader Service—see page 242

William Shakespeare * Thomas Edison * Aristotle * William of Occam * Thomas Jefferson * Baruch Spinoza * Sri Ramakrishna * Thomas Gainsborough * Hippocrates * Blaise Pascal *

Education

1: The action or process of training and developing knowledge.

Education for the School

Basic Math Program from EMSI

The Basic Math Program is a comprehensive math teaching package. It was created by a certified math teacher with 15 years of programming experience.

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Care about your appearance?
Then put some thought into your video page layouts.

The Plan of the Page

Alexander MacLean
18 Indian Spring Trail
Denville, NJ 07834

Many of the packaged programs for the TRS-80 computer use a multi-section technique. This is particularly true of the material for Level I 4K.

The tactics are simple.

This article will concentrate on the mechanics and tactics of writing a program. An educational program will be written for example that can be used to do several things—present information, quiz students and save results.

Programs are often repetitive uses of simple techniques. The key to using them is a basic understanding of the individual elements, and of how they are all hooked together in the whole.

The process can be broken into the following elements:

- Editorial content is the material you are trying to teach with the program.
- Format is the physical layout of the material.
- Computer operations are the actual programming. Once you decide what you want the computer to do, you have to tell it how.

How well you handle the first two elements is going to have a major effect on how well the third goes.

The basic computer format to keep in mind is the size of the page you are working with. The TRS-80 Level I page is 16 lines and each line is 64 characters long. Entries must be keyed to that format.

At this point, it will help if you have a supply of programming pads, and in particular, Radio Shack's TRS-80 video display worksheets.

Look at a worksheet carefully. There are two types of numbers on it. We want the larger outside numbers.

You will see 0, 64, 128 etc. on the left side. If you count the boxes, you will find 16 (lines). Across the top you will see a line of numbers called TAB, from 0 to 64. These are the character numbers. On the right you will see the end of the line count for each line.

The ability to use this chart is critical—and it's not hard. The important point is that everything fits on the page.

This imposes certain limits on your text and leads to a given style—brevity. It makes it hard for people who like to write long involved sentences with many clauses. That won't work with the computer.

Learn to think newspaper style. Keep everything brief and to the point. There are two reasons for this: There isn't much space on a page and there isn't much memory available.

The visual presentation must be considered. Remember that people will be using the program to learn. If the screen is completely filled with text, it will be hard to assimilate the material. A better presentation would use less text, more editing and plenty of blank space.

Outline Programs

The next thing to keep in mind is information flow. Outline techniques taught in school are highly effective for computer use.

Most programs have a title page. Our simple title could be Programming Lessons By Alexander MacLean. Program Listing 1, using the print statement, shows the easiest way to program the title.

Notice that when it runs there is some spacing between the lines. Everything is margined to the left. The print statement is only a basic text statement.

```
 5  CLS
10  REM *TITLE PAGE PROGRAM*
20  P. "PROGRAMMING LESSONS"
30  P.
40  P.
50  P. "BY"
60  P.
70  P.
80  P. "ALEXANDER MAC LEAN"
```

Program Listing 1.

```
 5  CLS
10  REM *TITLE PAGE PROGRAM II"
20  P.A. 276, "LESSON PROGRAM-
    MING"
30  P.A. 478, "BY"
40  P.A. 660, "ALEXANDER MAC
    LEAN"
```

Program Listing 2.

Apparat introduces

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You may want to emphasize something, or specifically place it on the screen. The PRINT AT statement is used for this. It is simple to use.

Program Listing 2 reprograms the title page using PRINT AT statements. Each space in each line has a numerical address.

Choose a line to start toward the right, rather than at the left margin. Note its number. On the worksheet find the TAB number of the space where the first character of the line will be printed on the screen. Add the TAB number to the line number.

The second line of the title page program is numbered 64 on the worksheet. The beginning of the line will be printed at TAB number 20. Since 64 + 20 = 84, enter PRINT AT 84, "PROGRAMMING LESSONS."

When centering with PRINT AT statements, make sure the line is short enough to fit in the space. If it is too long, it will curve around to the next line spoiling the effect.

A number of graphic embellishments can be added for visual effect, but most are beyond the scope of beginning programming. It is possible to use a PRINT AT statement to print two lines of asterisks as in Program Listing 3.

Notice that these are at the second and the next to last lines. When the program is run, the cursor will appear at the left and the word READY. This kicks the page up a notch and throws the top line off the screen.

If there was a second page, this would not happen. But there is some fussing to be done between pages.

The computer runs faster than anyone can read, so the change between pages must be slowed down. This is done by adding a timing circuit between pages. It's easy. Use the FOR-NEXT loop shown in Program Listing 4.

In line 70 N + 1 to 10,000 determines the time it takes the computer to perform that many operations. Adjust the time by the number of repetitions.

Leave enough time for anyone to read the material. The TRS-80 can do about 500 loops per second. Multiply 500 times the number of seconds you want to hold the page on the screen.

If you have used a full page of screen space, when more material is added to the program, the computer will present a fresh screen with the new material. If the full screen has not been used, new material will appear at the bottom.

This isn't always the best arrangement. Using the CLS statement gives the programmer a choice.

Given the title page, add the next page beginning with a lead sentence. In this case the page will begin, "Lessons programming has three basic elements."

The program for page two is given in Program Listing 4. Page spacing is used for both artistic reasons and to add emphasis. Notice the CLS command at the end of the NEXT N statement.

Available Memory

There is no easy way to calculate how much memory is needed on the basis of video pages or the amount of text. Before starting, hit PM to get the amount of working memory available. 4K is a nominal figure. You really only have 3583 bytes.

After you finish a page and enter it, use PM (PRINT MEMORY) to see how much memory is left and how much is used for each page.

There is a limit to how many computer "pages" you will get, because it just doesn't go that far. There is a simple solution, though. When they reach the end, instruct students to enter the next part.

Program 5 shows how quizzing might look set into part of a longer program.

To put all this in order:
Outline material to be covered.
Outline questions.
Put questions in order and place in outline.
Block out each "page" of computer text with text placement and typing instructions.
Add outline of computer instructions needed.
Write program first.
Transfer to computer, keeping track of memory left.
Transfer finished sections to master tape.
Test master tape.
Transfer to final tape.
Enjoy.

This is the basic teaching program method using the computer, geared at Level I 4K. There are a few more little hints that might be applied.

I used inexpensive Irish tape cassettes and they worked well. There are a number of sources for small computer grade cassettes for a buck each. This sure beats Radio Shack's $4 for 10 minutes of tape price.

There is no substitute for the Video Chart, however, the programming pad is not necessary. Ordinary writing pads and a soft lead pencil will do. You are going to have to make corrections. There are advantages to keeping a written copy of your program.

There is another area where the computer teacher can do well. Some types of testing are particularly suited to the computer. It can give the test, add up the answers and give you the score. This adds a tool to your computer bag of tricks.

