



The  
Small Computer  
Magazine

kilobaud<sup>T.M.</sup>

Understandable for beginners . . . interesting for experts

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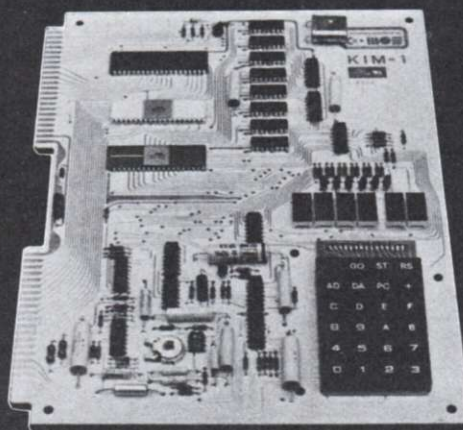
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# PUBLISHER'S REMARKS

Wayne Green

## The French Do It Again

A letter from W3NET included a reference from a navy-published book, and it covers the history of Teletype codes. The upshot of all this is that the five-level code we've been using all these years is not Baudot at all . . . it is the Murray code, developed by Donald Murray around 1901. The Baudot code is entirely different . . . though still a five-unit code. For instance, in case you don't want to believe me, the letter R in Murray is 2 & 4. In Baudot, R is 3. In Murray code, the uppercase R is the number 4. In Baudot, uppercase R is a hyphen. Convinced? Murray code is also known as the International Telegraph Alphabet No. 2.

It's time to change to ASCII and bury this whole mess.

## Spadework

There it was! Right by the ramp leading to the United Airlines plane at Logan (Boston) I saw this kiosk with a PolyMorphic microcomputer . . . all set up and running. It was put there by the Computer Shop of Cambridge and must have cost a bundle. I hope it draws some business for them.

Just to be sure, I called Bob Rivers at the Computer Shop and asked him how effective the kiosk was. That's awfully expensive



advertising, so it would have to pull a lot of customers to be worth the expense. Bob said that they had renewed their contract for the space, if that told me anything. It sure did.

When we were pricing displays for promoting Computermania, we checked on the cost of the billboards at the airport . . . hoot mon! They cost a couple hundred dollars a month each . . . just for the billboards . . . so I'm afraid to even speculate what a kiosk like that runs.

It's located where every passenger has to go right past it, so the visibility is high. There are some brochures available to help people remember the name and address of the store . . . and a rough outline of what they are selling. This is tremendous promotion for microcomputing.

The airline magazines are running a special computer section in June, so keep your eyes open if you are traveling to NCC or the Atlanta Hamfest/Computerfest.

## The Second Faire

The San Jose Computer Faire was enjoyed by just about everyone. It was packed with people and there were many more prospective exhibitors than space for exhibits.

Many exhibitors mentioned that there seemed to be a lot less room than there had been last year at San Francisco . . . room for fewer exhibits . . . and tiny aisles which quickly filled up, making it very difficult to get around.

A check with a Convention Facilities Directory showed us that San Francisco had 37,000 square feet in the main room and 30,000 more in the two side rooms, for a total of 67,000 square feet. The San Jose hall had only 30,000 square feet . . . plus about 2000 more for the micro-booths in a separate room. No wonder it seemed so crowded . . . it was half the size of the San Francisco Civic Auditorium.

A rough calculation of the aisle space showed about 11,000

square feet. When a density of one person per ten square feet is reached, an exhibit hall is generally considered full, and it is difficult for people to move around. This leaves room for elbows and a bag of literature, but not much more. At times the show reached this density in the more popular spots, indicating a possible head count of 1100 in the aisles.

That may seem a bit scant in view of the interesting numbers announced by the Chairwhat-ever, but I like to check little nit-picking items like this, so every so often I would take a quick run down a few aisles, counting the feet and dividing by two. There were seven aisles in all, with four of them shortened by the cut-off corners of the hall. This shortening just about made up for the space in the three cross aisles. My counts confirmed the approximately 1000 attendance figure during the more crowded times.

When the crowd density gets to five square feet per person, there is no longer room for elbows or much arm movement, and shuffling around is quite difficult; and this could account for a total of up to 2200 people in the exhibit aisles.

With 150 exhibits to see and a total of 1500 minutes of show time, maximum, no one could spend more than an average of ten minutes per booth and see the whole show. The attendance was scant on both Friday and Sunday mornings, so very few people managed to get in the entire 1500 minutes. The familiarity of the faces by Sunday indicated that a lot of people did come all three days and made an effort to see all of the exhibits.

Each person who got anywhere near the *Kilobaud* booth was asked to fill out a questionnaire which would be entered in a drawing for a Caribbean cruise. Few passed up the opportunity. By Sunday we found that most of the passersby had already filled in a card, indicating a high percentage of show-goers coming back for a second and third day to see the exhibits.

Though it's possible that a few people managed to see the show and not get near the *Kilobaud* booth, this is unlikely. Our count on the filled-out cards, after sorting out the duplicates (some people try to increase the odds on these things), came to 4100.

A check with several exhibitors who were handing out literature indicated that some had handed out over 3000 pieces . . . others claimed close to 5000.

## Software Needed

I don't think there was one manufacturer or dealer who didn't express the universal cry for programs. Hobbyists have been spending a lot of money on hardware, but so far there has been very little they could do with their expensive systems except play *Star Trek*, *Submarine*, *Mastermind* and so forth.

The *Kilobaud* plan for distributing software was enthusiastically embraced by everyone . . . now all we have to do is get it going. We do have the staff and the equipment to get this project running, so I hope the first programs will be coming out in the next few months. Programs for the TRS-80 and PET will be out on cassettes. We have a first-rate lab for checking out programs, a superb cassette duplication system for bulk production of cassettes, the publishing facilities for printing documentation, the sales force and list of dealers to distribute and an international rep organization to get us into every country.

Programmers can do a lot worse than get in touch with *Kilobaud* about publication and distribution of their programs. They must be complete and ready to go, with thorough documentation. The deal is simple: 20 percent royalty on our receipts. This is about five times the going rate, and we hope that we can establish this as a norm for this field by starting it out that way and maintaining this percentage.

What kind of programs are needed? Just about anything for the TRS-80 can be instantly distributed. At present the programs should fit the 4K systems, but it won't be long before we'll be needing most programs to work with the 16K systems. Almost anything will go for the PET too . . . 8K systems.

In the long run we will be able to do best for programmers who work on what we call vertical systems. These would be program packages that would enable computer stores to sell complete systems to specific businesses. Let's say a programmer has a good friend who runs a moving-van service. I picked that at random by opening the Yellow Pages. He would then consult with his moving friend and develop a program package that would do everything a moving-van firm could want . . . everything.

Once the package was done and carefully checked with a couple local van firms for accuracy and completeness, we would

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package it and sell it through computer stores. Stores would take the package, set it up to work on a system and then call van firms to come in and see it at work. It is unlikely that many would pass up the system. When you consider that there are over 80,000 such firms around the country, you can see that sales could be vigorous.

There are hundreds of vertical packages that can be developed to help computer stores with their sales . . . and these should bring in handsome royalties.

Next we come to computer-aided instruction . . . and the possibilities for thousands of more programs. Every course taught in school—and those that should be taught in school—are good prospects for this field.

Home-oriented programs will be popular . . . security programs, general business programs, games . . . the list is, fortunately, endless.

Programs that are usable on more than one system will be checked out on other systems in the *Kilobaud* labs . . . we have most of the microcomputer systems set up for this . . . and even our maintenance man is into working up programs. Of course we have the TRS-80 (16K), the PET, Altairs, Imsai, OSI, ISC, Heath H8 and H11, etc. This place is microcomputer heaven.

Programmers should send in complete listings, documentation, some data on how to use the programs and what they can do . . . plus a cassette or disk with the program on it, depending on the system. We would like to get as good a print of the program as possible.

Programmers interested in tackling a major programming package would do well to register with us. This could prevent ten programmers from working up very similar dental programs, for example. Tell us what you are planning to put together and we'll let you know if anyone else is working on something similar. Packages will be chosen on the basis of excellence, not first come.

### Very Rich Programmers

We feel it is in the interests of the whole industry that programmers get a major piece of the action. The ability to sell microcomputer systems rests on the excellence of the programs . . . more so than the hardware . . . so why not make it possible for programmers to benefit accord-

ingly? Our system should make it possible for programmers to get rich beyond their wildest dreams.

Suppose we come up with a hot moving-van package . . . and sell it for \$995 to the customer. This would wholesale to the dealer for \$597 (40 percent off). The rep would get 10 percent, leaving a net sale of \$537.30. Twenty percent of that would come to \$107.46. If only 10 percent of the van firms bought the system, this would net the programmer \$859,680 (before taxes). I suspect that sales will be more like 75 percent of the industry than 10 percent, but why build the pie factory in the sky? A 75 percent sale would bring in about \$6.5 million in royalties.

Is \$995 a little high for such a package? The customer would be buying about \$15,000 or so in hardware to go along with it, so it would really be miniscule . . . running less than \$25 a month!

What about my plan for \$7.95 software? Oh, we'll have a lot of that. The programs for games, for homes, general programs, teaching programs, these will be of interest to much wider interest groups, and we can look for sales in the millions of these programs. Most of the TRS-80 and PET programs will come in this category . . . at least until the hardware is available for business use of these systems.

Are you still reading and not rushing to your computer to program? You need some All-Bran . . . badly.

### The Kilobaud Lab

As soon as the TRS-80 and PET are brought into the system we'll have one of the most extensive microcomputing systems

anywhere. On line at present are two Altairs, an Imsai, an Ohio Scientific Challenger, a Heath H8, an H11 and five Compu-colors. Peripherals on line are a Centronics 51 printer, a G.E. Terminet, a Teletype, an OSI disk, two Altair disks, a North Star disk, the H10 and H9, the SWTP CT-64, a Computalker, a clock module, the Heuristics board, an S.D. Sales Z-80 etc.

Barry, our tech, is working to I/O all of this to our Prime mini-computer system as well as the TRS-80 and PET. This will enable us to check out submitted programs on just about everything popularly available . . . lacking only a 6800 system.

In addition to our wanting to know personally how all the various systems work, another reason for all this hardware is to give us the ability to produce programs for sale . . . and be sure they all work on the systems we say they will.

### What's Coming?

Initially we'll be putting out programs on cassettes. After that we'll probably be using more and more disks, then perhaps ROMs; but what will be next?

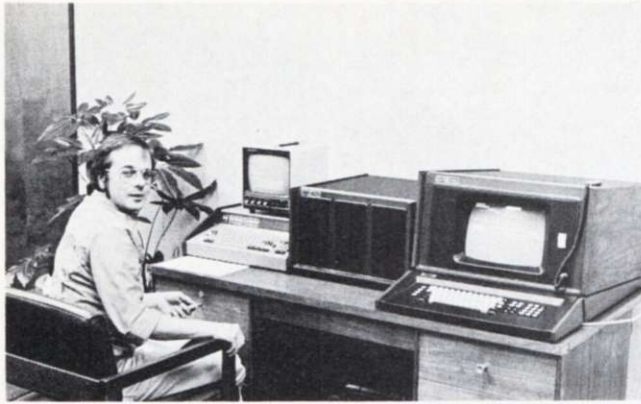
With the prices on video recording systems coming down, we may soon see video recorders used for program and data storage. These recorders are all set up to be easily controlled by a computer.

Picture, if you will, a study course of the future . . . on videotape. It will have full television action and sound in color . . . and program your computer as it goes along. It will show material and then stop and ask a question about what has been

### Reader Responsibility

One of your responsibilities, as a reader of *Kilobaud*, is to aid and abet the increasing of circulation and advertising, both of which will bring you the same benefit: a larger and even better magazine. You can help by encouraging your friends to subscribe to *Kilobaud*. Remember that subscriptions are guaranteed—money back if not delighted, so no one can lose. You can also help by tearing out one of the cards just inside the back cover and circling the replies you'd like to see: catalogs, spec sheets, etc. Advertisers put a lot of trust in these reader requests for information. To make it even more worth your while to send in the card, a drawing will be held each month and the winner will get a lifetime subscription to *Kilobaud*!

Reader-service card submission is on the increase, so we had plenty to draw from. Winner of a lifetime subscription to *Kilobaud* is Fred Schild of Playa Del Rey CA. Congratulations, Fred.



*This is the latest Extensys system. It is approaching the top end in performance microcomputers . . . and it isn't cheap, either. This is an excellent example of how far things have gone with micros.*



*Here's a view of the main part of the PET production department. The front line is brand new PETs that are being checked out with diagnostic programs to make sure they work.*

shown. If your answer is right it will compliment you and then go on with more instructions. If you goof, the tape will rewind and re-play the part you screwed up.

How far in the future is all this? Jolt had just such a system up and running two years ago . . . using a Sony video system and Jolt microcomputer. Prices on video recorder systems are coming down; performance and availability are going up. These would seem ideal mates to our computer systems. And think of the data storage on a video cassette!

Jolt was recently bought out by MOS Technology (Commodore), so we may see some of this technology coming along sooner than we think . . . if Commodore lets the Jolt crew have a free hand.

#### Speaking of the PET

After the Faire, Sherry and I stayed over a couple of days in the San Jose area. We made a visit to Extensys and then went over to Commodore to see the

#### What about Radio Shack?

On the way back from San Jose we stopped off in Dallas/Fort Worth.

The next day we had lunch with Bill Mueller of ICOM and Art Housholder of AGL Electronics in Dallas. A Mexican restaurant right near AGL was fantastic. I don't care if AGL wants to throw away their advertising money like drunken sailors in other magazines, I'll be stopping by to visit at every opportunity.

From there we waddled on to Radio Shack and Hy Siegel. Despite a broken leg, gained a

downtown area . . . and get to the parking lot easily. The ground floor ice-skating rink is ringed by a shopping plaza. Prominent in the plaza were a giant Radio Shack store, a Tandy Computer store and a new Tandy Telephone store.

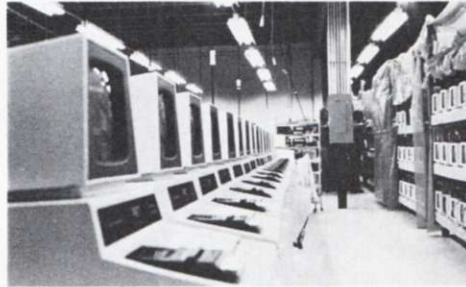
The elevators go up to the 17th floor; from there you have to take an escalator to the top corporate offices.

While some firms are being run by uptight people who appear to be well on their way to terminal constipation, the Radio Shack crowd seems to be having a good time at their work. I was surprised at the large number of hams involved in the higher positions . . . most of whom have been reading 73 for years. I like that in a person. I've known many of the people either through Radio Shack in Boston or Allied Radio. Quite a crew!

Tandy has built two tower buildings recently . . . both about 19 floors. They have a third tower going up soon . . . 45 floors. Tandy is dominating downtown Fort Worth. Some difference from when I lived in the area about 30 years earlier and the highest point in town was the dung heap at the stockyards.

After the visit to the offices . . . some talking with various departments about prospective microcomputer growth . . . my software plans, etc., Hy took us off to the plant not far away where the TRS-80s are being made. Wow! Again, no production figures were to be let out of the bag, but you can see from my pictures that the production is not insignificant. They run the systems in for 24 hours, so you know all the sets you can see are just a part of one day's production.

It was so difficult to tear myself



*On the right of the PETs being checked out is rack upon rack of PETs being burned in. They burn 'em in for 48 hours before packing them up for shipment. Normally they have those plastic covers over the burn-in racks to make sure that the PETs are hot, thus aggravating any troubles that might otherwise turn up later.*

few weeks earlier on the ice-skating rink in the center of the Tandy building shopping plaza, Hy took us all over the new Tandy headquarters building.

A few blocks away there is an enormous parking lot, serviced by a new subway system that ends in the Tandy building. This permits people to park and shop the



*Here are over 100 TRS-80s being burned in . . . and this is just one part of the burn-in area . . . which goes on and on . . . and on. If anyone tries to tell you Radio Shack isn't making a lot of 80s in Ft. Worth, tell him baloney.*

away from the factory that we almost missed our plane back to Boston . . . and home.

### TRS-80—Is It Any Good?

I've had letters from hundreds of TRS-80 owners . . . and talked with dozens at the recent shows, but I haven't had any negative comments yet on the system. Oh, everyone wants more memory and bigger BASIC, but they are amazed at what the 80 can do with what it has—and they are having a ball with it.

In view of this, the recent blast in PCC at the 80 is a mystery. The people at Radio Shack were numbed by the negative review . . . and as bewildered as I by it. Yes, the case for the keyboard and CPU is plastic, but it is very attractive and it resists dings a lot better than metal; and if you want to carry the system around the way most of us do, you loudly hail the use of lightweight plastic instead of boat-anchor iron. I carried my TRS-80 with me to San Jose . . . on to Dallas and back home. I sure wouldn't have done that if it had been in a metal case. What other computer system can you throw in a suitcase and take with you?

### Byting the Apple

Since they were giving out free copies of *Byte* at San Jose, I stuck a copy in my flight bag to bring back. The price was just right.

On the flight, I had the choice of sitting back and resting or reading the magazine. I made the wrong choice and soon got a mental hernia over a review of the Apple II by editor Helmers.

Before reading the Helmers view of the Apple, I had the impression that it was an excellent system. Many of the computer store owners I have talked with were very enthusiastic about it, and it seemed to be one of the best selling systems on the market . . . possibly giving Radio Shack and Commodore a run for their money. The reader comments in the letters had all been very positive, so I was unprepared for the vicious attack in *Byte*.

Helmers, who, I understand, got the Apple free, may provide an object lesson for manufacturers who are feeling generous. He apparently could see no good in the contrivance. He didn't like

(continued on page 106)

# EDITOR'S REMARKS

John Craig

### Who Reads *Kilobaud* Magazine?

We not only have a reputation for being a magazine for "beginners" in this field—we flaunt it! I think we need to sit back and examine just who these "beginners" are, however. It's really very simple . . . we're all beginners to one degree or another. The person who just developed an interest in building or using a personal computer, and hasn't any background, is most definitely a *beginner*. (And speaking of that type of person: I recently heard of a company that didn't feel they should be advertising in *Kilobaud* because of this "beginners' magazine" image. What a hogwash attitude! Are they going to totally ignore that ever-increasing segment of the market?)

Those "total novice" individuals need to be examined much more closely because they're coming from several different directions and have different objectives in mind. *Kilobaud*, and every other magazine in the personal-computing field, is being bought primarily by computer *hobbyists*. Some of those other magazines purport to be aimed at the mass market . . . those millions of average middle-class Americans who will be buying home systems in the years to come.

The key phrase there is "will be buying." That market hasn't arrived yet, but it will—and, needless to say, we've all got our eye on it. But for right now (approaching the middle of 1978), *Kilobaud* is providing a lot of material for this mass market.

I've come to this conclusion as the result of recently teaching a couple of one-day courses on personal computing for the University of California. At the beginning of both courses, I opened with the comment that even though I was the editor of a computer-hobbyist magazine, I had no intention of directing myself to computer hobbyists. Those in attendance included newcomers interested in home computers, students, professional people (some in data pro-

cessing) and small businessmen. I was rather amazed at the number of times I made reference to articles in *Kilobaud* that would be of interest to those people.

These two groups were made up of end users, or the mass market, we've been talking about. If you stop and think about some of the practical applications programs we've run, hardware and software reviews, and small-business software, I think you'll see what I mean.

Many see this new mass market as being made up of people who simply want to take their new computer system home, plug it in, load a cassette program and run! I agree with that concept . . . to a point. That point is where these people begin to tire of all the "canned" programs they can buy . . . and get the itch to generate some of their own. (That's not hard to imagine because many of the younger generation will be programming the home computer to solve homework problems, and thereby exposing mom and dad to programming.) There will be another segment of these end users (most likely those with an electronics background) who will start tinkering with the system by adding new peripherals, modifications and capabilities.

Aha! You know what we're going to have then? More computer *hobbyists*! I wonder what magazine they'll be buying when they go down to their local computer stores?

Now . . . what about some of the other "beginners" reading *Kilobaud*? I hope computer stores, and readers, are directing small businessmen (under 5' 5") shopping for a system toward *Kilobaud*. We're doing our best to provide material to help them in selecting a system . . . with articles written with them in mind.

Now we get to the best part: all those professional computer engineers and programmers out there who read *Kilobaud*. You know, there really aren't that many people out there who are *experts* in every single area of this field. To put it quite simply, there are a lot of software types who are interested in expanding their

knowledge in the hardware area . . . and probably even more engineers interested in picking up on programming techniques. Those people are, of course, interested in reading *Kilobaud* for the same reason as anyone else: articles of general interest, objective hardware and software reviews, and *the ads*.