I hope this has taken some of the mystery out of stringing together longer programs. ■

```
 5  CLS
10  REM *TITLE PAGE PROGRAM III*
20  P.A. 64, "********** fill out full line"
30  P.A. 276, "LESSON PROGRAMMING"
40  P.A. 478, "BY"
50  P.A. 660, "ALEXANDER MAC LEAN"
60  P.A. 896, "********** fill out full line"
RUN
```

Program Listing 3.

```
 5  CLS
10  REM *TITLE PAGE PROGRAM III*
20  P.A. 64, "********** fill out full line ***"
30  P.A. 276, "LESSON PROGRAMMING"
40  P.A. 478, "BY"
50  P.A. 660, "ALEXANDER MAC LEAN"
60  P.A. 896, "********** fill out full line ***"
70  FOR N = 1 TO 10000: NEXT N: CLS
80  REM * PAGE ONE *
90  P.A. 64, "LESSONS PROGRAMMING HAS THREE BASIC ELEMENTS:"
100 P.A. 202, "1. EDITORIAL CONTENT: THE MATERIAL YOU ARE"
110 P.A. 266, "TRYING TO TEACH WITH THE PROGRAM."
120 P.A. 394, "2. FORMAT: THE PHYSICAL LAYOUT DONE"
130 P.A. 458, "FOR COMPUTER PRESENTATION AND TEACHING"
140 P.A. 522, "EFFECTIVENESS."
150 P.A. 650, "3. COMPUTER OPERATIONS: THE INSTRUCTIONS YOU"
160 P.A. 714, "GIVE THE COMPUTER TO MAKE IT DO THE JOB."
170 FOR N = 1 TO 10000: NEXT N. CLS
RUN
```

Program Listing 4.

```
500 CLS
510 P. "WHAT HAS THE MOST EFFECT ON HOW YOU PREPARE YOUR
    PROGRAM?"
512 P.A. 340, "1. THE MATERIAL"
514 P.A. 468, "2. HOW IT LOOKS"
516 P.A. 596, "3. THE COMPUTER"
518 P.A. 714, "ANSWER 1, 3, or 3"; : INPUT A
520 IF A = 1 THEN 600
530 IF A = 2 THEN 610
540 IF A = 3 THEN 620
600 P.A. 906, "YOU ARE WRONG. TRY AGAIN"
605 FOR N = 1 TO 1000: NEXT N: GOTO 500
610 P.A. 906, "THAT'S NOT RIGHT. TRY AGAIN"
615 FOR N = 1 TO 1000: NEXT N: GOTO 500
620 CLS: P.A. 138, "THAT'S RIGHT"
630 P.A. 404, "THE COMPUTER DOES MOST TO SHAPE"
640 P.A. 468, "THE MATERIAL"
RUN
```

Program Listing 5.

Modem owners, don't be dumb.
Enhance your terminal operations with this piece of software.

Terminal Plus

Buzz Gorsky
712 Hillside Drive
Carlisle, PA 17013

In the April 1980 issue of *80 Microcomputing*, Terry Noreault presented a simple terminal emulator for the TRS-80/ RS232C. My program builds on his as well as the Radio Shack TERM program which is in the RS232 manual. It supports ASCII I/O and permits the UART and BRG to be set from the keyboard. It also permits 26 control characters to be generated and has a break key. You can send messages from memory as well as send and receive BASIC programs in compressed, executable format!

Let's look at the listing and see what goes on.

Operation

The program, as it stands, is written for a 48K disk system (TRSDOS 2.3 values assumed), but can be run on a 16K Level II system, as long as a few addresses are changed. Line 170 defines the address where BASIC program storage begins in 2.2 Disk BASIC. For a Level II system this should be changed to 42E9H.

Line 180 provides a location to store the address just below the origin of the program. This automatically answers the Memory Size question in BASIC. There appears to be no similar location for Level II, so the memory size location must be answered manually, according to where the program is stored.

In line 2440, address 402DH is referenced to return to TRSDOS. In a Level II system this should be replaced by 1A19H to return to BASIC.

The INIT routine which begins on line 280, permits the user to interact with the program, and set the UART and BRG. This routine follows the rules set down in the RS232 manual. It prints messages (PR1, PR2, etc.) by using the DISP routine, and gets input by calling 049H—a ROM routine. This waits for a byte from the keyboard before returning.

The user can select a duplex or half-duplex operation. Half-duplex, however, is not really half-duplex. All it does is insert a call to 33H at line 930 instead of

Program Listing 1

```
                00100 ;TERMINAL PROGRAM FOR TRS80/RS232C
                00110 ;PERMITS SETTING BRG AND UART FROM KEYBOARD
                00120 ;PERMITS SAVING A MESSAGE FROM KEYBOARD AND SENDING IT
                00130 ;PERMITS SENDING 3 MESSAGES FROM MEMORY
                00140 ;PERMITS SENDING & RECEIVING BASIC COMPRESSED CODE
                00150 ;IN EXECUTABLE FORMAT
                00160 ;BY BUZZ GORSKY, K8BG
6A24            00170 BASIC   EQU     6A24H    ;ADR FOR DISK BASIC PROG
4049            00180 TOP     EQU     4049H    ;TOPMEM ADR FOR PROTECTION
D000            00190         ORG     0D000H
2000            00200 BUFFER  DEFS    2000H
0001            00210 COUNT   DEFS    1
0001            00220 OTCNT   DEFS    1
F002 05         00230 UART    DEFB    5
F003 00         00240 IMAGE   DEFB    0
F004 00         00250 STATUS  DEFB    0
0002            00260 NEXT    DEFS    2
                00270
F007 CDC901     00280 INIT    CALL    1C9H     ;CLS
F00A 21FFCF     00290         LD      HL,BUFFER-1
F00D 224940     00300         LD      (TOP),HL
F010 D3E8       00310         OUT     (0E8H),A         ;RESET  UART
F012 2102F0     00320         LD      HL,UART
F015 3605       00330         LD      (HL),5
F017 21E0F2     00340         LD      HL,PR0
F01A CD21F2     00350         CALL    DISP
F01D CD4900     00360         CALL    049H
F020 FE31       00370         CP      49
F022 CA2BF2     00380         JP      Z,PRES
F025 211FF3     00390         LD      HL,PR1
F028 CD21F2     00400         CALL    DISP     ;DISPLAY
F02B CD4900     00410         CALL    049H     ;GET DIGIT
```

Program continues

```
F02E FE31     00420          CP      49
F030 C4D7F0   00430          CALL    NZ,HALF
F033 CCE4F0   00440          CALL    Z,FULL
F036 213FF3   00450          LD      HL,PR2
F039 CD21F2   00460          CALL    DISP
F03C CD4900   00470          CALL    049H
F03F 21F2F0   00480          LD      HL,SPEED
F042 D631     00490          SUB     49
F044 85       00500          ADD     A,L
F045 6F       00510          LD      L,A
F046 7E       00520          LD      A,(HL)
F047 D3E9     00530          OUT     (0E9H),A
F049 2195F3   00540          LD      HL,PR3
F04C CD21F2   00550          CALL    DISP
F04F CD4900   00560          CALL    049H
F052 D631     00570          SUB     49
F054 CCF6F0   00580          CALL    Z,SEVEN
F057 C4FCF0   00590          CALL    NZ,EIGHT
F05A 21C4F3   00600          LD      HL,PR4
F05D CD21F2   00610          CALL    DISP
F060 CD4900   00620          CALL    049H
F063 D631     00630          SUB     49
F065 CC04F1   00640          CALL    Z,NOPAR
F068 FE01     00650          CP      1
F06A CC0AF1   00660          CALL    Z,EVEN
F06D 210BF4   00670          LD      HL,PR5
F070 CD21F2   00680          CALL    DISP
F073 CD4900   00690          CALL    049H
F076 D631     00700          SUB     49



F078 C410F1   00710          CALL    NZ,TOSTP
F07B 3A02F0   00720          LD      A,(UART)
F07E D3EA     00730          OUT     (0EAH),A
F080 3203F0   00740          LD      (IMAGE),A
F083 CDC901   00750          CALL    1C9H    ;CLS
              00760
F086 2144F4   00770 TXCV     LD      HL,PR7
F089 CD21F2   00780          CALL    DISP
F08C 3A4038   00790 TXCV1    LD      A,(14400)
F08F FE04     00800          CP      4
F091 CA3DF2   00810          JP      Z,BREAK
F094 CD2B00   00820 MS1      CALL    2BH
F097 B7       00830          OR      A
F098 281C     00840          JR      Z,RXSTAT
F09A FE1F     00850          CP      1FH     ;CK FOR CLEAR KEY
F09C CAF5F1   00860          JP      Z,SWITCH
F09F FE60     00870          CP      96      ;SHIFT@
F0A1 2002     00880          JR      NZ,C5
F0A3 3E1B     00890          LD      A,1BH   ;ESCAPE
F0A5 FE1A     00900 C5       CP      1AH     ;IGNORE SHIFT DN ARROW-CTRL
F0A7 280D     00910          JR      Z,RXSTAT
F0A9 F5       00920          PUSH    AF
F0AA CDD6F0   00930 HFD      CALL    DIS
F0AD DBEA     00940 TRSTAT   IN      A,(0EAH)
F0AF CB77     00950          BIT     6,A
F0B1 28FA     00960          JR      Z,TRSTAT
F0B3 F1       00970          POP     AF
F0B4 D3EB     00980          OUT     (0EBH),A
F0B6 DBEA     00990 RXSTAT   IN      A,(0EAH)
F0B8 CB7F     01000          BIT     7,A
F0BA 28D0     01010          JR      Z,TXCV1
F0BC 3204F0   01020          LD      (STATUS),A
F0BF DBEB     01030          IN      A,(0EBH)
F0C1 E67F     01040          AND     7FH     ;GET RID OF PARITY BIT
F0C3 F5       01050          PUSH    AF      ;TEST FOR ERROR
F0C4 3A04F0   01060          LD      A,(STATUS)
F0C7 E638     01070          AND     38H
F0C9 2805     01080          JR      Z,CN1
F0CB 3EAA     01090          LD      A,0AAH
F0CD CD3300   01100          CALL    33H
F0D0 F1       01110 CN1      POP     AF
F0D1 CD3300   01120          CALL    33H
F0D4 18B6     01130          JR      TXCV1
              01140
F0D6 C9       01150 DIS      RET
              01160
F0D7 DD21AAF0 01170 HALF     LD      IX,HFD
F0DB DD360133 01180          LD      (IX+1),33H
F0DF DD360200 01190          LD      (IX+2),0
F0E3 C9       01200          RET
              01210
F0E4 DD21AAF0 01220 FULL     LD      IX,HFD
F0E8 21D6F0   01230          LD      HL,DIS
F0EB DD7501   01240          LD      (IX+1),L
F0EE DD7402   01250          LD      (IX+2),H
F0F1 C9       01260          RET
              01270
F0F2 22       01280 SPEED    DEFB    22H     ;110BAUD
F0F3 55       01290          DEFB    55H     ;300 BAUD
F0F4 66       01300          DEFB    66H     ;600 BAUD
```