A good friend of mine recently pointed out something about *Byte* and *Kilobaud* that gave me some food for thought. He held up a copy of one of the two magazines and said, "This magazine is almost exclusively filled with esoteric, high-level articles and very little in the way of light reading material."

Picking up the other one, he said, "Then we have this one, which is filled each month with *mostly* light reading, short articles . . . and very little that you can really sink your teeth into. Two magazines: one which is too technical in content, and the other too light." He suggested that since *Kilobaud*, rather than *Byte*, could more likely balance things out, I should consider including at least one or two "heavy" articles in each month's issue. I'm inclined to agree with him . . . what about you? (Heck, this business of putting together a magazine is a snap! All you have to do is provide material that will satisfy tens of thousands of readers . . . all with varying interests!)

### The Southern California Swap Meet

Got anything scheduled for July 1st? If so, get busy and cancel it . . . and don't plan to go out of town for the July 4th weekend . . . that is, if you live in Santa Barbara CA. If you don't . . . then, by all means, plan to drive there for the Southern California Swap Meet on July 1st. People will be coming from as far east as Phoenix . . . as far north as San Francisco . . . and as far south as San Diego . . . so there's no reason for *you* not to come!

Next month I'll include a map showing how to get to it . . . and a photo of the beautiful building the event will be held in. And, that's what it's going to be—an event: computer hobbyists, hams and electronics experimenters all getting together for a good time; and, without a doubt, that is the most important part.

Admission will be free . . . for buyers. Sellers can drop me a line

(continued on page 110)

# AROUND THE INDUSTRY

John Craig

*The following is from an official bulletin issued by the Santa Maria CA Police Department.*

The DataSync Corp. was started in early 1977 by Colonel David Winthrop and advertised extensively in the national computer magazines. In late June 1977, Santa Maria CA Police detectives learned that Colonel Winthrop had used other names and had obtained driver's licenses under at least three names. Police learned that the Colonel had defrauded a Santa Maria man of

pretense thefts amounting to a quarter of a million dollars in five different states within the past four years, other local, state and federal agencies declined to prosecute him.

On February 26, 1978, Hunt, who had been serving his term at Chino State Prison, escaped from a minimum security facility.

Hunt is currently being sought by California authorities. Hunt is a white male, 6' 3", 220 pounds, with reddish-brown hair, and hazel eyes. He has worked as a TV repairman and has run busi-



*The many faces of Norman Henry Hunt, Jr. (AKA Colonel David Winthrop).*

\$10,000 under the pretense of designing a computer board for him, and detectives obtained an arrest warrant for Winthrop along with search warrants for his home and his business. Winthrop was arrested at his business and was held under \$100,000 bail.

A check of Winthrop's fingerprints revealed that his true name was Norman Henry Hunt, Jr., and that he had been a parole violator in California since 1965. Hunt was charged with three counts of false-pretense theft as felonies, and he entered a guilty plea to the charges. Hunt was sentenced to two years, eight months in prison on the Santa Maria charges. Although the investigation revealed that Hunt had been involved in fraud and false-

nesses marketing CB radios, computer products and jacks for trailers.

His method of operation has been to move to a town under a new identity, rent a house with option to buy and to make contacts in his field of endeavor (recently, computer hobbyists). Hunt will generally begin his operation by soliciting backing for product design from private parties. Often he will sell his qualifications so well that it is the victim's idea to ask Hunt to design a product for him.

Hunt may then start a business and solicit partners. He will rent a building, hire employees, begin a credit line with suppliers. After enough equipment has been received from suppliers on credit to

look impressive, he will apply for a bank loan to start production. He will usually go to a local bank rather than a large bank chain. If the loan is received, Hunt empties the business of its equipment and leaves the area, leaving the creditors and the bank high and dry.

Hunt also orders equipment from dealers and pays by check. He then stops payment on the checks. When contacted by a dealer about why he stopped payment, he may say that the product was defective and is being returned, and request that another unit be shipped.

When Hunt was arrested in Santa Maria, he had a loaded shotgun in his closet at home, and he may be considered dangerous.

If anyone has information that may relate to this suspect, please contact Detective Ernest L. Kappahn, Santa Maria Police Department, (805) 922-7811, or Investigator Zeke Hernandez, Chino State Prison, (714) 597-1821.

## SS-50 Bus Manufacturers Meet

All manufacturers of SS-50 bus compatible hardware met at the second Computer Faire in San Jose to discuss possible new bus signal assignments. Represented at the meeting were Southwest Technical Products Corp., Midwest Scientific Instruments, Smoke Signal Broadcasting, Gimix and The Micro Works.

It was agreed the uniformity of use was essential to protect current and future users of the bus from the incompatibility and general chaos now being faced by S-100 bus users and manufacturers. It was agreed by everyone present that any revised, or additional bus line assignments would be cleared with all concerned

before being designed into equipment. A suggestion to change the present "Phase 1" line to "Slow Memory" was made by Mr. Childress of Midwest Scientific Instruments. Several others present agreed that this was a reasonable change, since "Phase 1" was a redundant signal that could be obtained by inverting "Phase 2," which is also present on the bus. If no objections are found, this change will be considered for action by all manufacturers of the SS-50 bus to make the change official.

A discussion of possible additions, or changes, to the bus system for MC-6809 processors brought up the subject of monitor and software compatibility in these machines. It was agreed that Mr. Dave Shirk of Technical Systems Consultants, Inc., would be asked to recommend jump table addresses that would be used by all SS-50 manufacturers in these systems. This would insure that all users of this advanced processor on the SS-50 bus would be able to interchange hardware and software easily between monitors written by different sources.

Mr. Robert Lentz, president of The Micro Works, reported that he had conducted some experiments with high speed processors and that he had found no problems with crosstalk, or any need for terminations, etc., at speeds up to 3.0 MHz with a standard SS-50 bus.

The next meeting of the SS-50 Manufacturers Association will be held at Personal Computing 78 in Philadelphia. All manufacturers of SS-50 bus compatible products are invited. All users of the bus are also invited to participate in the meeting and to send any suggestions they may have to any of the above manufacturers for consideration at this meeting.



*Photo 1. The complete Micro Works/Malibu system.*



Intertec's  
**SuperDEC**

**"pull out the guts & screw in the brains"**



While we'll admit the difference in appearance between the DECwriter II and our new SuperDEC is difficult at best to see, the difference in performance is astounding! The SuperDEC is our new Throughput Optimizer designed to be easily installed in your existing DECwriter II teleprinter. Not only can our SuperDEC Optimizer increase the print speed of your DECwriter II by as much as six times its original speed, it also gives you the features offered only by our famous SuperTerm teleprinter. Features you couldn't get on your DECwriter until now.

You've undoubtedly already heard of our SuperTerm. It's the 1200 baud teleprinter that has been replacing DECwriters by the thousands. And while you may have purchased your DECwriter prior to the introduction of our state-of-the-art SuperTerm, you can now have all of the SuperTerm's incredible features without having to throw out your DECwriter.

With the SuperDEC Optimizer installed, you will have such nifty features as bidirectional printing, manual and automatic top of form, full horizontal and vertical tabs (addressable and absolute), adjustable right and left margins, an RS-232C interface, a double wide character set and up to 32 user programmable characters. You can also add an APL character set, selective addressing and an answer back feature at nominal cost.

The SuperDEC Optimizer is designed to replace the digital electronics in your existing DECwriter II. In less than five minutes, your DECwriter can be transformed into a SuperDEC. The SuperDEC Optimizer is completely "plug-compatible" with the cables in your DECwriter. The only installation tool required is one that we give you—a screwdriver. Just pull out the guts and screw in the brains. No special technical skills are required. And if you get bored watching your DECwriter print faster than you can read, the old digital electronics may be reinstalled in a matter of minutes. It's really just that simple.

Every SuperDEC Throughput Optimizer carries a full one year warranty on all parts and workmanship. But our commitment to excellence in service goes beyond the warranty. Intertec can also offer on-site service contracts for all of your upgraded SuperDEC equipment.

So, when you're ready to "pull out the guts and screw in the brains", contact us at one of the numbers below and we'll give you the name of your local SuperDEC dealer. He'll show you what a difference \$395 can make.

**\$395.00**  
and  
**your old DECwriter**

# INTERTEC DATA SYSTEMS

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The SuperDEC and other Intertec products are represented in these cities: Albany, NY Alberquerque, NM Atlanta, GA Baltimore, MD Boston, MA Buffalo, NY Charlotte, NC Chicago, IL Cincinnati, OH Cleveland, OH Columbia, SC Columbus, OH Dallas, TX Dayton, OH Denver, CO Detroit, MI Hartford, CT Huntsville, AL Houston, TX Indianapolis, IN Jacksonville, FL Kansas City, KS Los Angeles, CA Louisville, KY Madison, WI Memphis, TN Miami, FL Milwaukee, WI Minneapolis, MN Nashville, TN New Haven, CT New Orleans, LA New York, NY Oklahoma City, OK Omaha, NB Philadelphia, PA Phoenix, AZ Pittsburgh, PA Portland, OR Providence, RI Raleigh, NC Richmond, VA Rochester, NY Sacramento, CA Salt Lake City, UT San Antonio, TX San Diego, CA San Francisco, CA Seattle, WA St. Louis, MO Syracuse, NY Tampa, FL Tulsa, OK Virginia Beach, VA Washington, DC. International offices located in Australia, Austria, Canada, Denmark, England, France, Germany, Holland, Switzerland, Taiwan.



Photo 2. Bob Lentz, president and master thinker.



Fig. 1. Shannon Sherrick, daughter of the Malibu 160's designer, Mike Sherrick.



Photo 4. Larry Lowe, layout, draftsman and corporate pilot.

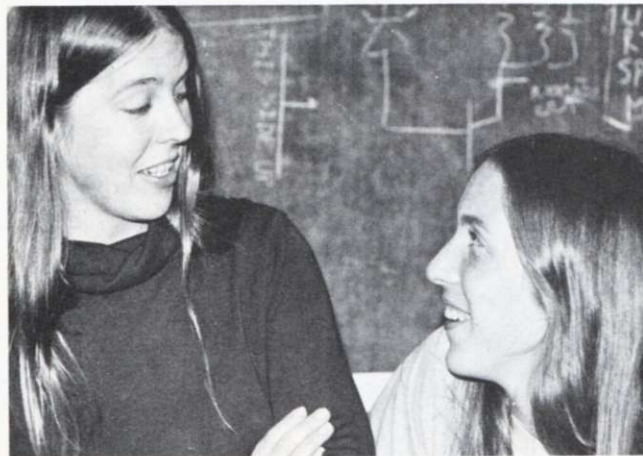


Photo 3. Jill Lentz, marketing, and Ann Curtis, #1 secretary.

### Computer Portraits from Micro Works!

Computer portraits have fascinated me for several years, but not for the reason you might think. The electronics, the software and the hardware of the system aren't much of a mystery, or a fascination. No, I've always been amazed at the tremendous cost of such systems and knew it was just a matter of time before some enterprising micro enthusiasts came along and developed one we could all buy. Well, it's happened. Let me tell you about it. . . .

In last month's editorial I gave you an introduction to what the folks at The Micro Works are up to. They've been building S-50 6800 boards for some time now (they have an EPROM Programmer, PROM board, Universal I/O board and extender boards), but their latest is really something!

They have developed a digital video system, called the Digisec-

tor<sup>R</sup>, which interfaces an inexpensive TV camera with a Southwest Technical Products 6800 system. The TV image is converted, by the Digisector board, into

a high-resolution digitized picture . . . and stored into the computer's main memory. So far, so good . . . and, up to now things have been *quite* inexpensive: the cost of an SWTP 6800 system, a \$200 to \$300 television camera, a video monitor for \$150, \$170 for the Digisector board and a terminal for the computer. Not too bad, right? Now we're going to have to spend a few bucks for a good high-quality printer . . . and the Micro Workers feel the Malibu 160 is the best for the job . . . and from what I've seen, I'll have to agree (catch the review on that printer in this month's *Kilobaud*).

Now, let's do a recap of the hardware, while referring to Photo 1. Going clockwise, starting on the left-hand side of the table, we have the TV camera sitting on top of the terminal (incidentally, you're going to need

some floodlights aimed at the subject), then we have a monitor for the video, the SWTP system with the Digisector sitting on an extender board (the right one), minimum of 18K of main memory and last, but not least, the Malibu printer. Add it up . . . it's a heck of a lot less than anything you've seen before! (The cost of the Digisector board includes the computer portrait software.)

Photos 2 through 6 will introduce you to the sharp team at Micro Works who put it all together . . . and Fig. 1 speaks for itself; The Micro Works/Malibu combination is a real winner! (By the way, they have an 8080/S-100 version of the board in the works, which will sell for about the same price.)

Micro Works, PO Box 1110, Del Mar CA 92014. Ph: (714) 756-2687.

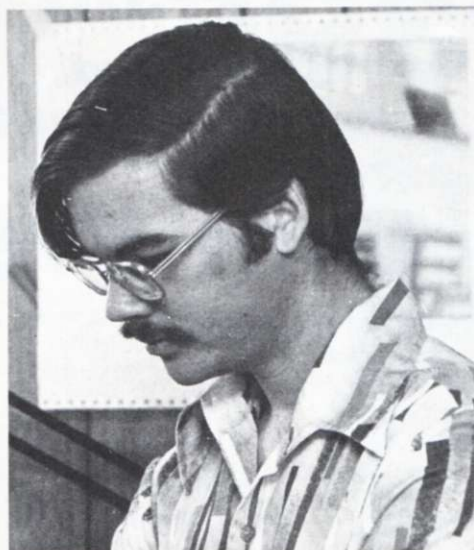


Photo 5. Andrew Phelps, senior programmer.

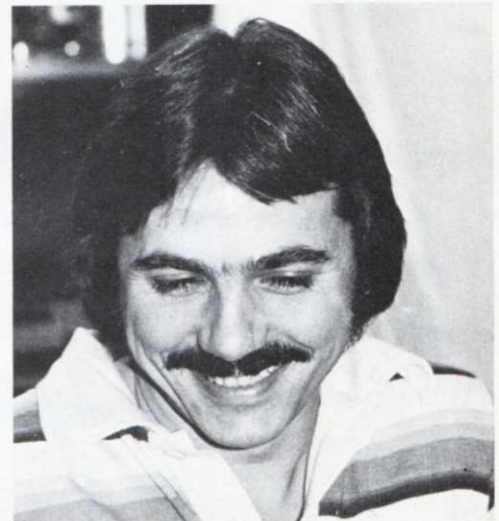


Photo 6. Bob McMann, tech writer and senior technician.

# BOOKS BOOKS BOOKS

## 8080A/8085 Assembly Language Programming Lance A. Leventhal

Adam Osborne & Associates, Inc.  
PO Box 2036, Berkeley CA 94702  
\$7.50, 400 Pages

Assuming that there are other computer hobbyists who enjoy assembly-language programming as much as I do, I would like to pass on my thoughts about *8080A/8085 Assembly Language Programming* by Lance A. Leventhal.

I use assembly language in situations where BASIC won't do the job, such as graphics, input-output, or where BASIC programs won't fit due to memory size limitations. In addition to the usual I/O operations (keyboard, printer and video), I turn various external devices on and off under computer control. This requires being able to manipulate CPU registers, addresses and data lines; it takes assembly-language programming to do this.

I have written many programs, but after skim-reading this book I realized that I have missed the significance of, or misused, many 8080 instructions. A second, more thorough, study confirmed this and contributed greatly to my assembly-language programming ability.

Table 1 is an outline of the contents of Leventhal's book. Just about every possible question that you could come up with is answered in one or more of these chapters. Chapters 1 and 2 serve as the appetizer—a comprehensive discussion of assembly-language programming and assemblers.

Chapter 3 does more than just list the instructions with a brief description; a half page or more is devoted to each instruction and explicit examples promote better understanding. Nowhere else have I seen the 8080 instruction set explained with such detail and clarity.

Chapters 4 to 12 are the main course; they take you from the simple program through every

conceivable CPU operation. I found the code-conversion and I/O information especially interesting since my current project is to interface an EBCD Selectric Data Terminal to my SOL.

There is hardly a page in this book that does not contain at least one example program with source and object coding plus flowchart. These examples are really subroutines that you can use in countless programming situations.

A partial list of these subroutines might include: checksums, finding a given ASCII character, changing the parity of a string of characters, ASCII-to-decimal conversion, addition, subtraction, multiplication, division, sorting, indexing a table, code conversion and so much more. In fact, the emphasis in chapters 5 to 12 is on subroutines that can be combined to form more complex programs.

Chapters 13 to 16 tie together everything you have learned. This is the dessert course. My assembly-language programming technique always started with coding after some sketchy mental problem definition. Dr. Leventhal has convinced me that this is wrong. Problem definition and program design should come first, followed by coding, debugging, testing, documentation, maintenance and redesign.

1. Introduction to assembly-language programming
2. Assemblers
3. 8080/8085 instruction sets
4. Simple programs
5. Simple program loops
6. Character-coded data
7. Code conversion
8. Arithmetic problems
9. Tables and lists
10. Subroutines
11. Input-output
12. Interrupts
13. Problem definition and program design
14. Debugging and testing
15. Documentation and redesign
16. Sample projects

Table 1.

*8080A/8085 Assembly Language Programming* has many more points to make... too many to cover here. This is not a one-evening book. If you have an 8080 or 8085 (improved 8080) CPU or have access to one, the ideal learning situation is to try the examples as you go along. Each chapter has, in addition, a series of problems for which clues, but no coded solutions, are supplied. These give you a chance to try your hand at assembly-language programming.

Particularly interesting is the discussion on various programming methods: flowcharting, modular, structured and top down. Although no one method is touted as being *the best*, each is explained, and advantages and disadvantages presented. Clearly, the author leans toward structured programming.

Major statements are printed in boldface type, and explanations to these statements are printed in a lighter type. The tendency is to read only the boldface sentences until you come to one that you don't understand, at which time you read the lightface type for clarification. Out of habit, I found myself reading it all.

This is definitely a software-oriented text, but an amazing amount of hardware information is given in the I/O and interrupt chapters—probably enough to implement any of the designs discussed.

So far, I have covered all the book's good points but none of its bad ones. That is probably because I couldn't find anything to criticize. My only negative reaction has to do with *8080A/8085 Assembly Language Programming* having been advertised as available in October 1977, which is when I ordered and paid for it; it was actually not printed until late January 1978, which is when I received it.

In my opinion, *8080A/8085 Assembly Language Programming* is a worthwhile text; and I'm hoping for a Z-80 version soon. If my technical library had to be reduced in size for some reason, this is certainly one book I would keep on the shelf!

Rod Hallen  
Tombstone AZ

*Simplified BASIC Programming*  
Gerald and Joan Silver  
McGraw-Hill, New York  
1974, \$12.85

*Simplified BASIC Programming* is an excellent text for those

of you who have absolutely no experience in computer programming and occasionally need to look up the definition or application of an instruction. *Simplified BASIC Programming* is an excellent reference manual.

The first section of the book is devoted to an in-depth explanation of the operation of a time-sharing system. For those of you who have access to a time-sharing system, this section is invaluable. For the microcomputer owner, this section may be skipped as your system probably operates in a substantially different manner.

The second section describes, in easy-to-understand language, how most of the instructions are used. I say *most* because in 1974 BASIC was not as sophisticated as it is today. Examples of the use of each instruction or combinations of instructions are clearly stated. At the end of each chapter, a review and a quiz are provided.

The last section of the book contains example programs with complete documentation and a description of the way the problem was solved.

This book is a good reference for those of us who can't seem to remember whether a comma or a semicolon is necessary to print closely spaced output, or any other syntax problem that may drive you to the brink of insanity.

Although *Simplified BASIC Programming* is available through any bookstore, you may find a used copy for sale at substantial savings at your friendly, neighborhood college bookstore. And if you are really watching your budget, you may find *Simplified BASIC Programming*, along with other informative reading on BASIC, at your local library.

Jim Cambron  
Topeka KS

*The 8080A Bugbook*  
Rony, Larsen, Titus  
Howard W. Sams & Co., Inc.  
Indianapolis IN  
\$9.95, paperback

One book out of a hundred makes you wish you had seen that one before slogging through the other ninety-nine. This is such a book. It should be subtitled "All You Wanted To Know about the 8080 and Its Support Chips, but Didn't Know Where To Look."

In the Bugbook tradition, the 8080A neatly balances theory and practical example. It comprises eight chapters with titles such as,

"What is a Microcomputer?" and "An Introduction to Microcomputer Programming." They are all informative and readable.

Unfortunately, there are some errors (no doubt accidental, but possibly confusing to the reader). Occasionally, the authors give a detailed explanation that ends just when you expect some vital truth to be revealed; but these rare omissions serve mainly to demonstrate the thoroughness of the rest of the book.

Each chapter begins with an outline and ends with a summary and some searching questions. In light of its format, it could well be used as a textbook. Let's take chapter 4 to consider the book's style.