Program continues

the call to DIS. When the 33H call is there, any transmitted characters will be displayed on the screen. When the call to DIS (which causes an immediate RETurn) is there, the characters are not displayed.

The BRG is set by entering a number corresponding to the displayed baud rates. It then finds a value in the speed table, which is output to the BRG.

Next, the UART, itself, must be set. The location, UART, is initialized with a decimal 5; which thus sets bit 0 and bit 2. If the user selects a seven-bit word length, bit 5 is set in the Seven routine (line 1330), or bits 5 and 6 are set in the Eight routine. Similarly, if the user selects no parity, then bit 3 is set, while bit 7 is set in even parity.

Bit 4 gets set in TOSTP, if two stops are desired. The completed byte is output to the UART in line 730, and a copy is saved in IMAGE. UART can also be set according to the switch settings on the RS232 board. The PRES routine is then entered and the switch settings are read. The control byte is output to the UART. The program does not read the speed switches, but puts out a byte for 300 baud. This can be changed by putting the appropriate byte into the A register in line 2990.

Transceiver Mode

When initialization is complete, the program continues to the transceive mode. The routine begins on line 770 by printing a message that the program is in transceive mode. Communication is effected in a duplex fashion.

In 790, the program checks the break key (A 4 in location 14400 indicates that the break key is down) and if depressed, branches to break. In this location, the IMAGE of the UART control byte is altered when clearing the break byte and then output to the UART. After a short delay, the IMAGE byte is restored to the UART—restoring normal operation.

When the break key is not down, the program continues at MS1, line 820, where the key-

```
F0F5 77        01310          DEFB    77H      ;1200 BAUD
               01320
F0F6 2102F0    01330 SEVEN    LD      HL,UART
F0F9 CBEE      01340          SET     5,(HL)
F0FB C9        01350          RET
               01360
F0FC 2102F0    01370 EIGHT    LD      HL,UART
F0FF CBEE      01380          SET     5,(HL)
F101 CBF6      01390          SET     6,(HL)
F103 C9        01400          RET
               01410
               01420
F104 2102F0    01430 NOPAR    LD      HL,UART
F107 CBDE      01440          SET     3,(HL)
F109 C9        01450          RET
               01460
F10A 2102F0    01470 EVEN     LD      HL,UART
F10D CBFE      01480          SET     7,(HL)
F10F C9        01490          RET
               01500
F110 2102F0    01510 TOSTP    LD      HL,UART
F113 CBE6      01520          SET     4,(HL)
F115 C9        01530          RET
               01540
F116 2156F4    01550 CAN      LD      HL,PR8
F119 CD21F2    01560          CALL    DISP
F11C 2100D0    01570          LD      HL,BUFFER
F11F 3A4038    01580 C7       LD      A,(14400)
F122 FE02      01590          CP      2
F124 280F      01600          JR      Z,ENDMSG
F126 CD2B00    01610          CALL    02BH
F129 B7        01620          OR      A
F12A CA1FF1    01630          JP      Z,C7
F12D 77        01640          LD      (HL),A
F12E CD3300    01650          CALL    33H
F131 23        01660          INC     HL
F132 C31FF1    01670          JP      C7
               01680
F135 3600      01690 ENDMSG   LD      (HL),0
F137 C3F5F1    01700          JP      SWITCH
               01710
F13A CD4900    01720 MSG      CALL    049H     ;KBD
F13D FE39      01730          CP      57
F13F F23AF1    01740          JP      P,MSG
F142 D630      01750          SUB     48
F144 87        01760          ADD     A,A
F145 2189F1    01770          LD      HL,MSGLOC
F148 4F        01780          LD      C,A
F149 0600      01790          LD      B,0
F14B 09        01800          ADD     HL,BC
F14C 5E        01810          LD      E,(HL)
F14D 23        01820          INC     HL
F14E 56        01830          LD      D,(HL)
F14F D5        01840          PUSH    DE
F150 E1        01850          POP     HL
F151 2B        01860          DEC     HL
F152 2205F0    01870          LD      (NEXT),HL
F155 2191F1    01880          LD      HL,MSOUT
F158 2295F0    01890          LD      (MS1+1),HL
F15B 218CF4    01900          LD      HL,PR9
F15E CD21F2    01910          CALL    DISP
F161 CD4900    01920          CALL    049H
```

```
F164 FE30      01930          CP      48
F166 2012      01940          JR      NZ,CN0
F168 3E00      01950          LD      A,0
F16A DD219EF1  01960          LD      IX,MSDEL
F16E DD7700    01970          LD      (IX),A
F171 DD7701    01980          LD      (IX+1),A
F174 DD7702    01990          LD      (IX+2),A
F177 C386F0    02000          JP      TXCV
F17A 3ECD      02010 CN0      LD      A,0CDH
F17C 219EF1    02020          LD      HL,MSDEL
F17F 77        02030          LD      (HL),A
F180 214FF2    02040          LD      HL,DELAY
F183 229FF1    02050          LD      (MSDEL+1),HL
F186 C386F0    02060          JP      TXCV
               02070
               02080
F189 00D0      02090 MSGLOC   DEFW    BUFFER
F18B 5AF2      02100          DEFW    MSG1
F18D 79F2      02110          DEFW    MSG2
F18F 8EF2      02120          DEFW    MSG3
               02130
F191 2A05F0    02140 MSOUT    LD      HL,(NEXT)
F194 23        02150          INC     HL
F195 3E00      02160          LD      A,0
F197 BE        02170          CP      (HL)
F198 2808      02180          JR      Z,MSSNT
```

Program continues

board is strobed. If nothing were present, the program would branch to the receive functions. When a byte is present, line 850 checks if it is the clear key. If so, control goes to a switch routine, and if not, the program checks if a shift @ was sent.