Title: Generating an output pulse.  
Outline: Objectives, definitions, 8080 I/O instructions, device select, pulse decoding, sample microcomputer program, device select pulses as control pulses, example, test, and "What have you accomplished in this chapter?"

Introduction: "In this chapter you will learn how to generate device select pulses . . ."

At the end of the chapter the reader is asked to "draw a schematic diagram for a circuit that can generate up to 256 different device-select pulses."

And if you read the chapter you should be able to do the above, and a great deal more.

In following chapters the authors explain the use of these and other signals for the control of outside devices via timing loops and other programming sequences. Throughout, however, they stress keeping the hardware simple and exercising control by software.

I appreciated most of the simplified, no-mystique approach to several things that had long bothered me—among these were flag testing, the use of status words, and the inside working of the many conditional branch instructions. The entire instruction set is covered in greater detail than I had previously encountered. It is methodically considered by function—by grouping the related logical operations, for example—and whole pages are devoted to illustrating certain instructions that might be considered tricky or difficult.

The use of octal may disappoint some readers. The explanation is that the 8080 instruction set was designed this way. Logical operations all begin with 2 in octal, and MOV instructions with 1. The accumulator is 7 and the memory 6. Thus, MOV A,M and

MOV M,A are 176 and 167, respectively, much easier to remember than two dissimilar hex codes.

The book's overall theme is that the microprocessor is a useful tool. No mention is made of high-level languages, games or heavy number crunching; the interfacing is to practical devices and the programs are in simple machine language, all designed to "do something." And although the special 8080 support chips are all covered in some detail, TTL alternatives are explained where they can be applied.

It is difficult to classify this as either a hardware or a machine-language software book, since it is really both. If the reader could previously build a kit or follow a program, he should, after digesting this volume, be able to design much of his own hardware and write programs to interface with other devices. That's a lot to learn for only ten bucks.

**Ernie Brooner  
Lakeside MT**

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**The Home Computer Revolution**  
**Theodor H. Nelson**  
**The Distributors,**  
**702 So. Michigan South Bend**  
**IN 46618, \$2**

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Most computer hobbyists, or those about to get into computing, will find this book easy to read, as well as entertaining. It is neither a technical book, nor a dry history book. The author has combined semitechnical material, computer-historical anecdotes and his forecast of the role of the computer in the future.

Reading this book, I found that my level of interest wavered between near boredom to moderate interest. However, because of the nature of the material, another reader might find different peaks and dips of interest.

For instance, as an advocate of the Altair bus, I reacted favorably to the author's repeated support of this configuration. A reader using the Digital Group bus, for example, might be disinterested in the Altair bus coverage.

At the other end of my interest spectrum, I found the frequent attacks on IBM to be objectionable. I have no particular like or dislike for IBM, but I certainly found the repeated negative attitude distracting.

It's a matter of psychology—if you like the Altair bus and have something against IBM, you'll enjoy the author's comments; on the other hand, if you don't like

the Altair bus structure and have a high regard for IBM, you won't enjoy reading this book.

A little more than half of *The Home Computer Revolution* is related to the author's predictions of the future home-computer world. Therefore, if you are going to read this book, do it now; very shortly, these precarious prognostications will either be history or wrong guesses. Some of the predictions concerning future home-computer input/output devices and techniques seem way out (but so was 1984 not very long ago).

On the positive side, I thought the historical notes on Mits, Cromemco and other companies were very interesting. Those readers new to home computing will find some seldom published background information.

There are brief hardware descriptions (Altair bus oriented), but with home computing moving so fast, a book would have to be published in loose-leaf style to keep up with the hardware changes. Only a monthly magazine, such as *Kilobaud*, can hope to keep you informed on the current hardware.

The program-languages descriptions are short, with most languages getting only one paragraph. The author suggests that a person learn programming with a BASIC interpreter, and this is probably what most home computerists are doing.

A serious oversight occurs on page 117. Add the following to the lists of available magazines on that page: *Kilobaud*, Peterborough NH 03458.

*The Home Computer Revolution* is light reading and generally entertaining; one of my next reading projects will be *Computer Lib* (\$7, same source), which is referred to often in this latest book by Theodor Nelson.

**Gordon Flemming  
Sylmar CA**

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**Home Computers: 2<sup>nd</sup>**  
**Questions and Answers;**  
**Vol. 1: Hardware (\$7.95)**  
**Vol. 2: Software (\$6.95)**  
**Rich Didday dilithium Press**  
**Forest Grove OR 1977**

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These two books fill a definite need. Most people who get started in the home-computer field find themselves in one of three situations: They know quite a bit about software but nothing about hardware; they know quite a bit about hardware but nothing about software; they don't know

much about either one.

The idea behind these books is that you can buy Vol. 1 if you're in the first category, Vol. 2 if you're in the second category, or both if you're in the third category.

That's the idea behind the books, but how well do they pull it off? Pretty darn well, I'd say.

Together, the two books represent a heavily edited transcript of nine days of conversation between two people on the subject of home or hobby computing. One of the participants (called "A" because he provides the answers) has a strong background in computing in general (both hardware and software), and home computing in particular.

The other participant (called "Q") is an intelligent, interested newcomer to the field who has visited the computer stores, picked up some literature and bought a few magazines, but needs further help to figure out what it all means. He doesn't understand too much of what he's read, and wants to know, for example, what is really involved in putting a computer kit together.

Is he better off getting a fully assembled system? Why are there so many different microprocessor chips? What does all this RAM/ROM/PROM/EPROM stuff mean? What's involved in programming? Why are there so many different programming languages? What can you really do with a home computer?

1024 is 2<sup>10</sup>, which is the number of questions and answers in the two books—thus the title for the work. But it's more than just a bunch of disjointed questions thrown together. The books are well organized and proceed logically from one topic to the next, building up your knowledge and tying things together as you read.

Of course, neither book is going to enable you to become a professional programmer or hardware designer overnight, but they'll give you a better idea of what these people do, and introduce you to some of the basics as they relate to home computing.

Usually, when I read an introductory level book or article on computing, I find myself saying, "That's not a very good example," or "Boy, that's sure going to mislead somebody." These books are a rare exception. The questions and answers both have a nice balance of simplicity, accuracy, and (amazingly enough) realism, and actually convey the

(continued on page 111)

# Radio Shack's personal computer system? This ad just might make you a believer.

You can't beat  
the 4K system at  
**\$599**



#### TRS-80 "Breakthru"

- TRS-80 microcomputer
- 12" video display
- Professional keyboard
- Power supply
- Cassette tape recorder
- 4K RAM, Level-I BASIC
- 232-page manual
- 2 game cassettes

... or the step-up  
16K system at  
**\$899**



#### TRS-80 "Sweet 16"

- Above, except includes 16K RAM

... or the fast  
4K/printer system at  
**\$1198**



#### TRS-80 "Educator"

- Above, except includes 4K RAM and screen printer

... or the Level-II  
16K/printer/disk  
system at  
**\$2385**



#### TRS-80 "Professional"

- Above, except includes 16K RAM, disk drive, expansion interface, and Level-II BASIC

**So how are you gonna beat the system that  
does this much for this little? No way!**

... The amazing new  
32K/Level-II/2-disk/  
line printer system at  
**\$3874**



#### TRS-80 "Business"

- Above, except includes 32K RAM, line printer, and two disk drives

Get details and order now at Radio Shack stores and dealers in the USA, Canada, UK, Australia, Belgium, Holland, France, Japan. Write Radio Shack, Division of Tandy Corporation, Dept. C-051, 1400 One Tandy Center, Fort Worth, Texas 76102. Ask for Catalog TRS-80.

**Radio Shack®**  
The biggest name in little computers

Prices may vary at individual stores and dealers.

R 17

# NEW PRODUCTS

## Plotters—Kit and Assembled

Sylvanhill Laboratory, Inc., has been sold to Pitsco, Inc., and offers plotter kits and plotters completely assembled. The kits require the purchaser to mount them on a drawing surface (console also available as a new product of Sylvanhill) and to do the interconnection between the control PC boards and his computer. Plotters require an 8 bit parallel I/O port and 5 and 24 V power sources. A basic 8080 software program is included in the owner's manual.

Sizes available are 11 x 17 (\$795 in kit form), 17 x 22 (\$950 in kit form) and 22 x 34 (\$1300 in kit form). Consoles priced separately.

Contact the new offices and manufacturing facilities of Sylvanhill Laboratory, Inc., PO Box 646, Pittsburg KS 66762.

## 202 Video Camera Kit

Solid State Sales 202 Video Camera Kit may be used for visible or infrared viewing for character recognition with computers with external circuits. It will operate in a vacuum, under water, at high altitude or in a magnetic environment because there is no high voltage or magnetic deflection. In addition, it may be used for IR surveillance with an IR light source, and is excellent for standard surveillance work because of its light weight (under 1 lb.) and small size.

Some advantages offered in this new kit from previous models are all clock voltages operating at

6 V requiring no adjustments, and a higher video output signal. The circuitry has been simplified for easier assembly, and a two-level TTL output is supplied for interfacing. In addition, a power board is supplied so only a 5 V, 1 Amp power source is needed, and, in the near future, Solid State Sales will supply a computer interface card.

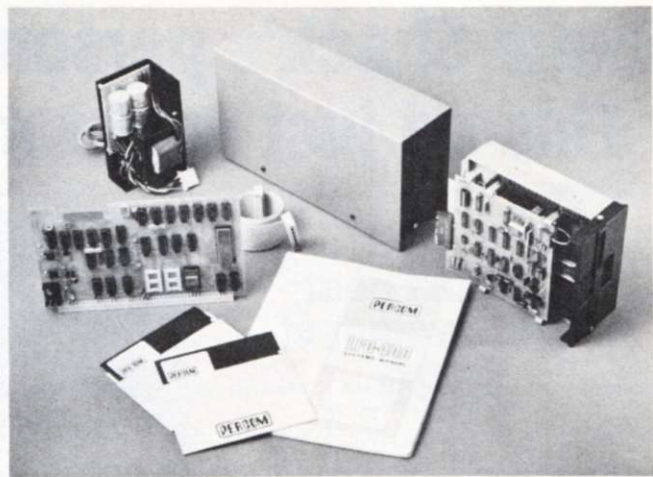
This kit includes all semiconductors, boards, data sheets, diagrams, resistors, capacitors, and an 8 mm lens. Assembly has been simplified so that the only equipment needed is an oscilloscope, soldering iron and some wire. The complete kit sells for \$349 (\$75 to assemble and test).

Solid State Sales, PO Box 74K, Somerville MA 02143.

## Serial Interface Module

The 9650 is an asynchronous serial interface module specifically designed for compatibility with the M6800 microprocessor bus. It is pin and outline compatible with the Motorola EXORCiser and Micromodules and with the MEK6800D2 Evaluation Kit. It features full address decoding and fully buffered data, address and control lines. This module utilizes 8 MC6850 Asynchronous Communications Interface Adapters with full RS-232C signal conditioning. An on-board bit rate generator simultaneously provides 14 standard rates that can be individually strapped to each ACIA.

The 9650 occupies 16 consecutive memory addresses. The lowest 8 of these access the 8 con-



PerCom's LFD-400 system.

trol/status registers and the next 8 access the transmit/receive data registers. This map arrangement allows optimum use of indexed addressing in I/O intensive systems and permits the use of a very tight interrupt polling loop.

The standard configuration of the 9650 is fully populated to 8 channels. Prices range from \$395 in single quantities to \$237 at 100. A partially populated 4-channel version is also available at lower prices.

The 9650 is one of a family of M6800 support modules. All cards of the family are 6.05 inches by 9.75 inches and utilize a 43-pin dual readout edge connector with 0.15625 inch pin spacing.

Creative Micro Systems, 6773 Westminster Avenue, Westminster CA 92683.

## Disk Storage System for the SS-50 Bus

PerCom Data Co.'s LFD-400, a minifloppy<sup>R</sup> disk memory system for the SS-50 bus, includes a controller PC board, PROMware disk operating system, disk drive and drive power supply, interconnecting cable, two minidiskettes, an operator's manual and a compact enclosure to house

the drive and drive power supply. System components may be individually purchased, and 2- and 3-drive systems are also available.

The controller board, which is installed in an SS-50 bus slot of the host computer, includes special low-voltage-drop regulators, a proprietary "bit shifting" compensation circuit, an inactivity time-out circuit to increase drive motor life, and provision for 3K bytes of PROM. The LFD-400 PROMware DOS, miniDOS, allows SS-50 bus owners to use their existing software with simple patches. This was a priority consideration in the development of miniDOS.

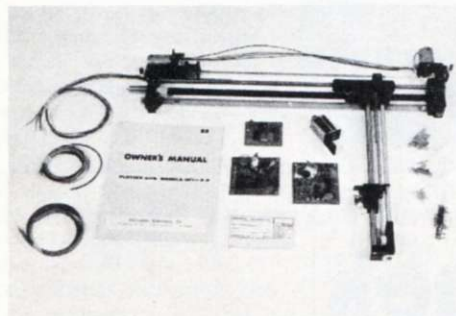
The LFD-400 uses the Shugart SA-400 drive. Disk speed is 300 rpm, which gives a data-transfer rate of 125 kilobits per second. The read/write head is stepped from track to track at 40 ms per step. The SA-400 drive system features a positive media interlock, which prevents door closure on a misaligned disk, and write protection circuitry. The LFD-400 storage media is a 10-sector hard-sectored minidiskette, which accommodates 89.6K bytes of data on 35 tracks. The recording technique is Bi-Phase-M (also known as "double frequency").

PerCom Data Company, Inc., 318 Barnes, Garland TX 75042.

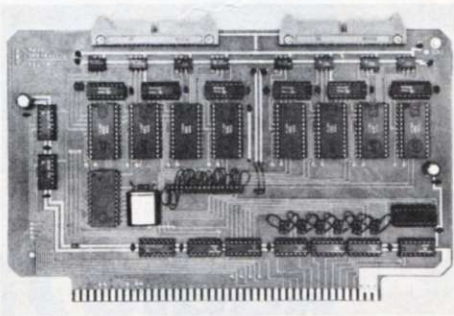
## CT Terminals

COMPUTER TEXTile announces its line of high-quality hard-copy hardware. CT sells reconditioned QUME and Diablo daisy wheel printing terminals, which feature 30-cps printers, 96-character keyboards with 10-key numeric pad, ASCII coded, RS-232 interface.

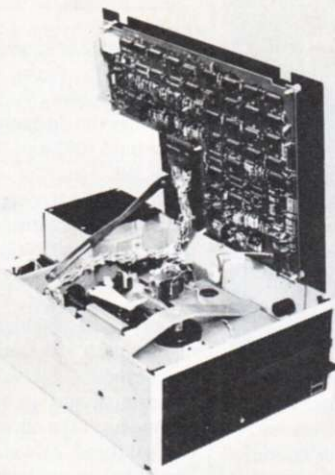
Also included are 256-charac-



Some of Sylvanhill's wares.



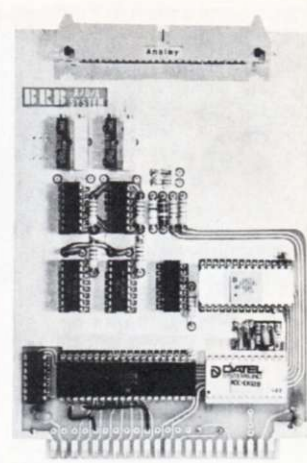
The CMS 9650.



The Innotronics Series 400 floppy disk drive.



CSD's Microdesk.



Wintek's analog interface module.

ter buffer, user's and service manual, with full graphics capability packaged in a cabinet with black-and-chrome-wheeled pedestal. Options include 45-cps and 55-cps mechanisms for some QUMEs, other encodings, pin-feed platen, tractor forms feeder and service contracts.

Each terminal comes with a limited 30-day warranty. Quantities are limited. Prices from under \$2000. Also available are reconditioned ADM-1s, modems and paper tape punch/readers.

COMPUTER TEXTile, 10960 Wilshire Blvd., Suite 1504, Los Angeles CA 90024.

#### Innotronics Floppy Disk Drives

The new Series 400 diskette drive, offering an array of new features that were previously unavailable in the market, has recently been introduced by Innotronics. Unique new features include automatic head-unload and stepper motor time-outs, bidirectional write-protect, radial stepping ability for truly overlapping seeks, host power-failure detector and six different LED activity indicator electronics.

Both the Model 410 (soft-sectored, IBM-compatible) and the Model 420 (hard-sectored) provide single- and double-density recording capability. In addition, a proprietary data separator design, coupled with a digital noise filter and a unique way of handling recorded signals, results in 35 percent greater data integrity margins.

The Series 400 also incorporates the field-tested Innovex mechanical design, which includes filtered air operating environment, single-side accessibil-

ity for maintenance, mechanical door interlock with a manual override button, targeted media loading, and a patented "wear-free" diskette hub rated for over 100,000 insertions. Prices for the Innovex Series 400 range from \$575 in single quantities to \$435 each for orders of 100.

Innotronics Corporation, Brooks Rd., Lincoln MA 01773.

#### Printer Interface for Apple II

Microproducts has announced a printer interface for the Apple II computer which is compatible with the Southwest Technical Products PR-40 Printer. It will be marketed as a preassembled PC board that plugs directly into the Apple II computer, an interconnecting cable and a cassette containing the operating software.

The printer prints one line at a time when the return key is struck. The printer subroutine can also be called in BASIC to print the entire contents of the video screen. While in the BASIC mode, using the list subroutine, the printer will continually record the program, while the video screen scrolls up one line at a

time. The complete plug-in interface with software sells for \$49.95.

Microproducts, Dept. K, 1024 17th Street, Hermosa Beach CA 90265.

#### Microcomputer Storage System

The Computer Systems Design Microdesk is a new addition to *Kilobaud's* microcomputer lab. (We ran a release on the Microdesk in November 1977; now we've had a chance to utilize it.) The desk's ease of assembly makes for a quick and useful addition to any room, with one adjustable shelf that you can arrange to your specific needs. Because of its air-vented design, the upper shelf is an excellent location for your unit. You can keep the unit close at hand without its being in the way. There's plenty of room for your terminal, and a sliding keyboard shelf can put the keyboard within comfortable reach—or out of the way when you're not using it.

The lower shelf fully handles the task of holding all the manuals that accompany a small microcomputer lab. The Micro-

desk is sturdily designed to last a long time under normal conditions.

Computer Systems Design, 1611 E. Central, Wichita KS 67214.

#### Microprocessor Analog Interface Module

The Wince Analog Interface Module makes it easy for laboratory and control engineers to interface thermocouples and other transducers to a microprocessor. It makes it equally easy to interface the microprocessor to motors, servos, etc. Options include a 16 channel multiplexer, an 8, 10, or 12 bit analog-to-digital converter, and one or two 8 bit digital-to-analog converters. The base price is \$99. Other Wince Modules include the Control, RAM, ROM, EROM Programmer, CMOS RAM/Battery, Driver/Sensor, Console I/O, Cassette Interface.

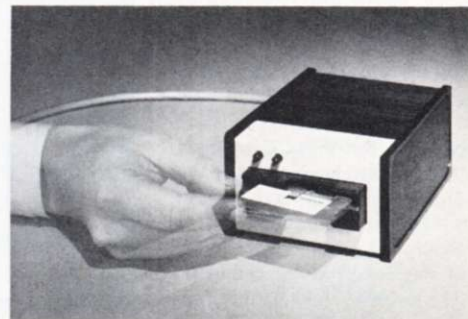
Wintek Corp., 902 N. 9th St. Lafayette IN 47904.

#### The Stringy Floppy

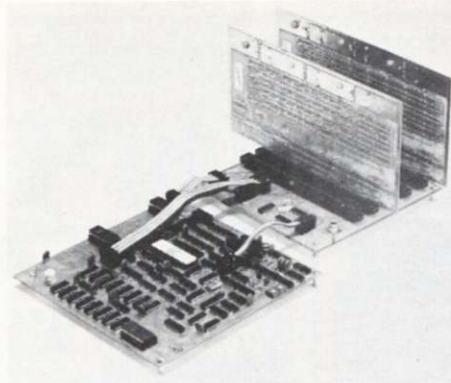
The Exatron Stringy Floppy™ is a subsystem consisting of a con-



Microproducts interface with Apple and PR-40.



Exatron's Stringy Floppy.



Central Data 2650 Computer System.

control board connecting to the S-100 bus, a small drive module outside the computer mainframe and the connecting cable.

The individual continuous-loop tape wafer, less than a fourth the bulk of the standard audio cassette and holding up to 40K bytes, is inserted in the slot in the front of the drive module, and will save or load 4K bytes in about 5 seconds. All operations are software controlled; the utility programs are contained in an EPROM on the control board. The subsystem is delivered ready to operate, and is backed by a one-year full warranty and a 30-day money-back guarantee.

Exatron Corp., 1030 East Duane, Suite 1, Sunnyvale CA 94086.

### The Electric Pencil II

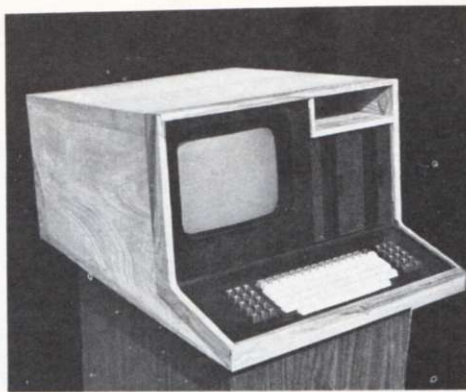
Michael Shrayer Software, 3901 Los Feliz Blvd., Los Angeles CA 90027, announces the Electric Pencil II. Some of the new features include: CP/M compatibility, simple file management, dynamic print formatting, multi-column printing, cassette backup capability, centering, underlining and boldface.

The Electric Pencil II is now available on CP/M—standard printer versions \$225; Diablo printer versions \$275. System hardware must include: 8080 or Z-80 based microcomputer, printer, video display, CP/M supported disk system, or North Star minifloppy disk, or cassette interface (Tarbell or SOL).

The Electric Pencil I is still available for non-CP/M users. Contact Michael Shrayer for more information.

### Central Data Boards

Central Data, PO Box 2484,



Northwest's 85/P.

Sta. A, Champaign IL 61820, offers a 16K RAM board specially designed for use in S-100 computers. The dynamic memory board uses a reliable refresh method that inserts cycles between the computer's normal access cycles. The 16K RAM board uses less than one-half the power of a comparable static RAM board.

CD's board comes completely assembled, tested and burned in—just plug it in and start using. Each board also comes with a full one-year warranty. Price is \$289. There is capacity on the board for up to 32K RAM (\$475), or add 16K for \$200.

S-100 extender board, assembled and tested, is \$110. The 2650 Computer System board retails for \$275. System board features include: 80 x 16 line display, 2650 microprocessor, 300 baud cassette interface, supervisor program, two parallel ports, one input and one output, and 2048 bytes of read-write memory.

### Naked Terminal Cuts Dumb Terminal Costs 1/3

Dynabyte, Inc., lowers the cost of a dumb terminal with its Naked Terminal, an S-100 module that functions with a key-

board and video monitor.

The Naked Terminal, priced at \$395, displays 80 characters by 24 lines, using both uppercase and lowercase characters in a 5 x 7 font. Half duplex, full duplex and a block mode that allows editing before transmission are features of the Naked Terminal. Editing is aided by an addressable cursor.

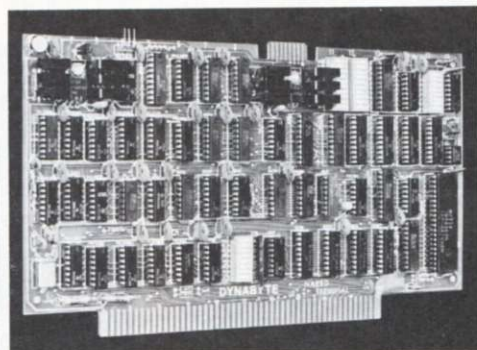
Switch-selectable features include black-on-white or white-on-black, blinking or nonblinking — cursor, and variable baud rates.

No software is required. The Naked Terminal can be configured by DIP switch to drop into an existing system, replacing the serial I/O card and stand-alone terminal without making any changes to software.

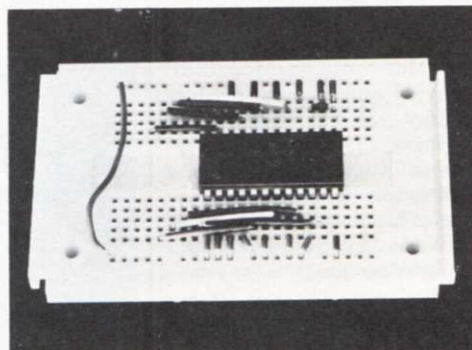
The Naked Terminal is a complete dumb terminal on an S-100 board. It contains a microprocessor with its own memory, its own software drivers and its own internal bus. It won't take up any of the 64K memory address space of the S-100 bus.

Like all Dynabyte products, the Naked Terminal is completely assembled, socketed, tested and burned in. Dynabyte's guarantee is for a full year—the longest in the industry.

Dynabyte, Inc., 4020 Fabian, Palo Alto CA 94303.



Dynabyte's Naked Terminal.



The EXP650.

### 8085 + PASCAL = 85/P

The new 85/P, programmer's workbench from Northwest Microcomputer Systems, Inc., combines the throughput of the 3 MHz Intel 8085 and the power of PASCAL.

The standard system features: (1) 8085 CPU with 54K bytes of static user RAM; (2) one megabyte of storage in two double-density Shugart floppy-disk drives; (3) 24 x 80 high-resolution display with 103 station Hall effect keyboard; (4) two serial ports for printer and second terminal or modem; (5) a choice of attractive solid oak or walnut cabinets that enhance any home or office.

The 85/P gains its efficiency in program preparation and code execution from the increasingly popular PASCAL language. The 85/P provides the full PASCAL environment including a 700 lpm compiler/interpreter, random and sequential files, a screen-oriented editor, interactive, source-linked debugger, plus full documentation and a 90-day warranty.

The complete system costs \$7495. Delivery is quoted at 30 to 60 days, with Northwest Microcomputer Systems paying for delivery on any order shipped later than 60 days. A variety of options is available.

Northwest Microcomputer Systems, Inc., 121 E 11th, Eugene OR 97401.

### "Byte-Size Breadboards" from CSC

The age of LSI has put a lot of power in Lilliput for users of Continental Specialties Corporation Experimentor Socket solderless breadboards. This seems especially true for the palm-size EXP350 and EXP650. Each is just 3.6 inches long. The EXP350 offers .3 inch center spacing to



accept standard DIP packages; the EXP650 offers the wide .6 inch spacing appropriate to wide LSI DIPs. Their small size offers the perfect opportunity for byte-size modularity. This can happen in several ways.

A complex LSI function IC like a UART, for example, can be accommodated, along with pertinent support discretes and connecting cables as a module on a CSC EXP650. An LSI function can be synthesized with less complex circuitry. A counter, decoder and display, for example, can be combined on a single EXP350 and treated as a unit—as can a data converter, an interface circuit or any of a number of functional modules.

CSC's EXP350 is priced at \$5.50 (unit), the EXP650 at \$6.25.

Continental Specialties Corporation, 70 Fulton Terrace, New Haven CT 06509.

### REX Computing System

RCC introduces REX—the total microcomputer system, fully assembled, complete with a Z-80 CPU, 24K of RAM, video output, system keyboard, a microfloppy disk drive featuring double-sided recording, cabinet and power supply.

The REX system includes an S-100 motherboard containing the CPU, video display interface, bootstrap and Monitor PROM, and powerfail and vectored interrupt circuitry. The system comes complete with a modern walnut-sided cabinet and a 15 Amp power supply, and includes space for a second microfloppy drive plus five slots for S-100 bus options.

A complete line of low-cost software options is available. These include ANSI FORTRAN IV with subroutine library and 8080 and Z-80 extensions, including advanced math and string-handling functions; floppy-disk operating system; file manage-



GRI Model 756 keyboard.

ment system; text editor; and linking loader.

RCC offers a wide range of options for the REX system, including b & w or color video monitors, rf modulator generator, expansion microfloppy drives, RAM memory to 64K on the motherboard (no bus slots needed), a 120 cps 80/96 column printer programmable serial communications channel, and a data communications modem. The REX system lists for \$2495, assembled and tested only.

Realistic Controls Corp., 404 W. 35th Street, Davenport IA 52806.

### New Model 756 Full ASCII Keyboard

The Model 756 keyboard from George Risk Industries provides encoding for all 128 ASCII characters and control functions, imposing no limitations on software design or hardware capability. Utilizing reliable IBM series keyswitches and low-power MOS encoder circuitry, Model 756 is designed to bridge the gap between basic keyboards and expensive custom OEM models. Assembly and mounting are simplified through OEM industrial grade components and a rugged MIL-grade printed-circuit board. The durable circuitry is complemented by custom molded keytops and a line of heavy-gauge steel enclosures for desktop use.

The 756's complete line of ac-

cessories includes a numeric pad, custom cables and connectors. The versatile interface allows user selection of parity, positive or negative logic data and strobe outputs, alpha lock operation and both dc level and pulse strobe signals. A latching shift lock key is included, and all outputs are TTL-DTL-MOS compatible. Kit is \$64.95; assembled and tested model, \$75.95. A matching enclosure, Model 702, is \$29.95.

George Risk Industries, Inc., GRI Plaza, Kimball NE 69145.

### Computer-related Cases

The Buckeye Stamping Company, 555 Marion Rd., Columbus OH 43207, now offers instrument cases with keyboard holders and CRT canopies. These computer-related additions, fabricated of durable, extruded aluminum, are offered in standard 17 inch widths. The new cases are now offered with blue or black vinyl tops with matching feature stripes, or with teakwood vinyl as an option.

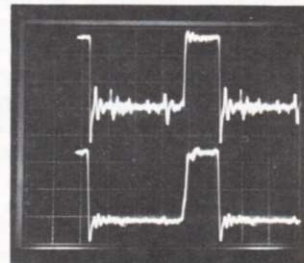
The new Buckeye computer-related cases sell in small quantities in a price range of \$110 or \$215, complete.

### Power Supply for KIM

K L Power Supplies, PO Box 86, Montgomeryville PA 18936, announces the model 512 power



K L Model 512 Power Supply.



Bottom oscilloscope signals show noise reduction made possible by the Glitch Grabber.

supply for MOS Technology KIM users, and for others needing a 5 volt and 12 volt regulated supply. The model 512 comes completely assembled and includes a total 4.3 Amp capacity and additional 8K memory.

The K L power supply features +5 volts regulated with 1.4 Amp maximum, +12 volts regulated with 1.0 Amp maximum, +8 volts unregulated with 4.5 Amp maximum, and +16 volts unregulated with 1.0 Amp maximum. It has regulated outputs with current limit and thermal overload protection, fuse-protected primary, ac line cord, and connector cable.

The unit is enclosed in a Bakelite case with aluminum bottom plate and rubber feet. It is 6.8 x 5.6 x 3 inches and weighs 3.5 lbs. Price is \$37.

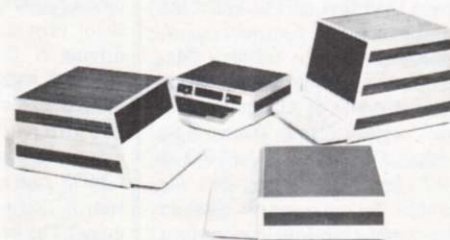
### New "Glitch Grabber" from Extensys

A board interconnection device from Extensys Corp. significantly reduces noise, glitches and jitter on the S-100 microcomputer bus and carries a suggested retail price of \$79.50 in single quantities (large-volume discounts available). Called the "Glitch Grabber," the printed circuit edge-connective device maintains clean signals on the notoriously noisy S-100 bus, safeguarding the low tolerance volt-

(continued on page 111)



RCC's REX Microcomputer.



Buckeye instrument cases.

# LETTERS

## PC Board-makers, Take Note!

Your otherwise fine article on making printed circuit boards (*Kilobaud*, April 1978) fails to give instructions and precautions for handling the chemical used to develop the photoresist-coated boards. The resist developer recommended is of completely different nature than the chemicals normally encountered by the home photography enthusiast.

I'm sure that your readers are aware that the resist developer is flammable and will take precautions to exclude potential ignition sources. They may not be aware that methylene chloride is the active ingredient in paint remover. As such it will rapidly ruin any painted or varnished surface with which it makes contact. A more serious consequence of splashes is that the developer is a serious skin and eye irritant.

Methylene chloride is an extremely volatile liquid. This means that a room containing an open tray of the developer solution would rapidly have its air contaminated with substantial amounts of the vapor. In a small bathroom with the windows and doors closed to make a temporary darkroom, the vapor concentration could far exceed the recommended peak exposure level. The present federal peak limit is 2000 ppm, but the National Institute for Occupational Safety and Health has recommended that it be substantially reduced.

Methylene chloride, which enters the body by inhalation, is rapidly metabolized. One of its breakdown products is carbon monoxide. This reacts with the hemoglobin in blood and reduces its oxygen carrying capacity. The heart and circulatory system must then work extra hard to pump blood faster in an attempt to make up for the decreased oxygen supply. Methylene chloride also affects the central nervous system as an anesthetic.

I recommend that anyone using a developer containing methylene chloride follow the general recommendations for paint removers in *Consumer Reports* (August 1976, page 434):

● "If at all possible, work out-

doors. And try to stay upwind . . . If you must work indoors, make sure there's plenty of ventilation—not just from an open window or two, but from a strong window exhaust fan.

● "Wear neoprene rubber gloves and goggles. If you splash yourself, wash the affected area immediately with soap and water.

● "Keep children away from the work site, and store the container out of their reach."

The developing of the photoresist could easily be performed safely in the backyard after sunset. The photoresist is not so light sensitive that night background illumination would be a problem.

None of the chemicals used in this process should be stored in a refrigerator that contains food, and flammable chemicals should never be stored in any home refrigerator.

With these precautions and common sense, printed circuit boards can safely and successfully be made at home.

**Jim Warner**  
Board of Studies in Chemistry  
University of California  
Santa Cruz CA 95064

## The Wired OR . . . Again!

I read with interest R. W. Burhans' letter (p. 21) regarding the wired OR in the December 1977 *Kilobaud* and would like to inject some word of warning. The wired OR (or, more correctly, wired NOR), when used with TTL devices, should be used *only*. I repeat, *only* with open-collector types. The M<sup>2</sup>L logic (I love Don Lancaster's term) or diode logic should be used *only*, I repeat, *only* with CMOS devices (which have logic levels much more forgiving than that of TTL) or if the input consists of a switch.

Anybody who follows Mr. Burhans' advice and uses diode isolated AND or OR configurations with normal (totem-pole output) TTL gates of the 7400 or 74LS family is asking for *big* trouble. The reason is simple: The worst-case low-level output voltage for gates of the 7400 family is .4 volts; for 74LS family it is .5 volts. Fast silicon diodes

(like those of the 1N444X family) at a forward current of .1 mA have a static forward voltage of maximal .55 volts (these figures come from the TI manuals).

If now the output of a TTL gate is driving the input of a following gate via a decoupling diode, the low-level input voltage for this gate can be .5 plus .55 or 1.05 volts or even higher, depending on the size of the pull-up resistor. The maximum permissible low-level voltage for all devices of the 7400 and 74LS series, however, is only .8 volts. That means this arrangement operates in a voltage range that is outside of the manufacturer's specifications. The circuit *may* work sometimes, and then it may not work, depending on the whim of the ICs, power buses, temperature and phase of the moon.

That's the reason diode logic with TTL devices having a normal (totem-pole) output should *not*, I repeat, *not* be used (unless, maybe, you are using hot carrier diodes, which have a lower forward voltage but are very expensive, or germanium—remember germanium—diodes, which are slow).

**Erich A. Pfeiffer**  
Granada Hills CA

## Ralph Burhans' Reply

The critique of "The Wired OR . . . Again!" is perfectly correct in stating that use of diodes in series with normal totem-pole TTL output (not O.C.) could create problems in excessive zero voltage drop and is not recommended by chip manufacturers. However, experimenters often do what is possible and not what is recommended, particularly if the risk of failure is very small.

Before the widespread use of MSI and LSI, many of us used Don Lancaster's technique (*TTL Cookbook*, Fig. 3-18A, p. 146) where a 74154 decoder is used to address a diode ROM matrix with a lot of NOR intersections. These work quite well, and I don't recall any failures. With the 74LS138 mentioned previously, a two diode NOR with one pull-up resistor provides elegant simplicity driving a D input on a KIM 74LS145 with no problems in my limited experience with four or five different chips.

It is also correct to state that CMOS has essentially no problem . . . so where is the argument? The basic difference in our thinking is perhaps that adverbs like "no" or "only" are applied here with some judgement based

on a typical case (not necessarily the worst case) and experimental trial. I built my first crystal set in 1933 and also know about germanium and use 1N695s if nothing else will work for a "quick and dirty" NOR. Many computer mods, where only a single extra input is needed, can be quickly solved with a single diode, and some of ours have been working for years with no problems.

When designing from scratch, I presently prefer CMOS, but when modifying someone's design, any trick of the trade is valid in my view. Diodes often solve a problem simpler than any other approach. Diode ANDs are still another method where input switching matrices for memory use can be implemented such as in Don Lancaster's *TTL Cookbook* (Fig. 6-27, p. 256).

**Ralph W. Burhans**  
Athens OH

## Due Credit

Just received *Kilobaud* No. 16 yesterday; the article was in there. What a good feeling, until I spotted the title block. Oh my!

new 4K EPROM board from  
SWTP

Credit needs to be given where credit is due.

new 4K EPROM board from  
APTEC

The goof was not in the proof copy I received because no title block was included.

**Harley D. Johnson**  
Oregon City OR

## 8080 Simulator Notes

I want to commend your magazine and Lee Stork for a functional and useful program/article on the 8080 Simulator (*Kilobaud*, September 1977, p. 64). After debugging I was able to adapt this program to an Intellec 8/Mod 80, to which I have access. For the benefit of readers who have tried, or are going to try, this program, here are a few notes:

1. At address 134, the mnemonic LSI should be LXI.

2. At address 172, MVI B, 5 was necessary to send a line feed to my console output device (a CRT terminal).

3. Likewise, address 138 needed MVI B,2 to give me the proper display format.

4. At address 1FD, my ICROM FDOS II assembler creates a

```

OUTPT: IN 1 ;GET STATUS BYTE
      ANI 4 ;MASK BYTE
      JNZ OUTPT ;LOOP IF NOT READY
      MOV A,M ;READY FOR DATA
      ANI 7FH ;ZERO PARITY BIT
      CMA ;INVERT BYTE
      OUT 0 ;SEND IT TO PORT 0
      DCR B ;DCRM. LOOP CNTR
      RZ ;RETURN IF DONE
      INX H ;GET NEXT CHAR. IF
           ;NOT DONE

      JMP OUTPT
INP: IN 1 ;GET STATUS
     ANI 01 ;MASK
     JNZ INP
     IN 0
     CMA
     ANI 7FH
     RET

```

Table 1.

machine code of 41,00, rather than the necessary 41,20. This can be rectified if a space follows the A in the source of DW 'A'. It should read DW 'A '.

5. My assembler didn't like the instructions given it on addresses 210-212, it would rather have seen SPACE: DB 20H,20H,20H.

6. Similarly, address 213 assembles to 0A0D, rather than the necessary 0D0A. A source statement fix of DW 0A0DH will straighten that out.

7. As is necessary for most machines, I had to rewrite the I/O routines to conform with the Intel TTY interface card. For those of you who have an Intellec 8/Mod 80, the routines are shown in Table 1.

This program is an asset to any hobbyist or programmer who programs in 8080 assembly language.

**Rick Beutnagel  
Hilton NY**

#### Score 2— For Consumer Computer

In the March 1978 issue of *Kilobaud*, a short article entitled "Consumer Computer, Inc.," appeared. This work describes software, written in North Star BASIC, capable of generating replies to billing form letters produced by large computers employed by giant corporations. The article stated that this software is running on an Imsai 8080 and is being utilized to do battle with one of the largest credit-card companies in business.

Well, the results are in, and Consumer Computer, Inc., lost a few battles but won the war. The form letters generated by the microprocessor were completely ignored by American Express and its overgrown computer system.

This was anticipated, since anything short of enclosing your payment within a ton of cement is usually insufficient to allow any correspondence to escape from the batch-processing syndrome. Therefore, Consumer Computer, Inc., was overcome in its first skirmish. No billing problem was corrected and a fee for the services of Consumer Computer was certainly not collected from the firm issuing the improper billings.

Round two saw "yours truly" taking American Express to New York City's Small Claims Court. Running true to form, American Express failed to answer the summons to appear in court. This caused a judgment to be entered against American Express. The arbitrator, who calculated the amount of the judgment award, allowed an added \$70 for expenses (largely Consumer Computer, Inc). Thus, Consumer Computer, Inc., won an overwhelming victory by correcting my billing difficulties and collecting \$70 from "Goliath," rather than the \$25 fee it was originally hoping to charge American Express for its services.

Beware Master Charge, Visa, Carte Blanche, et al—Consumer Computer is ready to pounce wherever and whenever you make the slightest error by slipping a loose bit in your overgrown computer frame.

**Joseph Roehrig  
Middle Village NY**

#### "Tiger Trouble" Trouble

This letter refers to the article "Tiger Trouble" (p. 106) in the March 1978 issue. Although the calculator used was not identified, I have assumed that it is either an SR-52, TI-58 or TI-59.

The program as printed on p.