If shift @ was sent, byte 1BH is loaded into the A register to output the ASCII escape code.

Line 900 of the program checks if the shift down arrow is being sent and, if so, control branches to the receive routine. These checks assure that the clear key's 1FH byte will not be sent, that a shift @ will not be sent, and that a shifted down arrow will not be sent either. This occurs because the clear key is used internally to enter the switching mode; the shifted @ is used for an escape key, and the shifted down arrow is used with the letters to send control codes.

The 2BH routine returns 2 through 26 (decimal) when down-arrow, shift and letters B through Z are depressed.

These correspond to standard control codes for many time-sharing systems. For some reason 01 is not put out when the A is sent. That does not seem to be a common control code, and so represents no problem. Thus CTRL "C" can be sent by sending down arrow, shift and C.

Once the program is satisfied that none of these characters are returned from the keyboard, the value is saved on the stack and at TRSTAT, line 940, the status of the UART is checked. The program loops until the UART can accept the byte, and then the value is retrieved from the stack and sent out via port (0EBH).

In the receive portion, we check if there is a character ready, and if not, we return to the transmit part of the program. When a byte is ready, the UART status byte is saved in STATUS. The received byte is put in A from port (0EBH). Line 1040 gets rid of the parity bit. Then the byte is saved on the stack. The STATUS byte is now checked for errors. If so, a vertical bar is displayed before the

```
F19A 2205F0    02190          LD      (NEXT),HL
F19D 7E        02200          LD      A,(HL)
F19E CD4FF2    02210 MSDEL    CALL    DELAY
F1A1 C9        02220          RET
               02230
F1A2 212B00    02240 MSSNT    LD      HL,2BH
F1A5 2295F0    02250          LD      (MS1+1),HL
F1A8 C9        02260          RET
               02270
F1A9 21246A    02280 RBAS     LD      HL,BASIC
F1AC 3E00      02290 RBAS1    LD      A,0
F1AE 3200F0    02300          LD      (COUNT),A
F1B1 DBEA      02310 RXST     IN      A,(0EAH)
F1B3 CB7F      02320          BIT     7,A
F1B5 28FA      02330          JR      Z,RXST
F1B7 DBEB      02340          IN      A,(0EBH)
F1B9 77        02350          LD      (HL),A
F1BA 23        02360          INC     HL
F1BB FE00      02370          CP      0
F1BD 2802      02380          JR      Z,DONE
F1BF 18EB      02390          JR      RBAS1
               02400
F1C1 3A00F0    02410 DONE     LD      A,(COUNT)
F1C4 3C        02420          INC     A
F1C5 FE03      02430          CP      3
F1C7 CA2D40    02440          JP      Z,402DH ;BACK TO DOS
F1CA 3200F0    02450          LD      (COUNT),A
F1CD 18E2      02460          JR      RXST
               02470
F1CF 21246A    02480 SBAS     LD      HL,BASIC
F1D2 3E00      02490 SBAS1    LD      A,0
F1D4 3201F0    02500          LD      (OTCNT),A
F1D7 DBEA      02510 TXST     IN      A,(0EAH)
F1D9 CB77      02520          BIT     6,A
F1DB 28FA      02530          JR      Z,TXST



F1DD 7E        02540          LD      A,(HL)
F1DE 23        02550          INC     HL
F1DF D3EB      02560          OUT     (0EBH),A
F1E1 FE00      02570          CP      0
F1E3 2802      02580          JR      Z,ALL
F1E5 18EB      02590          JR      SBAS1
               02600
F1E7 3A01F0    02610 ALL      LD      A,(OTCNT)
F1EA 3C        02620          INC     A
F1EB FE03      02630          CP      3
F1ED CAF5F1    02640          JP      Z,SWITCH
F1F0 3201F0    02650          LD      (OTCNT),A
F1F3 18E2      02660          JR      TXST
               02670
F1F5 2133F4    02680 SWITCH   LD      HL,PR6
F1F8 CD21F2    02690          CALL    DISP
F1FB CD4900    02700          CALL    049H
F1FE FE54      02710          CP      84
F200 CA86F0    02720          JP      Z,TXCV
F203 FE53      02730          CP      83
F205 28C8      02740          JR      Z,SBAS
F207 FE52      02750          CP      82
F209 289E      02760          JR      Z,RBAS
F20B FE49      02770          CP      73
F20D CA07F0    02780          JP      Z,INIT
F210 FE4D      02790          CP      77
F212 CA3AF1    02800          JP      Z,MSG
F215 FE43      02810          CP      67
F217 CA16F1    02820          JP      Z,CAN
F21A FE45      02830          CP      69      ;E
F21C CA9201    02840          JP      Z,402D  ;EXIT PROGRAM
F21F 18D4      02850          JR      SWITCH
               02860
F221 7E        02870 DISP     LD      A,(HL)
F222 FE00      02880          CP      0
F224 C8        02890          RET     Z
F225 CD3300    02900          CALL    33H
F228 23        02910          INC     HL
F229 18F6      02920          JR      DISP
               02930
F22B DBE9      02940 PRES     IN      A,(0E9H)
F22D E6F8      02950          AND     0F8H
F22F F605      02960          OR      5
F231 D3EA      02970          OUT     (0EAH),A
F233 3203F0    02980          LD      (IMAGE),A
F236 3E55      02990          LD      A,55H
F238 D3E9      03000          OUT     (0E9H),A
F23A C386F0    03010          JP      TXCV
               03020
F23D 3A03F0    03030 BREAK    LD      A,(IMAGE)
F240 E6FB      03040          AND     0FBH    ;CLEAR BREAK BIT
F242 D3EA      03050          OUT     (0EAH),A        ;START BREAK
F244 CD4FF2    03060          CALL    DELAY
F247 3A03F0    03070          LD      A,(IMAGE)
```

Program continues

character. If not, the character is displayed. Control then returns to the transmit routine.

I mentioned that holding the clear key while in the transceive mode causes branching to SWITCH. So let's look at that next.

Here, a message is displayed to indicate that the program is in the switch mode. Then a byte is obtained via 049H from the keyboard. Pressing T sends the program to transceive, an S will cause a BASIC program to be sent; R causes a BASIC program to be received; I returns to initialize; C permits a message to be saved in memory and M sends the program to the message sending routine. Hitting an E (for exit) will return to DOS.

SBAS at line 2480 will send a BASIC program in symbolic form. The program is stored at the BASIC address as a series of symbols. Each line of text ends with a 0 and the program ends when three 0s in a row are encountered. The program loads a 0 into OTCNT and the BASIC address into the HL register pair. At TXST it tests if the UART is ready to send a byte. If not, it loops back. When ready, the byte pointed to by HL is loaded into register A; HL is incremented, and the byte is output via port (0EAH). If the byte is a zero, the ALL routine is entered. Otherwise, the program loops back for the next byte. ALL increases the value stored in OTCNT, and then checks if three zeros in a row have been sent. If so, it branches to SWITCH. Otherwise control returns for the next byte.

In line 2280, RBAS functions the same way. Here, received bytes are stored sequentially beginning at the BASIC address. When three 0s have been received, control goes to DOS. Then BASIC * command can be used to enter BASIC and save the program. The program can now be run, listed, or saved, as desired.

In the RBAS routine, the DONE routine functions as ALL did in SBAS to keep track how many zeros in a row are received.

At line 1550, the CAN routine indicates that a text message

```
F24A D3EA      03080          OUT     (0EAH),A
F24C C38CF0    03090          JP      TXCV1
               03100
F24F 1E96      03110 DELAY    LD      E,150
F251 16FF      03120 DELAY1   LD      D,0FFH
F253 15        03130 D1       DEC     D
F254 20FD      03140          JR      NZ,D1
F256 1D        03150          DEC     E
F257 20F8      03160          JR      NZ,DELAY1
F259 C9        03170          RET
               03180
F25A 54        03190 MSG1     DEFM    'THE TEXT OF ANY MESSAGE HERE
F277 0D        03200          DEFB    13
F278 00        03210          DEFB    0
               03220
F279 4D        03230 MSG2     DEFM    'MESSAGE 2 TEXT HERE'
F28C 0D        03240          DEFB    13
F28D 00        03250          DEFB    0
               03260
F28E 54        03270 MSG3     DEFM    'TEST MESSAGE  ABCDEFGHIJKLMNOPQRSTUV
4567890!"#$%&() :-*=;+@,./<>?--------'
F2DE 0D        03280          DEFB    13
F2DF 00        03290          DEFB    0
F2E0 45        03300 PR0      DEFM    'ENTER 1 TO USE SWITCH PARAMETERS'
F300 0D        03310          DEFB    13
F301 20        03320          DEFM    '      2 TO SELECT PARAMETERS'
F31D 0D        03330          DEFB    13
F31E 00        03340          DEFB    0
               03350
F31F 45        03360 PR1      DEFM    'ENTER 1 FOR DUPLEX, 2 FOR HALF'
F33D 0D        03370          DEFB    13
F33E 00        03380          DEFB    0
               03390
               03400
F33F 45        03410 PR2      DEFM    'ENTER 1 FOR 110 BAUD'
F353 0D        03420          DEFB    13
F354 20        03430          DEFM    '      2 FOR 300 BAUD'
F368 0D        03440          DEFB    13
F369 20        03450          DEFM    '      3 FOR 600 BAUD'
F37D 0D        03460          DEFB    13
F37E 20        03470          DEFM    '      4 FOR 1200 BAUD'
F393 0D        03480          DEFB    13
F394 00        03490          DEFB    0
               03500
F395 45        03510 PR3      DEFM    'ENTER 1 FOR 7 BIT WORD'
F3AB 0D        03520          DEFB    13
F3AC 20        03530          DEFM    '      2 FOR 8 BIT WORD'
F3C2 0D        03540          DEFB    13
F3C3 00        03550          DEFB    0
               03560
F3C4 0D        03570 PR4      DEFB    13
F3C5 45        03580          DEFM    'ENTER 1 FOR NO PARITY'
F3DA 0D        03590          DEFB    13
F3DB 20        03600          DEFM    '      2 FOR EVEN PARITY'
F3F2 0D        03610          DEFB    13
F3F3 20        03620          DEFM    '      3 FOR ODD PARITY'
F409 0D        03630          DEFB    13
F40A 00        03640          DEFB    0
               03650
F40B 0D        03660 PR5      DEFB    13
F40C 45        03670          DEFM    'ENTER 1 FOR 1 STOP BIT, 2 FOR 2 STOP:
F431 0D        03680          DEFB    13
F432 00        03690          DEFB    0
               03700
F433 0D        03710 PR6      DEFB    13
F434 49        03720          DEFM    'IN SWITCH MODE'
F442 0D        03730          DEFB    13
F443 00        03740          DEFB    0
               03750
F444 0D        03760 PR7      DEFB    13
F445 54        03770          DEFM    'TRANSCEIVE MODE'



F454 0D        03780          DEFB    13
F455 00        03790          DEFB    0
               03800
F456 0D        03810 PR8      DEFB    13
F457 59        03820          DEFM    'YOU CAN PLACE A MESSAGE IN MEMORY/HI
HEN DONE'
F48A 0D        03830          DEFB    13
F48B 00        03840          DEFB    0
               03850
F48C 0D        03860 PR9      DEFB    13
F48D 45        03870          DEFM    'ENTER 0 FOR NO DELAY'
F4A1 0D        03880          DEFB    13
F4A2 20        03890          DEFM    '      1 FOR DELAY'
F4B3 0D        03900          DEFB    13
F4B4 00        03910          DEFB    0
               03920
F007           03930          END     INIT
00000 TOTAL ERRORS
```

can be input and stored. Storage begins at Buffer and continues until the clear key is hit. Then a 0 byte is stored at ENDMSG, and the program returns to SWITCH.

When MSG is called from the switch routine, the program requests a number to be input (line 1720). Then, based on this number, a given message is sent. 0 refers to a message stored with CAN, while 1, 2 and 3 are messages in the program.

MSGLOC stores the message locations sequentially in Z-80 format—least significant bit first, then most signficant bit (LSB, MSB). The ASCII value returned by the 049 routine is changed to a digit by subtracting 48; multiplied by 2 (by adding A to itself) and then added to the MSGLOC address by first adding the contents of A to HL via the BC register. When this is done, HL points to the address that contains the address of the appropriate message.

For example, if 1 had been entered, HL would contain an address which holds the LSB of the MSG1 address. The next address has the MSB of the MSG1 address. The address of the message is then loaded into HL via the DE register and then saved in NEXT as one less than this address.

The address of the MSOUT routine is now loaded as a call into the TXCV routine at the location of MS1. In this way, when the TXCV routine is next entered, it calls MSOUT instead of the keyboard. The user can then indicate a delay while sending the message. One might want a delay with a time-sharing system, which does not expect people to type at 300 baud. If no delay is selected, then three zeros (NOP) are entered at MSDEL.

To send or receive in BASIC, you must select eight-bit word lengths. To send a BASIC program, you should either run this program or set memory size manually before entering your BASIC program.

If anyone is interested in saving himself the typing, I will provide a tape (or disk, if you supply the disk) of the source code for a fee.

I'd also like to hear your comments about the program. ■

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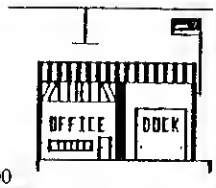

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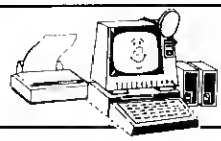

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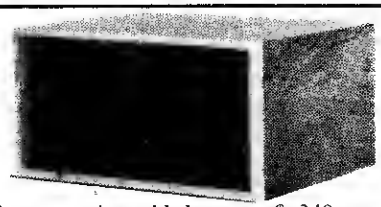

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A data reduction program for statistical studies.

Number Cruncher

James Barbarello
RD #1, Box 241H
Tennent Rd.
Englishtown, NJ 07726

Many business decisions and scientific conclusions are based on the results of population studies. These studies extract a small, relevant sample from the population to determine a general conclusion. Network news forecasts of political election winners are a prime example of this approach.

Because of the large number of necessary calculations, a computer is ideal for reducing raw data into a form whereby projections can be made. For this purpose a program should be able to:

- Perform the standard statistical calculations of mean (average), variance and standard deviation; indicate low and high data values.
- Produce a graph of the data in a normalized format (that is, not dependent on the data range). In this way, comparison to the expected results can be unmistakenly compared.
- Test the sample data to determine if it is a true representation of the population.

In addition, it should save all the above information as a hard copy and/or data file.

Reducing Data

The Data Reduction Program (DRP) in Program Listing 1 meets these criteria. This program is written in Level II BASIC for the TRS-80, but could be easily modified for any form of extended BASIC. The DRP accepts raw data from the keyboard or from a cassette.

The Sample Results (Table 1), are first printed as a permanent record. The program then proceeds to manipulate the data and obtain the mean (average), variance and standard deviation, and list the low and high data values.