108 contains errors in syntax, especially on line 72, which calls for a function not directly executable on these machines within the number of steps allotted, and on line 63, where no error halt at a "flashing 9.999 999999 99" will occur, at least on the TI-58/59, unless an R/S is provided or flag 8 is set. Furthermore, even after all syntax is corrected for the TI-59, this program will not yield the expected result with a seed of 0.9 given on pp. 108-109.

I suggest that in future articles on TI calculator programs, you specify the calculator model for which the program is intended, and that you provide a copy of the PC-100A program-listing printout, so that no ambiguity in interpretation is possible.

**David P. Leising  
Grand Rapids MI**

*It is an SR-56 program, and I apologize for the omission.*  
—John.

#### Defective Formula

In the December 1977 *Kilobaud*, p. 24, one of your correspondents suggests the formula  $\text{arc sin } X = \text{ATN}(X/\text{SQR}(1-X^2))$ . This formula has the defect that when  $X = 1$  or  $-1$ , a division by zero is required. Also, when  $X$  is close to 1 or  $-1$ , accuracy is impaired through the loss of significant digits in forming  $1-X^2$ .

I suggest instead the formula  $\text{arc sin } X = 2 * \text{ATN}(X/(1 + \text{SQR}(1-X^2)))$ . This formula is theoretically exact and preserves the number of significant digits. Also,  $X^2$  usually executes faster and more accurately than  $X^2$ .

The formula  $\text{arc cos } X = -\text{arc sin } X + (0.5 * \pi)$  holds in all cases, giving the angle between 0 and  $\pi$  radians.

**Charles A. McCarthy  
St. Paul MN**

#### Meatless Article

The quality of articles in *Kilobaud* has always ranged from fantastic to restating the obvious, and I have no complaints about this. However, in the April issue, on pages 116, 117, I found the biggest waste of paper I have ever seen in your magazine. Jim Huffman's "Finally: 8080 Meets the Fairchild Video Game" was a farce. It was nothing more than two pages of: . . . 9023, a number not yet given in any data books . . . will release data in a

month or so . . . doing something . . . should be a piece of cake . . . you could add . . . and you would be able to have . . . the schematic . . . was not available . . . at some time in the future will be invaluable. Etc. I am keenly interested in this subject and just wanted to express my disappointment.

**H. J. Kuhman  
Pittsburgh PA**

*Once in a while I really blow it, and this was one of those occasions. It was simply my enthusiasm for the subject, and that of many readers, that made me decide to run the article. Thanks for the feedback; I'll try to be more careful.*—John.

#### A Stimulating Response

Thank you for sending our book, *Stimulating Simulations*, to a reviewer who took the time to read the text and actually put the program listings into the computer. Robert Soltysik's statements (*Kilobaud*, April 1978, p. 13), although not in complete agreement with mine, were obviously based on careful examination of the book. His objectivity was certainly a relief after I read a review of *The Devil's Dungeon* in the March issue of *Interface Age*. The *Interface Age* reviewer made statements that indicated he had not entered the program in the computer or even read the scenario carefully. Instead, he vented his hatred for computer games, The Wumpus in particular, on my poor little book, which many readers and publishers have found delightful. Thank you for employing intelligent and conscientious reviewers. The next time I want to communicate with the West Coast, it will be through your magazine.

There was one problem with the review, however. My address and the price of the book were omitted. *Stimulating Simulations* sells for \$5 and can be purchased from Engel Enterprises, PO Box 16612-K, Tampa FL 33687.

**Jane E. Engel  
Publisher**

#### 6800 Owners: Look Out!

I recently purchased *Practical Microcomputer Programming: The M6800* by W. J. Weller, Northern Technology Books, 1977, \$21.95. I am very disappointed with the book and hope you will not promote it. Here are

my complaints:

1. There are no equipment block diagrams, such as to describe programming models of the MPU, PIA or ACIA. This is a particular disadvantage when trying to describe the behavior of the peripheral chips.

2. There is no description of the hardware interrupt signals, even though there is a chapter on interrupts. Also, this chapter contains inaccurate or misleading statements.

3. The book departs from Motorola assembly language with several pseudo-ops, with some of the number base conventions and with indexed address notation.

4. The book uses no flowcharts to outline or generalize programs.

5. The chapter on floating-point arithmetic could have been written for any computer or microprocessor. It had no real how-to-do-it information and did not even mention any actual floating formats.

I feel that the book is not well organized, but this, I know, is a subjective matter.

Who am I? MSEE with ten years' experience on minis and interfacing. Owner of Altair 680 and MEK6800D2 kit. Instructor (moonlight job) on 6800 system at Midwest College of Engineering. 31 years as W9CUP.

I do like Barden's book (reviewed in January 1978 *Kilobaud*) and the *Scelbi 6800 Software Gourmet Guide and Cookbook*.

**Terry A. Jackson  
Lombard IL**

#### More Articles on the 1802?

This is a brief letter of concern directed to your magazine. So far, most of the articles published deal directly with the 6800 series computers or the 8000 series computers. I agree these are popular, however, you seem to overlook the RCA CDP 1802 MPU.

Certainly a large audience exists for this computer, outcropping from the COSMAC Elf series, Netronics Elf II, COSMAC Micro tutor, UC 1800 and the COSMAC VIP. An outlay of only \$100 is needed for a basic computer.

Please publish more articles for the CDP 1802 COSMAC series.

**Mike Otis  
Aberdeen SD**

*I've said it before, Mike, but you've given me the opportunity to say it again . . . and I thank you. I don't have a magic hat to*

*reach into and pull out articles on a particular computer. We publish articles that have been written. If you, or any other 1802 owner, would like to see more material on the 1802, then go directly to your typewriter . . . do not pass GO . . . but perhaps you will collect that \$200! You're right about the 1802 gaining in popularity and I'll be happy to see more written about it.—John.*

#### Computer-Portraits Franchise

I read with interest your letter and reply in the letters column of December 1977 on the subject of computer portraits. We are presently setting up a franchise organization that will allow just about anyone to go into computer portraits. The franchise fee will be, not \$7000 to \$10,000, but only \$5000 for everything, including the computer, line printer, TV camera, video monitor and software. We feel this system will have more capabilities than any other system available, and we are dedicated to continually upgrading all units in the field so it will remain so. Anyone desiring more information is invited to write me at Tri Mark Engineering, 12402 W. Kingsgate, Knoxville TN 37922.

**Marshall Dudley  
President**

*Sounds like a good topic for an article, Marshall.—John.*

#### Demystifying the April Tic-Tac-Toe Program

I'm sorry about the errors in the Tic-Tac-Toe article appearing in the April *Kilobaud*. Basically what happened is:

1. I wrote the article before I had a printer and attempted to type the listings from my video.

2. *Kilobaud* returned a draft of the article. This draft contained numerous errors in the listing (my fault) and pages of program listing were out of order (*Kilobaud* placed page 10 in front of 9).

3. The new proof was sent to me and we still had problems. John Craig and I decided to hold publication of the article until I obtained a computer-generated listing.

4. I sent computer listings writ-

ten in North Star BASIC, since I no longer had Altair equipment. This changed the article drastically.

5. We decided to go with corrected versions of the typed listing so as not to change the article.

6. In the confusion, the necessary corrections were not incorporated and one additional type-setting error was added.

I have no Altair BASIC, so I cannot supply a listing. The corrections are shown in Fig. 1.

Other answers to questions are shown in Fig. 2.

In addition to the corrections, I have attached a North Star listing of a similar game (see below).

Thanks for your understanding.

**Joseph J. Roehrig  
Middle Village NY**

```
30 FORA = 1T03:A1 = A*10:FORA2 = 1T010:FORA3 = 0T03
105 IFA>64OR1>ATHENPRINT'ILLEGAL MOVE':GOTO90
200 M3 = -9
280 IFS>A6THENM2 = M2 + A6:A6:GOTO300
320 IFM2>M3THENM3 = M2:M4 = A
392 A1 = INT((M4-1)/16) + 1:A2 = M4 - ((A1-1)*16)
1000 PRINT'POSITIONS ARE':FORA = 0T03:FORA1 = 1T013STEP4:A2 = 20 + (A1*4)
```

Fig. 1.

NEXTA1,A Altair BASIC lets you end multi for loops with NEXT by listing the variable of the loops to be ended

SS(A) Altair BASIC treats string variables similar to numeric values. Thus:

Altair SS(1) could mean 'UU' and SS(2) would be 'CC'

North Star SS(1,2) = 'UU' and SS(3,4) = 'CC'

Fig. 2.

```
10 DIMS(64),W(3,76),S$(64),V(76)
11 DIMC9(64,8)
20 FORA=1T010\FORA1=0T03\READW(A1,A)\NEXTA1\NEXTA
30 FORA=1T03\A1=A*10\FORA2=1T010\FORA3=0T03
40 W(A3,A1+A2)=W(A3,A2)+(16*A)\NEXTA3\NEXTA2\NEXTA
42 !*HOW SHALL I PLAY ? 1=BEST 2=GOOD*
44 INPUT* 3=FAIR 4=POOR ? *,Q9
46 IFQ9<1THENQ9=1\IFQ9>4THENQ9=4
50 FORA=41T056\FORA1=0T03
60 W(A1,A)=(A1*16)+A-40\NEXTA1\NEXTA
70 FORA=57T076\FORA1=0T03\READW(A1,A)\NEXTA1\NEXTA
72 DATA1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,1,5,9,13,2,6,10,14
74 DATA3,7,11,15,4,8,12,16,1,6,11,16,4,7,10,13,1,22,43,64
76 DATA5,22,39,56,9,26,43,60,13,26,39,52,2,22,42,62,14,26,38,50
78 DATA3,23,43,63,15,27,39,51,4,23,42,61,8,23,38,53,12,27,42,57,16,27,38,49
80 FORA=1T064\SS=S$* * \S(A)=0\NEXTA
83 DATA 1,21,41,61,1,18,35,52,4,19,34,49,4,24,44,64
84 DATA13,25,37,49,13,30,47,64,16,31,46,61,16,28,40,52
85 PRINT*YOUR MOVES ARE UU AND I'M CC*
86 FORA=1T076\FORA1=0T03\A2=W(A1,A)\A3=-1
87 A3=A3+1\IFC9(A2,A3)=0THENB9
88 GOTO87
89 C9(A2,A3)=A\NEXTA1\NEXTA
90 GOSUB1000\INPUT*YOUR BOARD, POSITION ? *,A1,A2
100 A=((A1-1)*16)+A2
105 IFA>64THEN118
107 IF1>ATHEN118
109 IFS(A)<>0THEN118\GOTO120
118 PRINT'ILLEGAL MOVE'\GOTO90
120 S(A)=1\S$(A,A)="U"
125 U2=A\U4=1\GOSUB1400
190 M5=0\FORA=1T076
196 IFV(A)=4THEN410
198 IFV(A)=15THENM5=A
199 NEXTA\IFM5<>0THEN365
200 M3=-9
204 Y1=0
205 FORA=1T064
```

(continued on page 110)

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# Taming the I/O Selectric (Part 1)

*It's time to get that I/O Selectric you've been using as a typewriter and interface it to your home computer.*



Photo 1. The IBM Model 731 Selectric as used in the 1014 Remote Inquiry Unit. The case has an extension on the bottom to house the solenoids, which permit remote operation of the typewriter.

IBM is no longer making the I/O Selectric and as more and more IBM systems are upgraded there will be an increasing number of these units coming onto the surplus market. I've seen several articles on interfacing the Selectric, but I believe this is one of the best. It's very likely the I/O Selectric will become more and more popular as a hard copy device for hobby systems due to its rugged construction (no comparison with an office Selectric) and the cost (\$700 to \$950). The Model 731, which Emerson's article is based on, is mechanically the same as the Model 735. — John.

Last spring I was just getting started in the home computer hobby. I had assembled my SWTPC M-6800 kit and was making my first attempt at programming when it became obvious that any serious work would require a hard copy output. As is the case with all computer hobbyists, I talked about it at

work, and a friend offered me a surplus IBM 1014 Remote Inquiry Terminal, which contained an IBM Selectric Model 731 typewriter. So, here was my hard copy output device; all that I had to do was interface it with my computer.

Well, it's all working now, and I am very happy with it.

It makes beautiful copy. Now I can type assembly listings, use my computer as a text editor and type out letters or articles like this one.

Last January I gave a talk about my Selectric Interface at a meeting of the Computer Hobbyist Group of North Texas, which was received with a lot of interest. Editor John Craig heard about it and suggested an article for *Kilobaud*. So, I am now sitting at my TVT typing words into RAM and printing them out on the Selectric.

The Selectric Interface is presented in two parts: Part one describes the hardware, and part two will cover the software.

## More Than a Printer

The 1014 Remote Inquiry Terminal is of early 1960 vintage. The Selectric is mounted on a heavy steel desk, which is full of power supply, relays and diodes. I didn't have room for the desk so I removed the Selectric and discarded the relay encoder and decoder circuitry. That meant that I had to provide everything between the 6800 output and the solenoids in the Selectric. I also decided to give my hard copy printer some extra smarts by arranging for computer control of typewriter on/off, single or double spacing, all capitals or upper and lower-

case letters, and automatic page formatting. This was to be done by means of non-printing control characters, as will be explained in part two.

## The Mechanical Marvel

The Selectric typewriter is a mechanical marvel or nightmare, depending on whether it is working right or you are trying to understand how it works and repair and adjust it. The basic typewriter is entirely mechanical except for the electric motor and switch. The characters are selected by tilting and rotating the ball (typing element) to get the proper character in position, and then striking the ribbon and paper with it. The sequence of events goes something like this: The motor drives a pulley through a toothed belt, which drives the operational shaft on the right side of the machine. A series of clutches and cams on this shaft performs the carrier return, line feed, tab, space, back space and shift functions (more about this later). The pulley also drives the cycle shaft on the left through a clutch on the pulley. The cycle shaft drives the filter shaft and print shaft through gears and does the print function.

When you press a key, an interposer is pushed down so that it trips the cycle clutch to start the print mechanism. It is also positioned so that a blade on the filter shaft strikes it and pushes it forward. The interposers, a different one for each key, have teeth that push against six selector bails. The selector bails in turn push latches from under a latch bail that is being pushed down by cams on the cycle shaft. If the latches are left hooked, the latch bail will operate a mechanical differential mechanism that moves pulleys to pull on the steel tapes. These tapes are wrapped around two drums which rotate and tilt the type element. If the six latches are hooked, they produce rota-

tion of one unit (R1), two units (R2) and two units (R2A) to the right, and tilt of one (T1) and two (T2) units. The five-unit rotation (R5) is an exception. Latching prevents five units of rotation to the left. Combinations of these latches can then print any of the 44 characters on half of the type element (four rows with 11 characters per row). The shift operation turns the ball 180 degrees so that the characters on the other half of the ball can be printed.

Though all this may sound like a Rube Goldberg machine, it is really a carefully designed device, with interlocks to prevent improper operation if the operator presses two keys at once, or if there are other timing problems. Long trouble-free service is obtained through wear-adjusting compensation. You have to take your hat off to the Selectric designers.

You don't have to understand all this to get the point — to control the Selectric by the computer, all you have to do is provide solenoids to control the latches. Similar solenoids can control the clutches for space, back space, carrier return, line feed, tab and shift. My Selectric had all of the solenoids except for the shift. If yours doesn't, and you have a little mechanical ability, you should be able to add solenoids made from old relays. Before you start, be sure to get a copy of the service manual for your typewriter. Manuals and repair parts can be obtained through your local IBM office or through an IBM Parts Distribution Center, which, in major centers like Dallas, provide 24-hour service at fair prices.

#### How Many Control Lines?

There are 13 Selectric functions, so it would seem

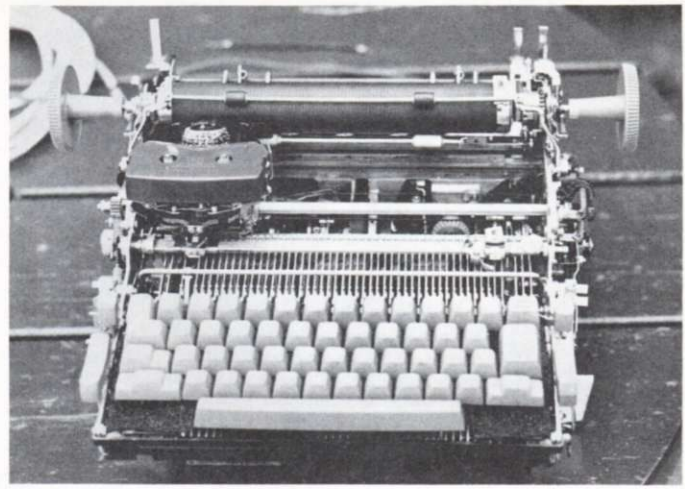


Photo 2. The type element is visible on the carrier. The carrier rides on the print shaft, which is driven by gears on the left side. The 11-inch platen has pins for paper drive.

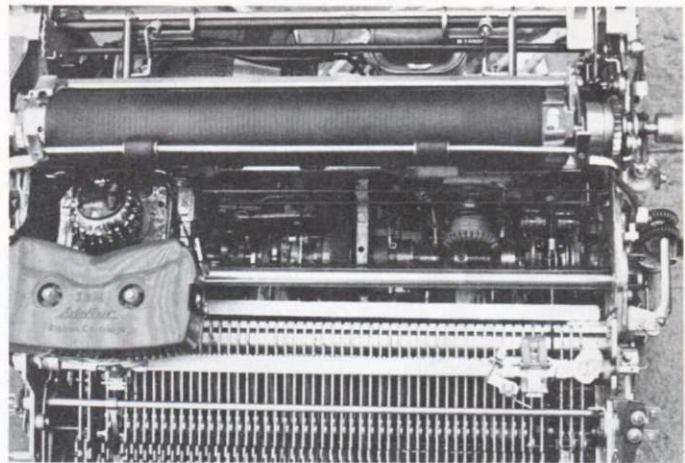


Photo 3. The belt drive is in the center of the photo. To the left of the drive pulley are the cycle clutch, five-unit cam, selector cam and reset cam on the cycle shaft. To the right is the operation shaft with the shock release clutch, carrier return clutch and pinion, tab governor and pinion, space and back space clutch and cam, and carrier return and index clutch and cam. The shift mechanism is on the right end of the operation shaft.

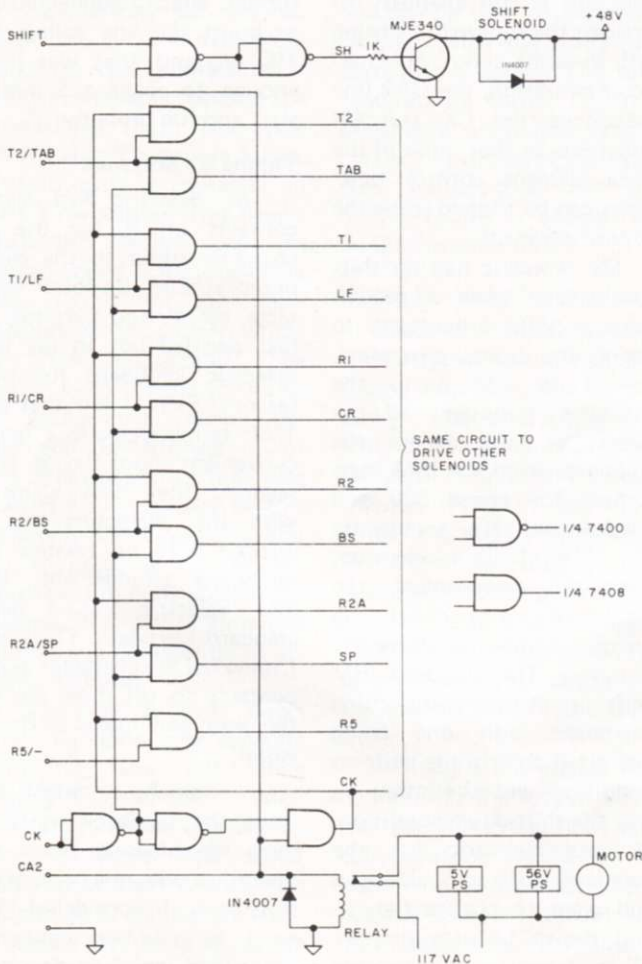


Fig. 1. Interface circuit diagram.

that 13 control circuits from the computer would be required to control the typewriter. However, when the typewriter is typing a character only the seven type element control functions, R1, R2, R2A, R5, T1, T2 and CK (trip the cycle clutch), and SH (shift) may be required at the same time. The next five functions, SP (space), BS (back space), CR (carrier return), IND (index = IBM for line feed) and TAB (tabulate), do not need any of the type element control functions. This allows a line-saving multiplexing scheme to be used. As shown in the

circuit diagram (Fig. 1), the CK line that is always on when a character is being typed is used to control the electronic equivalent of a six-pole double-throw switch. When CK is on, the type element control functions are connected to the computer. When CK is off, the non-printing functions are connected.