In addition, the expected (±3 standard deviation) population limits are provided. These limits are calculated on the assump-

Program Listing

```
10 REM     ************************************
20 REM     *                                  *
30 REM     *       DATA REDUCTION PROGRAM     *
40 REM     *                BY                *
50 REM     *           JIM BARBARELLO         *
60 REM     *                                  *
70 REM     ************************************
80 CLEAR640:CLS:PRINT
90 PRINTTAB(10);"D A T A  R E D U C T I O N  P R O G R
   A M"
100 PRINTTAB(18);"(FOR USE WITH LINE PRINTER)":PRINT
110 INPUT"DO YOU WANT TO ENTER DATA DIRECTLY";Q$
120 INPUT"ENTER THE NUMBER OF DATA POINTS";L:DIMA(L+9),
    B(11),C(11)
130 IF LEFT$(Q$,1)="Y"THEN CLS:GOTO 170
140 FOR I=1 TO L STEP10
150 INPUT #-1,A(I),A(I+1),A(I+2),A(I+3),A(I+4),A(I+5),A
    (I+6),A(I+7),A(I+8),A(I+9)
160 NEXT I:GOTO 230
170 FOR I=1 TO L:PRINT"#";I;" : ";:INPUT A(I):NEXT I
180 INPUT"DATA CORRECTION REQUIRED (YES/NO)";Q$
190 IF LEFT$(Q$,1)="N" THEN 230
200 CLS:INPUT"ENTER DATA # TO BE CORRECTED";F
210 PRINT A(F):INPUT"CORRECTED VALUE= ";G
220 A(F)=G:CLS:GOTO 180
230 HI=A(1):LO=A(1)
240 FOR I=2 TO L
250 IF A(I)>HI THEN HI=A(I)
260 IF A(I)<LO THEN LO=A(I)
270 NEXT I
280 FOR I=1 TO L:S=S+A(I):NEXT I
290 M=S/L
300 FOR I=1 TO L:E=(A(I)-M)↑2/(L-1):T=T+E:NEXT I
310 U=SQR(T)
320 CLS:PRINT"ENTER TITLE INFORMATION A LINE AT A TIME
    (10 LINES MAXIMUM)."
330 PRINT"TO EXIT, PRESS <ENTER> AFTER QUESTION MARK AP
    PEARS."
340 FOR I=1 TO 10:INPUT T$(I)
350 IF T$(I)=""THEN LPRINT CHR$(138):GOTO 370
360 LPRINT T$(I):NEXT I
370 CLS:LPRINT "DATA:"
380 FOR I=1 TO 1000:LPRINT TAB(10*J);A(I);:J=J+1
390 IF J=6 THEN LPRINT CHR$(10):J=0
400 IF I=L THEN LPRINT CHR$(10):GOTO 420
410 NEXT
420 Q=M-2.5*U:V=M+2.5*U:W=M-3*U:C=M+3*U
430 CLS:LPRINT CHR$(138):LPRINT TAB(23);"DATA STATISTIC
```

Program continues

```
     S":LPRINT CHR$(138)
440 LPRINT"LOW VALUE = ";LO:LPRINT"HIGH VALUE = ";HI:LP
     RINT"MEAN = ";M
450 LPRINT"VARIANCE = ";T:LPRINT"STANDARD DEVIATION = "
     ;U:LPRINT CHR$(138)
460 LPRINT"THE EXPECTED LIMITS ARE ";W;" TO ";C
470 CLS:PRINT"CALCULATING":D=Q:H=U/2
480 FOR I=1 TO L
490 IF (A(I)<=D) AND (A(I)>(D-H)) THEN B(K)=B(K)+1
500 NEXT I
510 K=K+1:D=D+H:IF K=11 THEN 530
520 GOTO 480
530 FOR I=1 TO L
540 IF A(I)<(Q-H) THEN B(0)=B(0)+1
550 IF A(I)>V THEN B(11)=B(11)+1
560 NEXT I:CLS:HI=B(0)
570 FOR I=0 TO 11
580 IF B(I)>HI THEN HI=B(I)
590 NEXT I
600 PRINT"PRESS <ENTER> FOR HISTOGRAM PRINTOUT"
610 PRINT"(THE HIGHEST INTERVAL FREQUENCY IS ";HI;" )";
     :INPUT Q$
620 LPRINT CHR$(138):LPRINT TAB(23);"HISTOGRAM OF DATA"
630 LPRINT CHR$(138):LPRINT"FREQ:";
640 FOR I=0 TO 11:LPRINT TAB(I*5+7);B(I);:NEXT
650 LPRINT CHR$(10):LPRINT CHR$(138)
660 FOR J=HI TO 1 STEP-1:LPRINT J;
670 FOR I=0 TO 11
680 IF B(I)>=J THEN LPRINT TAB(I*5+8);CHR$(42);
690 NEXT I:LPRINT CHR$(10)
700 NEXT J
710 LPRINT STRING$(64,45)
720 FOR I=1 TO 12:LPRINT TAB((I-1)*5+7);I;:NEXT
730 LPRINT CHR$(10):LPRINT TAB(31);"INTERVAL":LPRINT CH
     R$(138)
740 LPRINT"INTERVAL","ENDS AT";TAB(37);"# DATA POINTS I
     N INTERVAL"
750 D=Q
760 FOR I=1 TO 12
770 IF (I=1)+(I=12) THEN 800
780 LPRINT I,D;TAB(37);B(I-1)
790 GOTO 820
800 IF I=1 THEN LPRINT I,"ALL PTS <= ";D;TAB(37);B(0)
810 IF I=12 THEN LPRINT I,"ALL PTS > ";(D-H);TAB(37);B(
     11)
820 D=D+H:NEXT I
830 FOR I=1 TO 5
840 FOR J=0 TO 5
850 IF B(J)>=5 THEN 870
860 B(J+1)=B(J+1)+B(J):B(J)=0
870 NEXT J,I
880 FOR I=1 TO 5
890 FOR J=11 TO 6 STEP-1
900 IF B(J)>5 THEN 920
910 B(J-1)=B(J-1)+B(J):B(J)=0
920 NEXT J,I
930 FOR I=0 TO 11
940 IF B(I)>0 THEN DOF=DOF+1
950 NEXT I
960 DOF=DOF-3
970 C(0)=.0062:C(1)=.0166:C(2)=.044:C(3)=.0919:C(4)=.14
     98:C(5)=.1915
980 C(6)=C(5):C(7)=C(4):C(8)=C(3):C(9)=C(2):C(10)=C(1):
     C(11)=C(0)
990 FOR I=0 TO 11
1000 IF B(I)=0 THEN 1030
1010 SUM=((B(I)/L)-C(I))|2/C(I)
1020 CHI=CHI+SUM
1030 NEXT I:LPRINT CHR$(138)
1040 LPRINT"CHI SQUARE VALUE IS ";CHI;" WITH ";DOF;" DE
     GREES OF FREEDOM"
1050 LPRINT CHR$(138):LPRINT"LUMPED FREQUENCY VALUES:";
     CHR$(10)
1060 FOR I=0 TO 11
1070 LPRINT TAB(I*5+7);B(I);
1080 NEXT I
1090 LPRINT CHR$(10)
1100 INPUT"DO YOU WANT TO STORE DATA ON TAPE (DATA WILL
      BE LOST IF NOT STORED)";Q$
1110 IF LEFT$(Q$,1)="N" THEN PRINT:PRINT"ANALYSIS COMPL
     ETED":END
1120 FOR I=1 TO L STEP10
1130 PRINT#-1,A(I),A(I+1),A(I+2),A(I+3),A(I+4),A(I+5),A
     (I+6),A(I+7),A(I+8),A(I+9)
1140 NEXT I:PRINT"DATA RECORDED - PROGRAM COMPLETED"
```

tion that the population can be represented graphically by a bell-shaped curve. This assumption provides the basis for test score results, physical measurements, variations in electronic components and demographics.

The DRP then generates a discrete graph (or histogram) of the data, grouping it into 12 intervals. Each interval width is always one half the standard deviation. This method eliminates having to refer to the absolute value of the data. The resulting histogram can therefore always be proportionally compared to the expected bell-shaped curve.

Finally, the DRP performs a chi-square "goodness of fit" test. This test determines if the sample data fits into the expected (bell-shaped) distribution. By comparing the values the DRP obtains for chi-square and Degrees of Freedom (DOF) to those contained in Table 2, the probability of a representative sample can be determined.

About the Program

Before we go through an example using the DRP, let's look at some of the workings of the program itself. Line 80 sets aside 640 bytes of string storage for use in entering text information. This text information, which might include a printout title, indication of data type, date, etc., will be entered starting at line 320.

Line 110 allows the program to input data stored on cassette (by entering "NO" to the "Enter Data Directly" prompt). Line 120 dimensions the data matrix A(I) as the number of data values to be entered plus nine. This allows the data to be retrieved from cassette in groups of ten rather than storing and retrieving each data value separately.

Lines 200 through 220 allow correction of erroneous manually input data. The data mean is calculated in line 290. The data variance is calculated in line 300. Note that lines 300 and 1010 contain a right bracket which is used interchangeably with the up arrow to represent exponents.

Line 320 begins the process of titling. During operation a 64-character or less string is en-

```
                SAMPLE RUN USING DATA REDUCTION PROGRAM
                ------ --- ---- ---- --------- -------
                          JUNE 2, 1979

DATA:
 1050      1064      1062      1061      1071      1065
 1051      1059      1065      1066      1072      1050
 1059      1070      1057      1077      1066      1068
 1056      1066      1057      1065      1051      1070
 1064      1053      1063      1056      1061      1067
 1055      1062      1075      1069      1057      1065
 1066      1059      1060      1056      1059      1052
 1062      1061      1068      1053      1070      1059
 1074      1055      1062      1067      1053      1062
 1063

                        DATA STATISTICS

LOW VALUE =  1050
HIGH VALUE =  1077
MEAN =  1061.95
VARIANCE =  44.4229
STANDARD DEVIATION =  6.66505

THE EXPECTED LIMITS ARE  1041.95  TO  1081.94

                        HISTOGRAM OF DATA

FREQ:   0    0    4    6    6    9    12   8    5    2    1    0

 12                                  *
 12                                  *
 11                                  *
 10                                  *
 9                              *    *
 8                              *    *    *
 7                              *    *    *
 6                         *    *    *    *    *
 5                         *    *    *    *    *    *
 4                    *    *    *    *    *    *    *
 3                    *    *    *    *    *    *    *    *
 2                    *    *    *    *    *    *    *    *
 1                    *    *    *    *    *    *    *    *    *
-------------------------------------------------------------------
      1    2    3    4    5    6    7    8    9    10   11   12
                          INTERVAL

INTERVAL        ENDS AT              # DATA POINTS IN INTERVAL
1               ALL PTS <=  1045.28   0
2                1048.62              0
3                1051.95              4
4                1055.28              6
5                1058.61              6
6                1061.95              9
7                1065.28              12
8                1068.61              8
9                1071.94              5
10               1075.28              3
11               1078.61              1
12              ALL PTS >  1078.61    0

CHI SQUARE VALUE IS  16973  WITH  3  DEGREES OF FREEDOM

LUMPED FREQUENCY VALUES:
      0    0    0    10   6    9    12   8    9    0    0    0
```

Table 1

DOF	Probability 90%	80%	70%
2	.211	.446	.713
3	.584	1.005	1.424
4	1.064	1.649	2.195
5	1.61	2.343	3.0
6	2.20	3.07	3.828
7	2.833	3.822	4.671
8	3.49	4.594	5.527
9	4.168	5.38	6.393

NOTE: data is not statistically significant for chi-square values greater than those indicated in the 70 percent column (for the specific DOF) or if DOF is less than 2.

Example: Refer to Table 1. chi-square = 0.16973. DOF = 3. For DOF = 3, and 90 percent confidence, Table 1 indicates a chi-square value of .584. Since the data chi-square value (0.16973) is LESS than the 90 percent value, the confidence factor is GREATER than 90 percent.

Probability of Statistical Significance using Chi-Square Error Value and DOF.

Table 2

tered after each input prompt (?). It should be remembered that if string delineators such as a comma or colon are to be contained in the string, the string information should be contained in quotation marks. A maximum of ten lines can be entered this way. After titling (if less than ten lines), pressing ENTER (a null string) will execute to line 370.

Lines 530 through 550 group the data values below and above the expected (± 3 standard deviation) limits into the first and last intervals respectively. If you wish to use standard size paper (8½" × 11") for the printout, line 610 forewarns you of the size of the histogram. A lengthy histogram usually requires a change of paper at this point.

Lines 850 through 920 combine intervals with less than six data points into the adjacent interval closest to the mean. This procedure, called lumping, is performed so as to eliminate the inordinately large chi-square error values which might result from a small interval. This is a standard statistical practice and produces more relevant results.

Line 960 calculates the DOF, which is simply the number of lumped intervals minus three. Lines 970 and 980 contain the expected chi-square values for a relevant sample. These values are compared to the normalized sample data values in lines 990 through 1030 to obtain the total chi-square error value (CHI). Data storage to cassette is performed by lines 1100 through 1140 if desired.

An Example

A manufacturer requires that approximately 1100 pellets of packing material be added to each package before it automatically seals. If less than 1000 pellets are added, damage to the package contents might occur. If greater than 1200 pellets are added, the automatic sealing device malfunctions.

This process currently requires manual intervention and is, therefore, costly. The manufacturer wishes to automate this packing process but is concerned that an automated process will be incapable of operating within these limitations. The seller of the automatic pellet dispenser agrees to install the machine for a trial run.

"A computer is ideal for reducing raw data into a form whereby projections can be made."

The automatic apparatus is used for one day. At the end of the day, 55 packages are randomly selected from the day's production. The number of pellets in each package is counted and recorded. This data is then manipulated by the DRP with the results shown in Table 1.

We see that an average of 1061 pellets are loaded into each package. In no instance has there been less than 1050 nor more than 1077 pellets loaded. The DRP indicates that, if the data is statistically relevant, the automatic process should never add less than 1041 nor more than 1081 pellets to each package.

A histogram of the data indicates a good approximation of the bell-shaped curve. Furthermore, a chi-square error value of 0.16973 with three DOFs is recorded. Checking Table 2, we see that the sample data represents a normally distributed population (is statistically significant), and has a confidence factor (probability) of greater than 90 percent.

Based on these findings, the manufacturer is confident that the automatic process will more than meet his needs, and he purchases the equipment.

The DRP can be a very useful decision-making tool in many areas of business, education and scientific study. It should, however, be used only when you are reasonably certain that a normally distributed population is under study. ■

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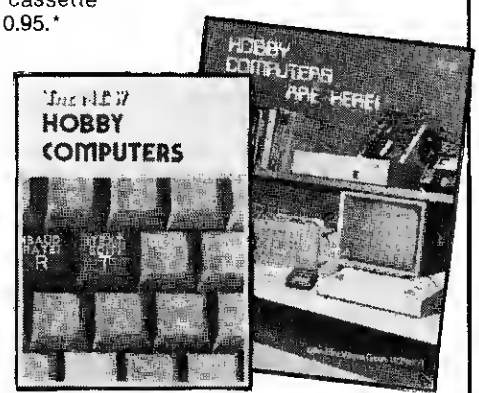

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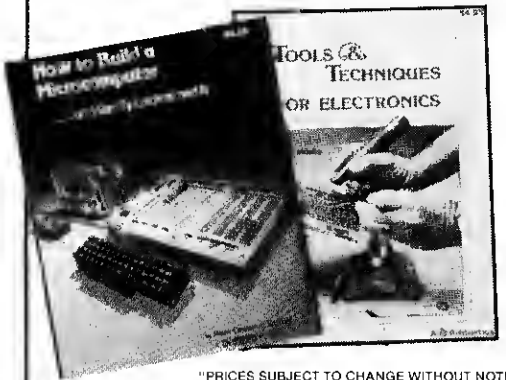