The shift function must not change during a character typing operation and is provided a control line of its own so that it may be controlled separately from the other functions.

With this interface cir-

cuitry, all of the functions of the typewriter can be controlled. For example, to do a line feed, binary 00100000 or hex 20 should be the output to the typewriter. To type a capital A requires shift up, tilt two units and rotate left two units. The typewriter then requires binary 10100111 or hex A7. If the typewriter was in a down-shift condition, a binary 10000000 or hex 80 would be required to shift up before sending the typewriter the A7 to type A. As soon as the typewriter has started the type operation, the output should be changed to 80 to hold the up-shift condition but allow resetting of the latches to prevent typing a string of AAAAAAAA. Now, if a hyphen is to be typed, shift down, tilt three and five right rotation are required. Before typing, 00 would be sent to the typewriter to

cause down shift. Then binary 00000001 or hex 01 would cause "-" to be typed. Following this pattern, you can make up a table of typewriter codes for all of the characters on the type element just by noting what shift, tilt and rotation is needed.

Turning on the typewriter and the power supplies is a little different because the switching circuit can't work with the power supply off. To get around this I used the CA2 handshake control line to directly operate a relay (Radio Shack #275-004). The power relay applies the 115 V ac to the typewriter motor, the 5 V and 56 V power supplies.

The solenoids in the typewriter require about 48 V dc at about 100 mA to operate reliably. This is too much for the usual TTL device, so a driver circuit is required. I

used surplus Motorola MJE340 Darlington transistors, one for each solenoid. All of the solenoids in the typewriter were disconnected from the original circuit, and reconnected with common leads to the +56 V supply. The transistor collector was connected to the other terminal of the appropriate solenoid, with a 1N4007 diode to protect the transistor from the solenoid fly-back voltage. (A similar fly-back protection diode is provided with the power relay.) The transistors are driven directly from the TTL ICs with a series 1k Ohm resistor to limit current. The power supply is 56 V to allow for voltage drop in the transistors and supply 48 V to the solenoids.

The solenoids in the typewriter operate trip-type mechanisms — that is, when a solenoid is energized it trips a latch, and then even if the solenoid is turned off, the function is still enabled. To prevent the typewriter's being left in some unknown character condition, the CA2 line interlocks the CK and SH functions so that none of the type element control functions can be tripped while the typewriter is off.

My Selectric had no shift mechanism when I got it. Since a shift is necessary to get all the desired characters, I had to add it to the machine. I bought all the necessary parts except the solenoids from the IBM Parts Center for about \$20 and used an old relay to operate the shift clutch mechanism. With this arrangement, the shift circuit must be energized whenever shift-up is required. The standard IBM shift circuit uses two latching solenoids with one being energized to trip the shift-up condition and the other to trip the shift-down condition. If your Selectric has the standard shift solenoids you will want to change the circuit shown by providing another transistor to operate the second shift solenoid and

two one-shots with about 20 milliseconds on time to drive the two shift solenoids. The shift line switching on should then trigger the up-shift one-shot and when the shift line switches off the down-shift one-shot should be triggered.

The 5 V power supply is a 1 Amp regulated supply I got in a kit. The 56 V supply was made from a surplus 40 V 1 Amp transformer, bridge 1 Amp rectifiers, a surplus 1000 uF 100 V filter capacitor, but no regulator.

The interface circuitry was built on Vector .1 inch perforated circuit board and with a Vector wiring pencil and solder-through wire. All of the circuitry and power supplies were mounted on a plastic cradle in the space under the typewriter mechanism, as shown in the photo. The third transformer was required because my typewriter motor turned out to be a 208 V motor. I found a 75 V 1 Amp surplus transformer, which I connected up to boost the line voltage to 190 V, and that was high enough to make the motor start and run properly.

#### Timing By Software

The Selectric had many contacts on it for use as character input to the computer and as feedback contacts for timing purposes. I had decided not to use the Selectric keyboard for two reasons. First, I felt that the TVT terminal made a more convenient input device, and second, the type element with the characters that I wanted bore no relation to keyboard arrangement. My 731 Selectric has a non-standard keyboard. Therefore I removed the character input contacts to get them out of the way and make servicing easier.

I originally thought of using the feedback contacts in a handshaking mode of operation with the computer. But then I considered the need to maintain contacts, the added interface circuitry required and the possibility

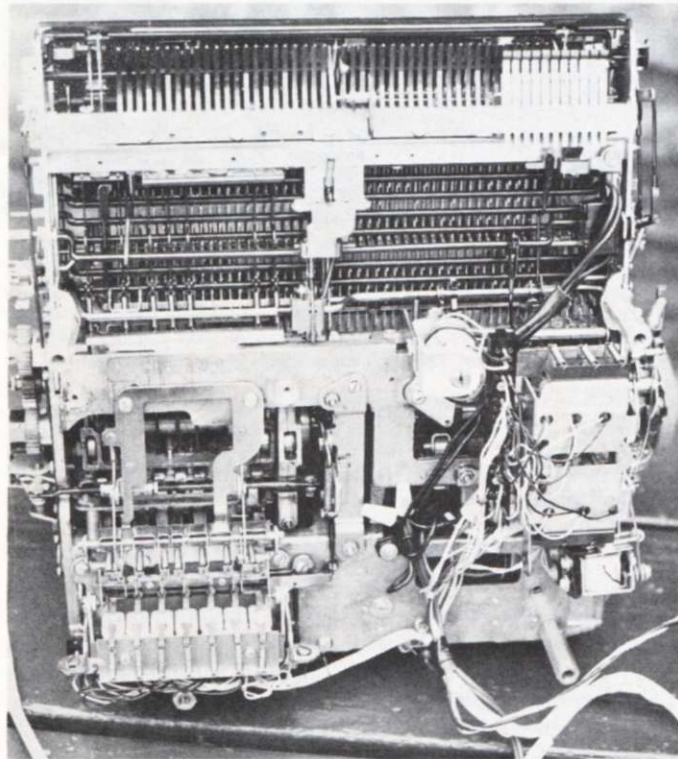


Photo 4. A view of the underside shows the seven selector solenoids at the left rear. These push the latches from under the latch bail for character selection. The vertical bars at the front under the keyboard are the interposers, and the horizontal bars are the selector bails mentioned in the text. On the right side are the five operation solenoids for space, carrier return, etc. Below these is the relay I added to trip the shift mechanism. The solenoid near the middle is a keyboard lock-out which I have not used. The typewriter mechanism sits in a plastic cradle, which serves as a mounting for the parts for the electrical interface.



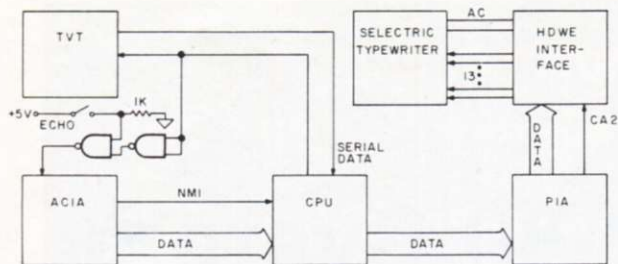


Fig. 2. System block diagram.

of the computer's hanging up waiting for a missing contact closure because of grease, dirt or other problems. Open loop software timing by the computer looked pretty good, and as it has turned out it was a trouble-free choice.

In order to do the software timing, you have to know accurately the time required for each function, or allow extra time for the uncertainty and thus slow down the output rate.

The basic timing comes from the rotation of the operational shaft, which turns at  $7\frac{1}{2}$  revolutions per second. When the cycle clutch is engaged to type a character it turns at the same speed as the operational shaft. The cycle shaft cams are double lobed, and so type a character in half a revolution. This means that the basic maximum typing speed is 15 characters per second (or 67 milliseconds per character), which is pretty respectable. The pull-in time for the solenoids is appreciable, about ten milliseconds. However, all of the typewriter functions are initiated by solenoids; so this common time doesn't have to be counted, as far as the software timing is concerned, because the pull-in time can overlap the completion of another function.

Shift up or shift down must be done as a separate function, and not while typing a character. A half revolution of the operational shaft is required for either shift up or shift down (1/15 second or 67 milliseconds).

Space and back space are also done in half a revolution of the operational shaft, but

with a difference. The cycle and shift clutches are wrap-up spring clutches, and take hold almost instantly. The space, back space, carrier return and line feed clutches are sprocket-and-dog clutches, the sprocket having nine teeth. This means that there is a  $1/9$  operational shaft revolution time uncertainty or 15 milliseconds in the time for these functions. For this reason, the space and back space functions are allowed 81 milliseconds.

Line feed requires a full turn of the operational shaft and gives a time of 148 milliseconds when the clutch uncertainty is added. The time required for carrier return is dependent upon how far the carrier has to travel. I allowed 525 milliseconds for the carrier return — enough for an 80-character line.

#### Where Do You Plug It In?

There are ten wires going to the typewriter — eight for typing functions, one for the power relay and a common ground. These connect to an MC6820 peripheral interface adapter (PIA) in the computer: the eight control lines to the data output PIA terminals and the power relay line to the CA2 terminal. Then the computer only has to put the proper outputs to the PIA to control the typewriter.

I thought the easiest way to interface the typewriter to the program requiring hard copy output would be to have the typewriter echo what is being written on the TVT screen, thus requiring minimum modification of existing programs. The sys-

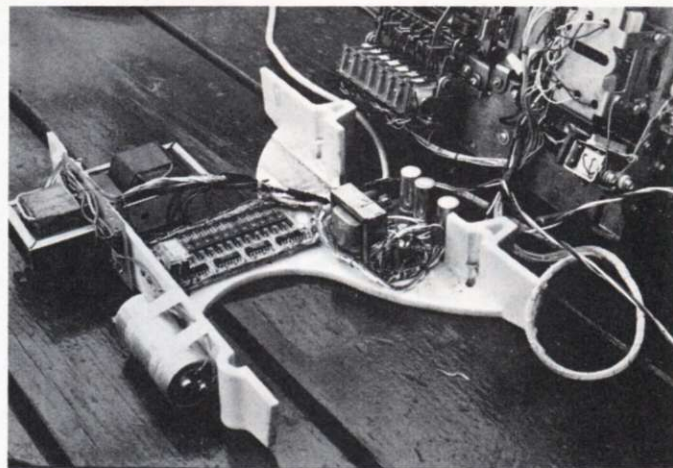


Photo 5. On the left is the 56 V power supply to operate the solenoids. The other large transformer is to adapt the 208 V motor to the 117 V power. The circuit board with the transistors, diodes, and the ICs that control the solenoids are mounted on the bottom of the cradle beneath the power relay. The 5 V power supply is at the rear.

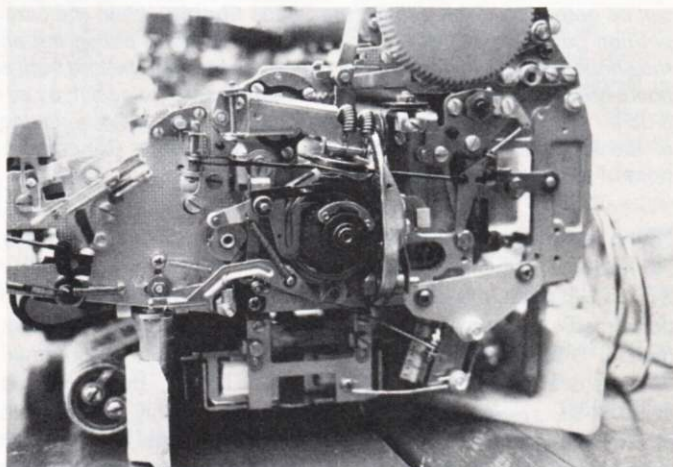


Photo 6. The shift clutch, cam, and solenoid had to be added to my machine. The shift cam pushes out the arm with the pulley on the upper end, which pulls the rotate tape to turn the type element 180 degrees.

tem block diagram (Fig. 2) shows how this was done.

Two NAND gates (7400) were connected in cascade, with the ECHO switch tied to one of the inputs of the second gate. The two inputs of the first gate connect to the serial data line from the computer to the TVT. When the ECHO switch is on, the output of the second gate echos the serial data going to the TVT. When that switch is off, the output is high or mark. The output is connected to the serial input terminal of an MC6850 asynchronous communications interface adapter (ACIA). With the echo switch on,

when a character has been sent to the TVT and the ACIA has received it, the ACIA interrupts the computer through the nonmaskable interrupt line (NMI). The computer takes the character from the ACIA receive buffer, converts it to the proper control byte for the typewriter and puts the byte out to the PIA. After the proper time delay for typewriter operation, the computer is returned to the main program.

The software that does all of this and controls the Selectric typewriter will be described in part two of this article. ■

# Home-Brew Z-80 System (Part 1)

---

*If you want to build your own system from scratch, just follow these instructions.*

---

*Due to the informal nature of Kilobaud, we don't normally provide an author's profile with each article... or even discuss an author's background. With Norm Thagard, I'm going to make an exception. Norm was one of 8079 applicants for America's next generation of astronauts... the NASA Mission Specialists who will be going into orbit aboard the Space Shuttle. When the competition got narrowed down to 208 aspirants Norm called me on the phone and told me he wanted to use the fact that he had built a home-brew computer system, and published an article on it, as additional leverage with NASA. Maybe it helped, because he was one of the 35 selected for the mission-specialist slots. Congratulations... and the very best to you, Norm.—John.*

The availability of several low-cost S-100-compatible Z-80 CPU boards, the high cost (for a medical student) of commercial S-100 systems and a burning desire to have a personal Z-80 system prompted me to design and construct a front panel that provides the logic to use the commercial CPU boards in an otherwise home-brew system. In my case, the S.D. Sales Z-80 CPU card was available locally and was the starting point for the design.

Lacking software experience with the Z-80, I needed a software-independent unit. Indeed, one of my major goals was to have a system with which I could develop software. The result was a manual front panel permitting direct access to memory for both read and write operations.

Armed with the Z-80 technical manual and the schematic of the S.D. Sales CPU card, I began the design. The outgrowth of the effort is depicted in this article.

## Design Considerations

There were several things I

especially wanted from my system: First, compatibility with the many commercial S-100 peripherals available. Since I was using the commercial CPU card, this aim was easily met—I only had to avoid compromising what was already there. Second, an expandable system—up to 64K of memory and I/O ports galore. Basically, this meant the use of Tri-state buffers in an expandable bus configuration.

Also, I wanted to use, wherever possible, standard TTL chips that I had pulled off old boards at an average cost of three or four cents. I wanted to avoid, at all costs, the use of special devices. However, in the interest of reducing bus loading and parts counts, I was willing to use some low-power Schottky packages.

I was also willing to sacrifice the dynamic refresh capability of the Z-80 to take advantage of a straightforward method of front-panel operation. This method is called direct memory access (DMA) and is readily implemented with the Z-80 MPU. Dynamic memory could still be

used but would require the use of an external refresh circuit.

My home-brew TVT is entirely stand-alone with off-line capability; so I did not care that DMA by other devices, such as DMA requiring TVTs, would not be possible during front-panel operation. This would not be a serious disadvantage considering the normal reason for using the front panel, that is, for small program development and/or bootstrapping tape programs into memory. With data latches and additional logic, it would be possible to restore full DMA operation. Single-step operation is a nice feature permitting you to go through a program op code by op code. This is very handy for debugging software and, fortunately, very easily implemented.

## Theory of Operation

DMA is possible with a Tri-state bus system and some means to suspend MPU operation. On the Z-80 chip is a pin labeled  $\overline{\text{BUSRQ}}$ . It might better be named  $\overline{\text{DMARQ}}$  because bringing this pin low forces the MPU to set its address, data and Tri-state output control signals to the third, or high-impedance state, thereby facilitating DMA operation. In our case, switch S3 (Fig. 1) is debounced and forces  $\overline{\text{PHOLD}}$  low, which is applied through a Tri-state buffer at the CPU card to pin 25 of the Z-80 MPU (Fig. 2). As soon as the current machine cycle is ended, the MPU grants the request and acknowledges the grant by

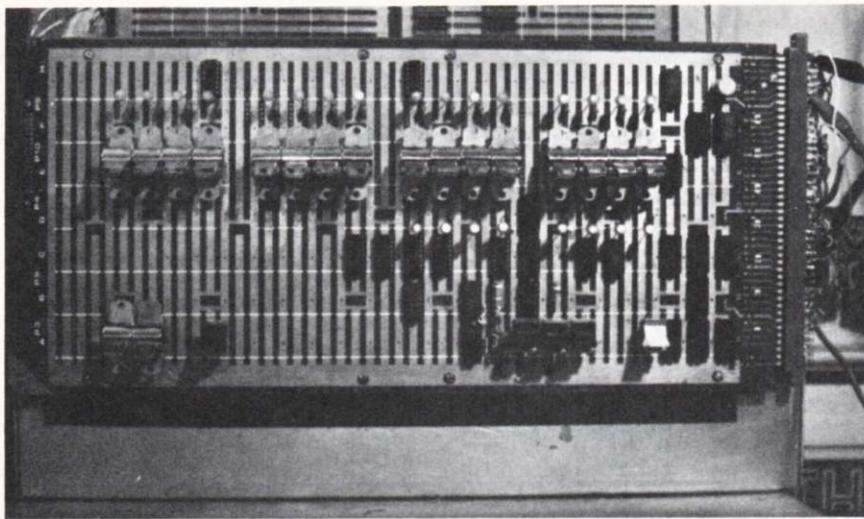
bringing  $\overline{\text{BUSAK}}$  low. On the CPU card, this signal is inverted to become the S-100 signal  $\overline{\text{PHLDA}}$  (DMAG or DMA grant).

If the front panel has requested the DMA, the address bus is controlled by 74193 counters through Tri-state buffers ICs 15 to 17. At the same time, control of the data-out bus is made possible should a front-panel write operation ensue. Finally, the CPU card Tri-state buffers are disabled by the active low signals  $\overline{\text{CC}}$ ,  $\overline{\text{DSBL}}$ ,  $\overline{\text{DO}}$ ,  $\overline{\text{DSBL}}$ ,  $\overline{\text{SDSBL}}$  and  $\overline{\text{ADDRDSB}}$ .

ICs 19 to 21 are depicted as 74LS368 Tri-state buffers, but could be 8T98 or 8098 types as direct replacements. However, the 8T98 will draw more current and the 8098 will represent a larger load to the bus. Alternatively, 7404, 7405 or 7406 types could be used with a different pin-out and higher bus loading. The 74LS04 cannot be used because it will sink only eight mA in output low state. A bit that is at logic one will cause the indicator LEDs to be forward biased and the 10 or 12 mA should give adequate light output.

To load the address, set the 16 sense switches, SS0 to SS15, to the desired location and toggle the LOAD ADDRESS switch S7. This brings the load pin on the four counters, IC11 to 14, low, which latches the address. Then this address appears at the Q outputs and at the address bus via the buffers.

To increment an address already loaded, toggle the EX-



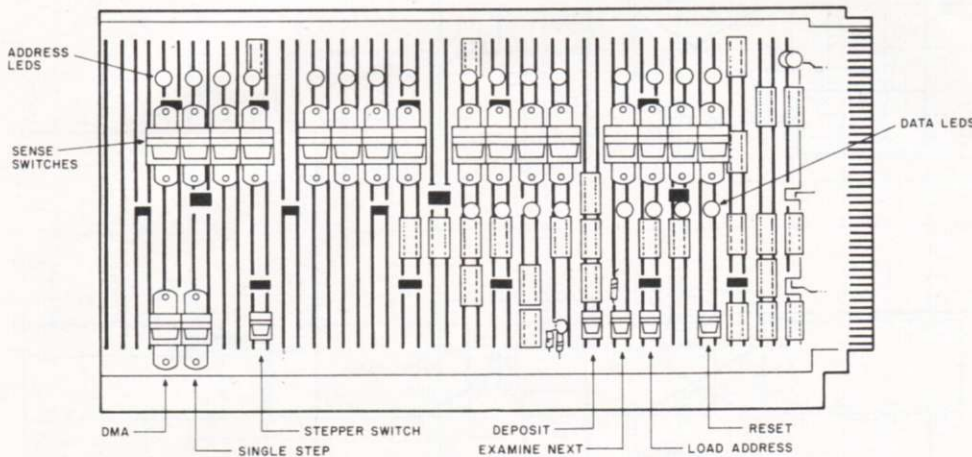
its socket. Bend pin 11 outward carefully and replace the IC (be careful that pin 11 remains outside the socket). If other Z-80 circuit boards output the machine cycle state  $\bar{M}1$  on bus line D05 (S-100 bus line 39) during PSYNC, it may be necessary to disable this feature in a similar manner. Otherwise, attempts to load memory from the front panel may result in errors in bit 5 as two Tri-state devices fight each other for control of that bit.