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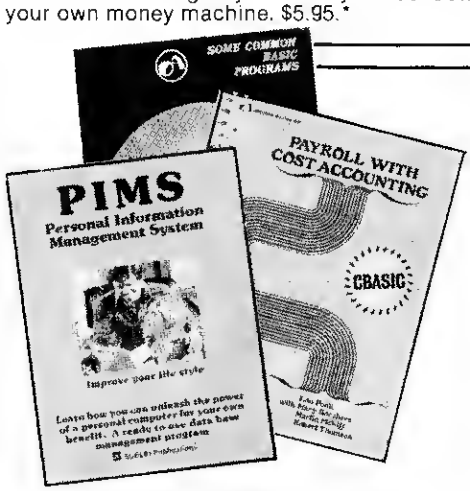

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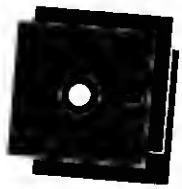

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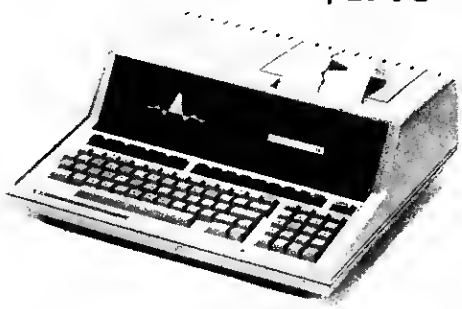

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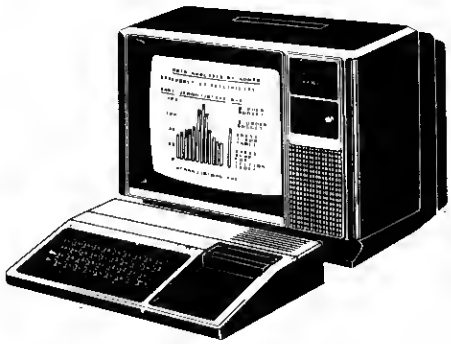

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54	59	64	69	74	179	184	189	194	199	304	309	314	319	324	429	434	439	444	449
55	60	65	70	75	180	185	190	195	200	305	310	315	320	325	430	435	440	445	450
76	81	86	91	96	201	206	211	216	221	326	331	336	341	346	451	456	461	466	471
77	82	87	92	97	202	207	212	217	222	327	332	337	342	347	452	457	462	467	472
78	83	88	93	98	203	208	213	218	223	328	333	338	343	348	453	458	463	468	473
79	84	89	94	99	204	209	214	219	224	329	334	339	344	349	454	459	464	469	474
80	85	90	95	100	205	210	215	220	225	330	335	340	345	350	455	460	465	470	475
101	106	111	116	121	226	231	236	241	246	351	356	361	366	371	476	481	486	491	496
102	107	112	117	122	227	232	237	242	247	352	357	362	367	372	477	482	487	492	497
103	108	113	118	123	228	233	238	243	248	353	358	363	368	373	478	483	488	493	498
104	109	114	119	124	229	234	239	244	249	354	359	364	369	374	479	484	489	494	499
105	110	115	120	125	230	235	240	245	250	355	360	365	370	375	480	485	490	495	500

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Expansion and enhanced capabilities are key words in achieving full utilization of your computer system. LOBO DRIVES complete line of TRS-80 compatible disk drive subsystems is the ideal, cost effective way to provide the expansion capabilities you need to meet your system growth requirements.

*TRS-80 is a trademark of Radio Shack, A Tandy Company.

TRS-80 MODEL II

LOBO DRIVES makes expanding your TRS-80 Model II very, very easy. Now you can add more floppy disk memory at less cost. And, LOBO can provide you with up to 40 MBytes of fixed disk Winchester technology storage capacity that is completely software compatible to your Model II.

- Model 800-850 8-inch dual Floppy Systems
- Model 1850 Dual Floppy/Fixed Disk Memory System

MODEL 1850 DUAL FIXED/FLOPPY DISK MEMORY SYSTEM

LOBO DRIVES has combined a 5 or 10 MByte Winchester technology fixed disk and 1.6 MByte double-sided, double-density floppy disk drive in one cabinet. The unique controller can accommodate two dual units. Now you can have the speed and reliability of fixed disk, with built-in floppy back-up.

- 5 or 10 MByte Fixed Disk Capacity
- Up to 1.6 MByte Floppy Disk Capacity
- Winchester Reliability
- Software Compatible

MODEL 800/850 DUAL FLOPPY DISK MEMORY SYSTEM

Complete with stylized cabinet, power supply, controller, interface, and cables, the Model 800/850 Dual Floppy Disk Memory System is the ideal way for the serious user to expand his disk-based TRS-80.

- Up to 3.2 MBytes Capacity
- Single-side, Single or Double Density
- Double-Side, Single or Double Density
- Complete Software Compatibility
- High Speed Access Time

MODEL 400 5¼-INCH FLOPPY DISK MEMORY SYSTEM

A low-cost, high performance, software-compatible Floppy Disk for TRS-80 Model I users.

- Up to 220 KBytes Capacity
- Single/Double Density
- Soft Sector Format
- 298 Msec Access Time

MODEL LX80 EXPANSION INTERFACE

LOBO DRIVE's new Model LX80 expansion interface enhances system performance by expanding disk storage capacities beyond 40 MBytes, adding a second serial port and facilities for an additional 32 K RAM. The LX80 permits you to achieve the maximum expansion capabilities of your TRS-80.

- Connects Directly to Keyboard
- Two Serial Ports (optional)
- One Parallel Expansion Port (standard)
- One Parallel "Centronics" Printer Port (Standard)
- Supports Double Density 5¼ and 8 inch Floppies
- Separate Port for 8-inch Floppies
- Switch for Overriding Keyboard ROM
- Separate Port for Fixed Disk Drives

MODEL 950 DUAL FLOPPY/FIXED DISK MEMORY SYSTEM

LOBO combines the outstanding capabilities of the latest technological breakthrough in disk drives, the Shugart Technology 5¼-inch Micro Winchester fixed disk drive with the proven reliability of the Model 400/450 Floppy Disk in one easy-to-use cabinet.

- The Storage Capacity of 16 double-sided, double-density Mini-Floppies
- Built-in Floppy Disk Back-up
- 170 Msec Average Access Time
- Sealed Environment/Winchester Reliability

NOTE: Limited Availability in the Fall, 1980

See your nearest dealer, call, or write for the complete LOBO DRIVES story... find out just how competitively priced a quality drive can be.

↙ 15

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Pump Up Your TRS-80 with the ES/F Mass Storage System

▲ Actual Size Actual Thickness ▼

THESE FACTS SPEAK FOR THEMSELVES!

	CASSETTE	ES/F	MINI-DISK
SPEED (Seconds to load "Blackjack")	56	6 (5" wafer)	6½
CAPACITY (thousands of bytes)	38 (C-20)	64 (75" wafer)	59 (TRSDOS)
RELIABILITY (Oesigned for digital data?)	NO	YES	YES
SYSTEM COST (First unit plus interface)	$60	$250	$800
MEOIA COST (in quantities of ten)	$3.10 cassette	$3.00 wafer	$3.20 disk

Let's face it. Cassette players were not designed to store digital data and programs. That's why we designed a digital storage system using a continuous tape loop: the Exatron Stringy/Floppy (ES/F) and the Wafer. There's no expensive interface to buy—the ES/F comes ready to pump up your TRS-80.*

Once your TRS-80* is pumped up by our ES/F . . . you won't want to deflate it. We're so sure, that we offer an unconditional 30-day money-back guarantee and a one-year limited warranty. Over 2,000 TRS-80* owners have met the wafer . . . why don't you?

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