### Construction

Because of a fortuitous circumstance (low price and availability), my front panel was constructed on a large prototyping board with excellent ground and power buses. Either this sort of board or an S-100 prototyping board is recommended. If the S-100 board is used, you can simply take a standard aluminum chassis of appropriate size, mount the desired number of S-100 edge connectors on top of the chassis, hand-wire the connectors together and place the front-panel board in the forwardmost edge connector. (The pin connections on the diagrams reflect S-100 bus signals.)

A PC board is really not very practical. It would be tedious to design and would not be suited for the inevitable modifications that home-brew enthusiasts are prone to make. Wire-wrap and wiring pencil are the two techniques usually employed; I used the latter. Layout is by no means critical, and I actually used no bypass capacitors except for 50  $\mu\text{F}$  electrolytics at the points where  $V_{cc}$  entered the board. However, good practice (according to Don Lancaster's *TTL Cookbook*) calls for one 0.01 to 0.1  $\mu\text{F}$  ceramic capacitor per four gate packages or per two MSI packages. When using a wiring pencil, it is a good idea to check continuity of each interconnection with an ohmmeter.

You may generally follow the layout shown in the accompanying photograph or change it to suit your own inclinations.



Results of my efforts.

AMINE NEXT switch S5, which is debounced and applied through IC7a to pin 5 of IC11. Note that the increment does not occur until S5 is released. This is because the 74193 counts up on a zero-to-one transition, which does not occur until S5 is released.

Access to the data-out bus is through buffers IC17 and 18. These buffers are activated only during a write operation. After the desired address is loaded, the data is set by sense switches SS0 to SS7, which do double duty as data and low-order address byte switches. With the data set, the DEPOSIT switch S4 is activated. If DMA has been granted to the front panel, the debounced toggle passes through IC7b to IC9a, a one-shot. The one-shot places the data on the data-out bus by enabling IC17 and 18 and triggers the write pulse generator IC9b. At the end of the data-

enable pulse from IC9a, the address counters are incremented automatically to access the next sequential location.

The data-in bus is continuously monitored by the inverter/LED circuitry of IC6 and 22. Here, 7404 types are used because there is little need to reduce loading on a bus that usually communicates only with the CPU.

If a program has been loaded into memory, it will execute, starting at location 0000<sub>16</sub>, by returning the DMA switch to RUN and then depressing the RESET switch S6. If the CONTINUOUS/SINGLE STEP switch S1 is in CONTINUOUS mode, the execution will continue until a software HALT, 76<sub>16</sub>, is encountered or DMA is requested and granted. If SINGLE STEP mode is selected, each op code must be executed one at a time by toggling the STEPPER

switch S2. This switch is debounced and clocks in a logic one to the D flip-flop IC2a. This, in turn, allows  $\overline{\text{PRDY}}$  to go high via IC4c and 10.  $\overline{\text{PRDY}}$  communicates with  $\overline{\text{WAIT}}$  on the Z-80 MPU. As long as  $\overline{\text{WAIT}}$  is held low, the Z-80 will continue to "spin its wheels" by executing wait states.

Activating the STEPPER switch allows the Z-80 to resume normal operation until the next instruction-fetch cycle comes up. When this happens, the Z-80 signals the event by bringing its  $\bar{M}1$  pin low. This signal appears inverted as SM1 on the S-100 bus and will trigger the one-shot IC1. In turn, IC1 clears the flip-flop once again, bringing  $\overline{\text{PRDY}}$  low and throwing the Z-80 back into neutral until the next STEPPER switch toggle.

One change should be made on the S.D. Sales CPU card. IC20 should be removed from

A word of advice: the DEPOSIT, EXAMINE NEXT and STEPPER switches will be frequently used and should be conveniently placed. The sense switches can be grouped in fours as shown for hex notation or in

threes for octal. Although space requirements may tempt you to place the sense switches as close together as possible without grouping them, don't do it! With such an arrangement your error rate will

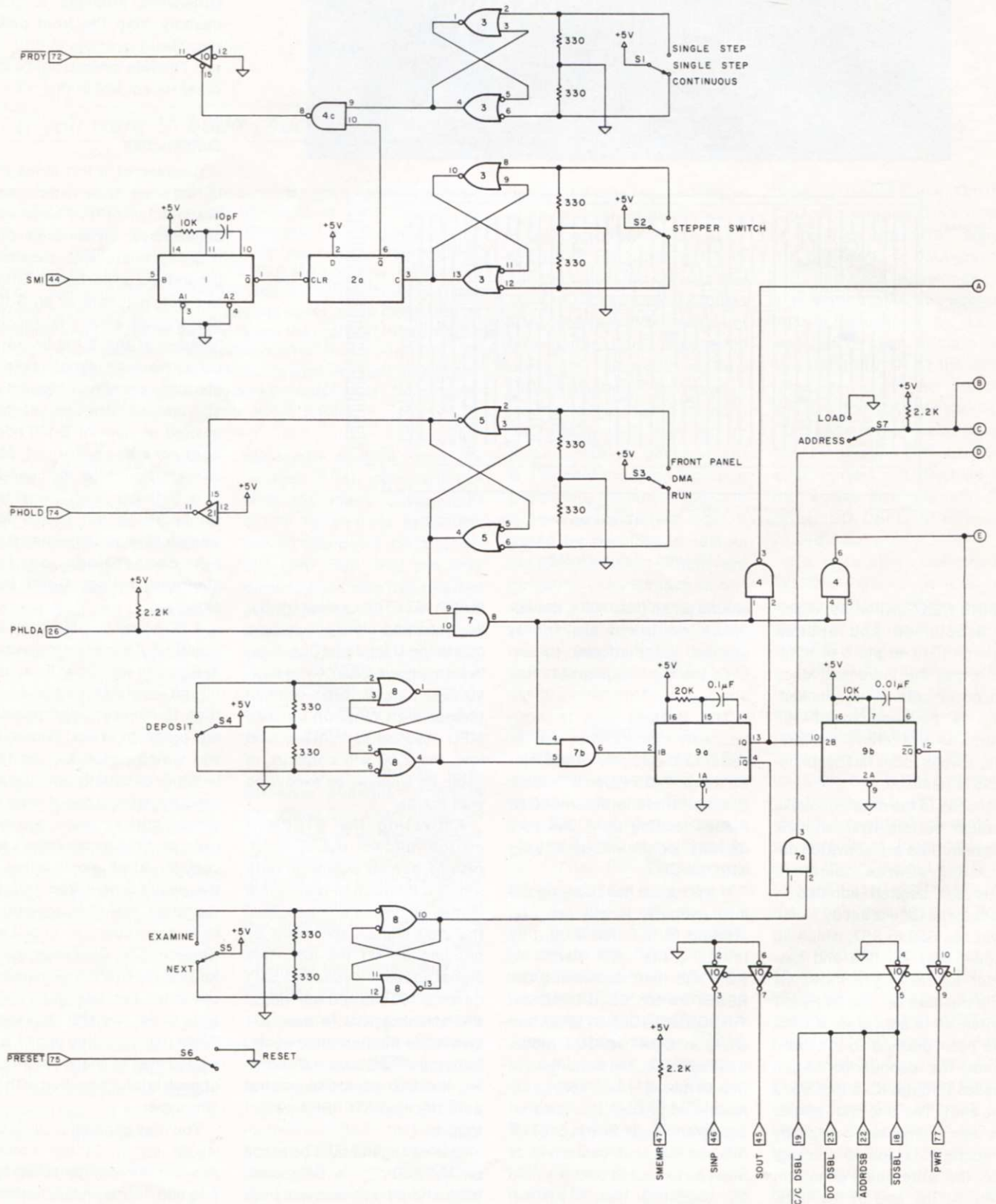
be phenomenal.

### Checkout

Prior to applying power, use your ohmmeter to ensure that no Vcc-to-ground short exists. The supply connections to the

ICs in this project are all "at the corners," as is standard with TTL, so make sure they are connected to the appropriate bus.

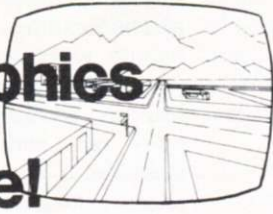
With no other device in the panel, power up the front panel. It should draw about 1







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# A Strategy for Healthy Living

*This computerized exercise/fitness program provides a systematic approach to getting—then staying—in shape.*

*Al's exerciser program has laid the groundwork for some really exciting possibilities. The next step is to have an analog-to-digital pulse counter so the computer can monitor the pulse continuously. And, along with that, speech output so the computer can tell you (as you exercise) if the pulse rate is high or low! — John.*

*Al Gerbens  
1038 E. 6th Pl.  
Mesa AZ 85203*

**R**ecently, in the process of surviving that ordeal known as a physical examination, I was introduced to a

book entitled *Total Fitness in 30 Minutes A Week* by Morehouse and Gross (Simon and Schuster, NY, 1975). I later purchased a copy, read it and began following much of the advice and direction it contains. Very briefly, building and/or maintaining

physical fitness is accomplished using three ten-minute exercise sessions per week. During each of these sessions you monitor your pulse rate and attempt to maintain it near a predetermined value. Each session requires more work to produce the same pulse rate as your condition improves.

Timing the segments in each ten-minute session and timing six seconds to obtain a pulse count turned out to be a pain in the neck. For example if you begin at 06:59:22 and time one minute, then you should stop at 07:00:22 and then begin timing the next two minute segment. It's now 07:02:22 and time to check pulse rate for six seconds while counting the beats. Then multiply the pulse count by ten in order to get the rate, and begin another two-minute countdown at 07:02:37. Let's see ... adding two minutes gives 07:04:37. ... It's really not all that complicated until you try it while concentrating on the exercises. I thought that programming our microcomputer to assist in timing and pulse rate determination would be an interesting application. Here is the result.

## Exercise Program Functions

The program listed provides the functions of:

1. Reviewing the major concept of utilizing pulse rate as an effectiveness indicator.
2. Displaying the exercise sequence.
3. Calculating and displaying your training pulse rate based on your age.
4. Displaying that segment of exercise sequence to be accomplished next.
5. Timing each segment while displaying segment elapsed time on a video display in five-second increments.
6. Indicating when pulse rate determinations should be made.
7. Accepting 15 pulses that correspond to heartbeats, and

```
10 INPUT"HOW MANY DATA POINTS DO YOU HAVE?",W
20 FOR Z=1 TO W
30 # "ENTER THE NUMBER OF BEATS FOR POINT":Z
40 INPUT X(Z)
50 # "ENTER THE VALUE OF T FOR POINT":Z
60 INPUT Y(Z)
70 NEXT Z
80 # "DATA ENTRY COMPLETE"
90 FOR Z=1 TO W
100 H1=LOG(X(Z))*LOG(Y(Z))
110 H=H+H1
120 J1=LOG(X(Z))
130 J3=J3+J1
140 J2=LOG(Y(Z))
150 J4=J4+J2
160 K1=LOG(X(Z))*LOG(X(Z))
170 K=K+K1
180 L1=LOG(X(Z))
190 L2=L2+L1
200 M1=LOG(Y(Z))
210 M=M+M1
220 Q1=LOG(Y(Z))*LOG(Y(Z))
230 Q=Q+Q1
240 NEXT Z
250 J=(J3*J4)/W
260 L=(L2*L2)/W
270 B=(H-J)/(K-L)
280 A=EXP((M/W)-((B)*(L2)/W))
290 R2=((H-J)*(H-J))/((K-L)*(Q-(M*M/W)))
300 # "B=":B
310 # "A=":A
320 # "CORRELATION FACTOR = ":R2
330 # "USE THE FOLLOWING EQUATION FOR LINE 308 IN THE EXERCISER PROGRAM."
340 # "B1=INT(EXP(LOG('A:/'T))/((-1)*('B:')))"
350 END
```

*Calibration routine.*



acting as a frequency counter calculating and displaying your pulse rate.

8. Interpreting that pulse rate and recommending an in-

crease or decrease in the rate of activity, including taking a break. Timing of any recommended breaks is automatically accomplished and

displayed.

### Frequency/Pulse Rate Counter.

The pulse rate subroutine

begins in line 290. When called up the subroutine watches input port one for any change from 255, which it sees if all eight lines are left

RUN

#### EXERCISER

THIS PROGRAM PROVIDES THREE FUNCTIONS RELATED TO THE FIRST LEVEL EXERCISES DESCRIBED IN -TOTAL FITNESS IN 30 MINUTES A WEEK-BY L.E. MOREHOUSE.

THE THREE FUNCTIONS ARE SEQUENCE, TIMING AND PULSE RATE DETERMINATION.

TO CHECK PULSE RATE, FIRST LOCATE YOUR PULSE BY PRESSING AN INDEX FINGER AGAINST ONE TEMPORAL ARTERY AT THE SIDE OF YOUR FOREHEAD.(TEMPLE). USING THE OTHER HAND SHARPLY PUSH THE BUTTON IMMEDIATELY FOLLOWING EACH HEART BEAT. IF CORRECTLY ENTERED A SINGLE NUMBER WILL APPEAR ON THE SCREEN.

AVOID HOLDING THE BUTTON DOWN TOO LONG. MULTIPLE ENTRIES CAN RESULT.

15 BEATS WILL BE ENTERED AND THEN YOUR PULSE RATE WILL BE AUTOMATICALLY DISPLAYED.

THE EXERCISE SEQUENCE IS

- 1) LIMBERING UP(1 MIN)
- 2) MUSCLE BUILDUP(4 MIN)
- 3) CIRCULO-RESPIRATORY CONDITIONING (5MINS)

THE REFERENCED TEXT SHOULD BE READ BEFORE PROCEEDING FURTHER.

WHAT IS YOUR AGE? 34  
YOUR BEGINNING TRAINING PULSE RATE IS 111 BEATS PER MINUTE.

BEGIN WITH ONE MINUTE OF LIMBERING EXERCISES, SUCH AS

- 1) STRETCHING
  - 2) TWISTING
  - 3) BENDING
- EASY DOES IT. LIMBER UP SLOWLY.

START  
5 SECONDS  
10 SECONDS

[ETC.]

60 SECONDS  
ONE MINUTE

NEXT UP, 4 MINUTES OF MUSCLE EXERCISES TO ADD MUSCLE TISSUE. DO 15 PUSH AWAYS AND THEN 15 SITBACKS IN APPROXIMATELY THE NEXT TWO MINUTES. THEN CHECK YOUR PULSE RATE.

[COUNTDOWN TWO MINUTES FIVE SECONDS AT A TIME]

NOW LETS CHECK YOUR PULSE RATE. PRESS THE BUTON AFTER EACH BEAT. KEEP MOVING!  
PROCEED WHEN YOU ARE READY

1  
2  
3

[ETC.]

15  
THANK YOU  
RATE = 120 BEATS/MINUTE  
GOOD, WITH A PULSE RATE OF 120

YOU CAN NOW REPEAT THE PUSH-AWAY AND SITBACK EXERCISES. 15 TIMES EACH; TAKE ABOUT 2 MIN.

[COUNTDOWN TWO MINUTES FIVE SECONDS AT A TIME]

NOW LETS CHECK THAT PULSE RATE.

PRESS THE BUTTON AFTER EACH BEAT. KEEP MOVING!  
PROCEED WHEN YOU ARE READY.

1  
2

[ETC.]

15  
THANK YOU  
RATE = 123 BEATS/MINUTE

SELECT ANY EXERCISE SUCH AS RUNNING IN PLACE. THE OBJECTIVE IS TO GET YOUR PULSE RATE UP TO 111 BEATS/MINUTE AND KEEP IT THERE FOR ABOUT FIVE MINUTES. BEGIN EXERCISING AND CHECK YOUR PULSE RATE IN ONE MINUTE  
START

[COUNTDOWN ONE MINUTE FIVE SECONDS AT A TIME]

PULSE RATE CHECK AGAIN  
PRESS THE BUTTON AFTER EACH BEAT. KEEP MOVING!  
PROCEED WHEN YOU ARE READY

1

2

[ETC.]

15  
THANK YOU  
RATE = 153 BEATS/MINUTE  
AT 153 BEATS/MIN. YOU SHOULD SLOW DOWN. CUT YOUR EXERCISE RATE TO ABOUT ONE HALF OF WHAT IT HAS BEEN FOR THE LAST ONE MINUTE. NOW CONTINUE EXERCISING FOR THE NEXT TWO MINUTES.

[COUNTDOWN TWO MINUTES FIVE SECONDS AT A TIME]

TIME FOR ANOTHER PULSE RATE CHECK.  
PRESS THE BUTTON AFTER EACH BEAT. KEEP MOVING!  
PROCEED WHEN YOU ARE READY

1

2

[ETC.]

15  
THANK YOU  
RATE = 130  
LETS CONTINUE. TWO MINUTES REMAIN IN THIS SESSION.

[COUNTDOWN TWO MINUTES FIVE SECONDS AT A TIME]

THIS SEQUENCE SHOULD BE REPEATED THREE TIMES PER WEEK. SEE YOU IN TWO OR THREE DAYS.  
READY

*Sample run.*

*Program listing (continued on following pages).*

```
10 GOSUB318
12 # " EXERCISER "
14 # "
16 # "THIS PROGRAM PROVIDES THREE"
18 # "FUNCTIONS RELATED TO THE FIRST"
20 # "LEVEL EXERCISES DESCRIBED IN"
22 # "-TOTAL FITNESS IN 30 MINUTES"
24 # "A WEEK- BY L.E. MOREHOUSE."
26 GOSUB314:GOSUB318
28 # "THE THREE FUNCTIONS ARE"
32 # "SEQUENCE, TIMING AND PULSE RATE"
34 # "DETERMINATION."
36 GOSUB314:GOSUB318
38 # "TO CHECK PULSE RATE, FIRST"
40 # "LOCATE YOUR PULSE BY PRESSING"
42 # "AN INDEX FINGER AGAINST ONE"
44 # "TEMPORAL ARTERY AT THE SIDE OF"
46 # "YOUR FOREHEAD. (TEMPLE)":GOSUB314
48 # "USING THE OTHER HAND, SHARPLY"
50 # "PUSH THE BUTTON IMMEDIATELY"
52 # "FOLLOWING EACH HEART BEAT."
54 GOSUB314
```

```

56 # "IF CORRECTLY ENTERED A SINGLE"
58 # "NUMBER WILL APPEAR ON THE"
60 # "SCREEN.":GOSUB314
62 # "AVOID HOLDING THE BUTTON DOWN"
64 # "TOO LONG. MULTIPLE ENTRIES WILL"
66 # "RESULT.":GOSUB314
68 # "15 BEATS WILL BE ENTERED AND"
70 # "THEN YOUR PULSE RATE WILL BE"
72 # "AUTOMATICALLY DISPLAYED."
74 GOSUB314:GOSUB318
76 # "THE EXERCISE SEQUENCE IS:"
78 # " 1) LIMBERING UP (1 MIN)"
80 # " 2) MUSCLE BUILDUP (4 MINS)"
82 # " 3) CIRCULO-RESPIRATORY"
84 # " CONDITIONING (5 MINS)"
86 GOSUB314:GOSUB318
88 # "THE REFERENCED TEXT SHOULD BE"
90 # "READ BEFORE PROCEEDING FURTHER."
92 GOSUB314:GOSUB318
94 INPUT "WHAT IS YOUR AGE? ":A
96 A1=INT(.6*(220-A))
98 # "YOUR BEGINNING TRAINING PULSE"
100 # "RATE IS ":A1;" BEATS PER MINUTE."
102 GOSUB314:GOSUB318
104 # "BEGIN WITH ONE MINUTE OF LIMB-"
106 # "ERING EXERCISES; SUCH AS:
108 # " 1-STRETCHING"
110 # " 2-TWISTING"
112 # " 3-BENDING"
114 # "EASY DOES IT. LIMBER UP SLOWLY."
116 GOSUB314:GOSUB318
118 #TAB(12);"START"
120 FORX=1TO8:#"";NEXT
122 M=60:GOSUB264
124 #TAB(10);"ONE MINUTE"
126 GOSUB318
128 # "NEXT UP IS 4 MINUTES OF MUSCLE"
130 # "EXERCISES TO ADD MUSCLE TISSUE."
132 GOSUB314
134 # "DO 15 PUSHAWAYS AND THEN 15"
136 # "SITBACKS IN APPROXIMATELY THE"
138 # "NEXT TWO MINUTES. THEN CHECK"
140 # "YOUR PULSE RATE."
142 GOSUB314:GOSUB318
144 #TAB(10);"START"
146 M=120:GOSUB264
148 # "NOW LETS CHECK YOUR PULSE RATE"
150 GOSUB282
152 IF B1 > A1+20 THEN # "TAKE A MINUTE BREAKBEFORE CONTINUING."
154 IF B1 > A1+20 THEN 156 ELSE 164
156 # "KEEP MOVING AROUND DURING THE"
158 # "NEXT MINUTE TO IMPROVE BLOOD"
160 # "CIRCULATION":M=60:GOSUB264
162 GOTO 168
164 # "GOOD, WITH A PULSE RATE OF"
166 # B1
168 # "YOU CAN NOW REPEAT THE PUSH-"
170 # "AWAY AND SITBACK EXERCISES. 15"
172 # "TIMES EACH; TAKE ABOUT 2 MIN."
174 GOSUB314
176 #TAB(10);"START":M=120:GOSUB264
178 # "NOW LETS CHECK THAT PULSE RATE."
180 GOSUB282
182 IF B1 < A1+20 THEN 192
184 # "YOUR PULSE RATE IS A LITTLE"
186 # "HIGH. TAKE A 30 SECOND BREAK"
188 # "BEFORE CONTINUING"
190 GOSUB314:M=30:GOSUB264
192 # "SELECT ANY EXERCISE SUCH AS"
194 # "RUNNING IN PLACE. THE OBJECTIVE"
196 # "IS TO GET YOUR PULSE RATE UP TO"
198 # "A1:" BEATS/MINUTE AND KEEP IT"
200 # "THERE FOR ABOUT FIVE MINUTES."
202 GOSUB318
204 # "BEGIN EXERCISING AND CHECK"
206 # "YOUR PULSE RATE IN ONE MINUTE":GOSUB318
208 # "
START":M=60:GOSUB264
210 # "PULSE RATE CHECK AGAIN.":GOSUB282
212 IF B1 < A1+20 THEN 224
214 # "AT":B1;" BEATS/MIN. YOU SHOULD SLOW DOWN."
216 # "CUT YOUR EXERCISE RATE TO ABOUT"
218 # "ONE HALF OF WHAT IT HAS BEEN"
220 # "FOR THE LAST ONE MINUTE."
222 GOSUB314
224 IF B1 < A1-10 THEN # "PICK UP EXERCISE RATE IN ORDER TO BRING PULSE RATE UP TO ":A1;" BEATS/MIN."
226 GOSUB314
228 # "NOW CONTINUE EXERCISING FOR"
230 # "THE NEXT TWO MINUTES."
232 GOSUB314
234 M=120:GOSUB264

```

alone. Grounding one of these lines produces an input different from 255, and the program drops into another loop. You can momentarily ground one of the port one input lines by using a push button attached to a ten-foot cord, which allows you to move around during the pulse rate determination. It is important not to stand perfectly still during this process. According to the book, passing out cold is a possible consequence of remaining still immediately following exercise, and my computer's bag of tricks does not yet include administration of smelling salts or respiration-assistance capability. Enter each heart-beat as you feel it with one hand by momentarily pushing the button with the other hand. To feel your pulse, lightly press an index finger against one of your temporal arteries (located in the temple area of your head). *Never press both arteries simultaneously.*

To help prevent multiple entries caused by holding the button down for too long, each beat is displayed on the video screen as it is recorded. Try it a few times; it won't take long to get the hang of it. If you have trouble, two solutions are potentially helpful. 1. Increase the timing of the counting loop by changing the software. 2. Add some hardware in the form of a nonretriggerable one-shot between the push button and the input port.

### Counter Calibration

Each time through the counting loop, the variable T is incremented. Calibration was not as easy as I expected, however, because the relationship between pulse rate and T turned out to be non-linear. After collecting a few data points and cranking them through linear and exponential curve fit routines, I obtained a 99.8 percent fit using the power curve  $Y=AX^B$  line fit routine on an HP-65 programmable calculator. Realizing a lot of people don't have access to this resource, I've written a routine in BASIC that you can enter into your micro-computer for calibration of the counting loop on your system. Here's how to use it:

1. Enter the exerciser program, or just the counting loop if you prefer.
2. Collect three or more data points by entering known rates, which can be generated by carefully watching the sweep second hand of a clock. One pulse each second is 60 beats per minute, two pulses each second is 120 beats per minute and one pulse each two seconds is 30

beats per minute. Collect the value of T each time after the routine has counted 15 beats. Repeat each input rate about ten times and use the best eight determinations, throwing out the highest and lowest T value determination per rate.

3. Now enter the calibrating program listed with this article. It will ask you how many data points you have and then will ask you to input the values you have collected. The program then performs a line fit routine, matching the points to the general formula  $Y=AX^B$ , and generates a formula for a line on which the points fall. It then converts this formula into the format required in line 308 of the exerciser program. Watch R2; it is a goodness of fit value, and if it's not between .94 and 1.0, something is amiss.

4. Enter the output as line 308 in the exerciser program, and you're calibrated. Each time you enter a T value, a

B1 or heartbeat rate value will be calculated using that formula.

An alternative is to collect enough data points to build a lookup table into the program or alter the counter loop to produce a linear correlation.

The program occupies about 4.5K of RAM and is written in D.G. Maxi-BASIC Version 1.0. It is running on a Digital Group Z-80 system with a 2.5 MHz clock and 18K of RAM.

This is a unique application of a microcomputer in the home. Automatically inputting the heartbeat data using sensors such as strain gauges or force transducers is the next step. That's a hardware problem of no small magnitude at the home brew level, and would make an interesting project and article.

I strongly recommend you read and/or check with a physician before beginning any exercise program. ■

```

236 # "TIME FOR ANOTHER PULSE RATE CHECK."
238 GOSUB282
240 IF B1 > A1+20 THEN242ELSE246
242 # "BETTER SLOW IT DOWN, YOUR"
244 # "PULSE RATE IS TOO HIGH!":GOSUB314
246 IF B1 < A1-10 THEN248 ELSE250
248 # "PICK UP YOUR EXERCISE RATE!":FORX=1TO1E3:NEXT
250 # "LETS CONTINUE. TWO MINUTES"
252 # "REMAIN IN THIS SESSION."
254 M=120:GOSUB264
256 # "THIS SEQUENCE SHOULD BE"
258 # "REPEATED THREE TIMES PER WEEK."
260 # "SEE YOU IN TWO OR THREE DAYS."
262 END
264 E=O
266 FORW=1TO50
268 E=E+5
270 FORX=1TO2800:NEXT
272 #TAB(10);E;" SECONDS"
274 FORX=1TO9: #"" :NEXT
276 IFE=M THEN EXIT280
278 NEXT W
280 RETURN
282 # "PRESS THE BUTTON AFTER EACH"
284 # "BEAT. KEEP MOVING!"
286 # "PROCEED WHEN YOU ARE READY"
288 T=O: B=O
290 X=INP(1)
292 IFX=255 THEN290
294 Y=INP(1)
296 T=T+1
298 IF Y <> 255 THEN B=B+1
300 IF Y <> 255 THEN #B
302 IF B=15 THEN306
304 GOTO294
306 # "THANK YOU"
308 B1=INT(EXP((LOG(85440.83/T))/1.2237))
310 # "RATE=";B1;"BEATS/MINUTE"
312 RETURN
314 FORX=1TO 4E3:NEXT
316 RETURN
318 FORX=1TO16: #"" :NEXT
320 RETURN

```

# THE MICRO WORKS

Give your 6800 computer the gift of sight! The Micro Works Digisector\* opens up a whole new world for your computer. Your micro can now be a part of the action, taking pictures like this one to amuse your friends, watching your home while you're away, helping your household robot avoid bumping into walls, providing fast to slow scan conversion for you hams... the applications abound.

The Micro Works Digisector is a completely unique device; its resolution and speed are unmatched in industry and the price is unbeatable anywhere. The Digisector and a cheap TV camera are all you'll need to see eye to eye with your 6800. Since operation is straightforward, you don't have to be a software wizard to utilize the Digisector's extensive capabilities. The Micro Works Digisector board provides the following exclusive features:

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- Economy—The Digisector is a professional tool priced for the hobbyist

The Digisector (DS-68), like all Micro Works products, comes fully assembled, tested and burned in. Only the highest quality components are used, and the boards are double sided with plated through holes, solder mask and silkscreen. All software is fully source listed and commented. The Micro Works is proud to add the DS-68 to its line of quality computer accessories for the hobbyist. Price 169.95

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regulated + 12 volts	104.95

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M31

# A Tour of the Faire (Part 1)

*Kilobaud's editor, John Craig, takes a look at some of the people and products that made up the San Jose show.*

The Second West Coast Computer Faire. What a show! I always enjoy getting out for a good convention, and this one was no exception. It occurred to me that you folks who couldn't make it would also like a peek at what the show had to offer. Therefore, I took my camera along . . . and shot pictures like crazy! I sincerely hope you find it as interesting and entertaining as I did. As a matter of fact, I'd appreciate any feedback on how you feel about the effort . . . I was a little concerned with the length.

If you're looking for software for home or small business, you'll find it here. If you're looking for the latest in mass storage, you'll find that also. Terminals? You bet. New, low-cost systems—one or two. Boards and components . . . all over the place! Finally—some of those miscellaneous pieces of hardware you've been hoping someone would develop for your system. What the heck—mention that you saw it in *Kilobaud* when you drop a line to these companies, OK?

Not all is well in "photography land," I'm afraid. I shot seven rolls of film at the Faire. You're going to be seeing the results of six rolls . . . and I'm going to be looking for a new film processor! There are quite a few companies, large and small, who didn't make it into this write-up because of that goof—and I'm truly sorry.

Come along with me and I'll give you a grand tour of the Second West Coast Computer Faire . . . and, above all, *enjoy yourself!* ■



OK, TRS-80 owners, here it is: the first computer cassette "magazine." CLOAD Magazine arrives by first-class mail each month on a C-30 cassette . . . for \$24 a year. Should be interesting! PO Box 1267, Goleta CA 93017.



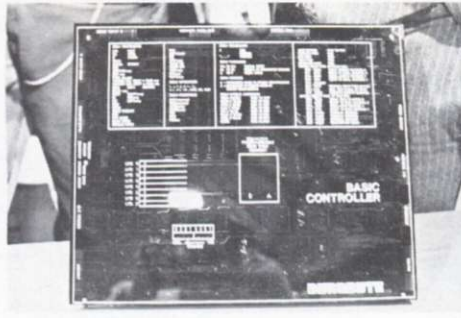
Bob Lentz, the president of Micro Works, is as pleased with the computer portrait system his company has developed as the gentleman on the left who just had his picture taken. (PO Box 1110, Del Mar CA 92014.)



Kinda show-offish, don't you think? Although it sure did the trick when it came to attracting crowds!



I keep hearing more and more good things about the service and products from S.D. Sales . . . and they sure were doing a brisk business at the Faire. Bet they'll send you their catalog if you write for it . . . or, better yet, just check their ads in *Kilobaud*.



Is it Dynabyte . . . or dynamite? Let me tell you, these folks have some exciting things going! On the left we have Mike Watts, president of Dynabyte, standing in front of their Z-80 based dual minifloppy system . . . and their new double-sided, double-density Shugart floppy system. They have a rather unique dedicated-controller board (shown in the middle photo), which uses BASIC, which is why it's called a BASIC Controller. They were using the controller to run the two robots shown in the right photo, and they sure were a hit. (I think it was the robots that attracted the crowds . . . but it could have just as easily been Pam Farnsworth, the young lady minding the cables and the booth.) They have several other interesting products you might want to check into . . . drop 'em a line: 4020 Fabian Way, Palo Alto CA 94303.



What can I say? That staid, conservative gentleman on the left is the one and only Bill Godbout! (The mood of revelry was probably due to the tremendous success of his Econoram memory boards . . . and all the other items in his catalog!) The smiling face in the center belongs to none other than Carl Warren, the Senior Editor of Interface Age. The gentleman on the right? That's the real George Morrow. (Somebody who looks like George posed for the ad on page 128 of the April Kilobaud, but I know it wasn't really him because George always wears tennis shoes—and you'd never catch him with a tie on!) Godbout Electronics, Box 2355, Oakland Airport CA 94614.



Hey, there he is. The handsome and debonair Dr. Lloyd Rice, creator of famous Computalker Voice Synthesizer. If you're in the market, give this one a listen before you buy. Computalker Consultants, PO Box 1951, Dept. K, Santa Monica CA 90406.



One of the busiest booths at the Faire had to be Jade Computer Products! The man behind all the action is Don Smith (shown in the center photo with his better half, Joanne). One of the latest products to be added to their line is the REX personal computer shown in the left photo. Don's "adopted son," Heath Kline, president of Priority One Electronics (10031 Woodley Ave., Sepulveda CA 91343), was sharing the booth—and showing off his MiniScope (and many other items). You cannot believe the incredible line of computer systems, components and peripherals Jade is carrying these days. Their spring catalog will make you drool! 5351 West 144th St., Lawndale CA 90260.



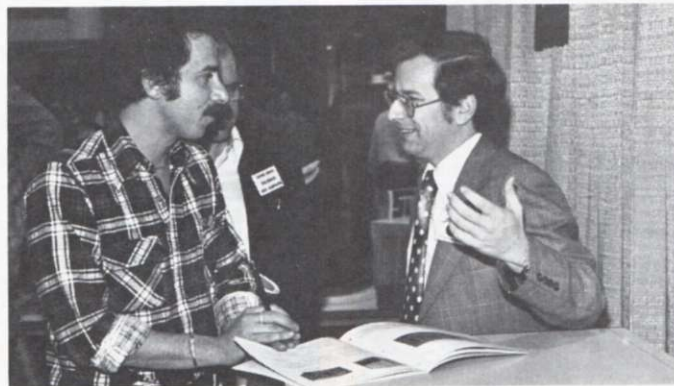
Tandy was there in force . . . with many new goodies for the TRS-80. Don French (merchandising mgr. for Tandy Computers) is behind the TRS-80 on the left. His head is directly above their new electrostatic screen printer, which sells for \$599 . . . and spews out printed copy at 2200 characters per second! They also had their new minifloppies and business systems line printer up and going (right photo). Be sure to send off for their new 1978 catalog . . . it looks like they're carrying every brand on the block! 1500 One Tandy Center, Ft. Worth TX 76102.



Would you buy a reconditioned Diablo (\$1995) or QUME-based terminal (\$2495) from that gentleman standing in the background? Sure you would, because he's Ken Widelitz, attorney-at-law, author of Kilo-baud's Legal/Business Forum and president of COMPUTER TEXTILE, the company offering those terminals. 10960 Wilshire Blvd., Suite 1504, Los Angeles CA 90024.



Hey, that RCA VIP (Video Interface Processor) is quite a little machine! The price is kind of high (\$275 kit), but it sure is a snap to create video patterns and games. I'd sure like to see it made a little more affordable because the 1802 has a lot going for it. RCA Solid State, Box 3200, Somerville NJ 08876.



I think I really captured the flavor of the moment here. The man on the left was a serious shopper who stopped by the Cromemco booth and hit Harry Garland (president of Cromemco) with some good questions about his system. As you can see, Harry thoroughly enjoys himself when it comes to answering such questions and pointing out the merits of his system. If you're shopping around, perhaps you should check into this "Cadillac" of S-100 systems. (Send for their new Spring Microcomputers/Peripherals catalog—\$1.) Cromemco, 2400 Charleston Rd., Mountain View CA 94043.



Dr. Curt Childress, president of Midwest Scientific Instruments, is on the left with Midwest's super 6800 system . . . and their new double-sided disk system. Curt borrowed a copy of Issue #10 of Kilo-baud and entered the Rugg/Feldman benchmarks; and he and Wayne Green are checking out the results in the photo on the right. At 1.6 MHz, the MSI 6800 came up with the following mind-blowing speeds: #1, .5 sec; #2, .5 sec; #3, 6 sec; #4, 10 sec; #5, 9 sec; #6, 12 sec; #7, 15 sec. Furthermore, the system can be run at even higher clock speeds! Their Catalog #2 is chock-full of 6800 boards, peripherals and whatever . . . send for it: 220 W. Cedar, Olathe KS 66061.



That's Mike Sherrick, the designer of the fantastic Malibu printer, and we have a review of the Malibu 160 in this month's issue. (One of their largest distributors is Jade Computer Products. Drop a line to Jade for more info.)



There seems to be an abundance of S-100 disk systems hitting the market, right? Well, in the course of shopping around, be sure to look over the capacity and software being offered with the Micropolis MetaFloppy and MacroFloppy drives. Their Extended Disk BASIC has file-management and programming capabilities, and they also have a 16K DOS. 7959 Deering Ave., Canoga Park CA 91304.



If you 6800 owners haven't checked into the line of SS-50 bus products from Smoke Signal Broadcasting then you're missing the boat! They have a DOS that supports from 1 to 3 of their minifloppies . . . patches for SWTPC BASIC . . . and a co-resident editor/assembler. They also have a 16K static memory board (\$529), and more. PO Box 2017, Hollywood CA 90028.



igital group

The Digital Group was demonstrating a graphics system that made a lot of mouths water.



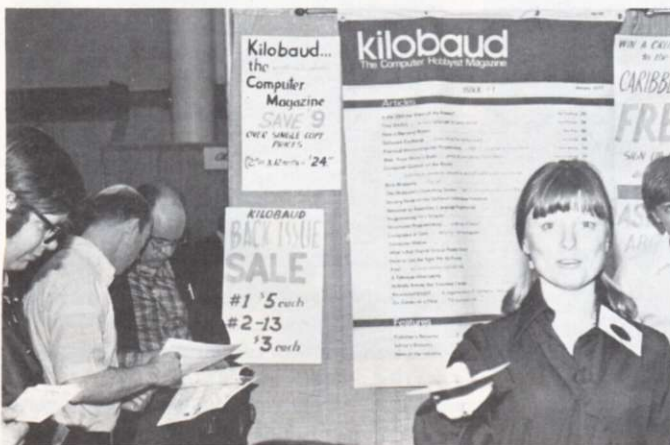
There he is, folks. The man behind the CP/M Users' Group: Tony Gold. Drop him a line . . . they've got twenty-four volumes (diskettes) in the library at this time! 164 W. 83rd St., New York NY 10024.



Here's the group from ALF: Greg Bloom, Philip Tubb (did you catch his "Incredizing" article in the April issue?) and Tim Gill. If you're into computer-generated music, these folks have some top-notch boards for the S-100 bus. Send for their catalog: 128 South Taft, Denver CO 80228.



Isn't that a beauty? The new Bytemaster from the Digital Group . . . Z-80 based with either floppies (DISKMON OS) or Phi-decks (PHIMON). They have a complete product catalog now. PO Box 6528, Denver CO 80206.



For those of you who haven't had the opportunity to meet our executive vice-president, Sherry Smythe, then allow me to introduce her. Her son, Matt, is on the far right . . . and is one of the best booth managers in the business. (Unfortunately, we're going to have to do without his fine services for a couple of years while he goes down to Central America for some missionary work.)



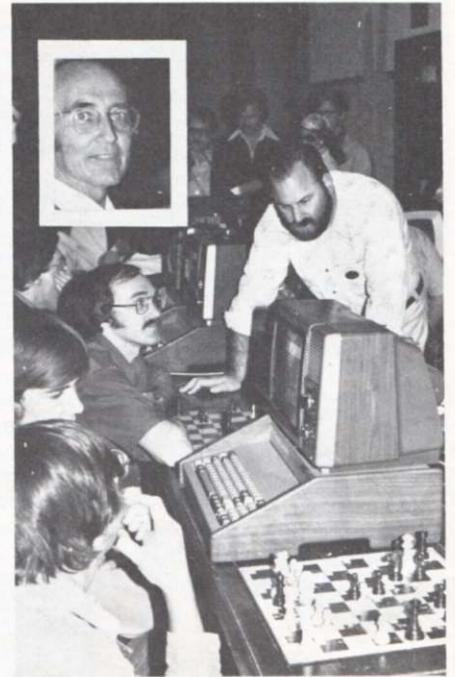
When it comes to quality S-100 systems, you're going to have to look far and wide before you find something comparable to the Equinox 100 . . . both electrically and mechanically. There were three factors that accounted for the tremendous crowds around the Thinker Toys/Parasitic Engineering booth: George Morrow's new floppy interface board, which can be configured for mini or standard-sized drives, the Equinox 100 and Lauren Kawakami. Thinker Toys, 1201 10th, Berkeley CA 94710—Parasitic Engineering, PO Box 6314, Albany CA 94706.



There's Chuck Grant, president of North Star Computers, with his arm resting on one of their Horizon systems. Keep your eyes open for a review of that system in an upcoming issue. With the wide-ranging use of North Star hardware and software these days, I suspect Chuck is quite pleased with what they've done. (I would have asked him, but he was too busy selling systems!) 2547 9th St., Berkeley CA 94710.



Why is this man smiling? Because he's Lou Frenzel, director of computer marketing at Heath, and he (along with everyone else at Heath) is tickled pink at the way their systems have taken off in sales. Now their floppies are here . . . and Heath's even happier! I can't tell you who that gentleman kneeling down (eyeing their new floppy system) is, but his initials are Steve Jobs! Drop a note to Heath and ask for their new catalog: Heath Co., Benton Harbor MI 49022.



Oh, yes . . . the chess tournament. What a crowd! I wasn't able to follow the action, but it was sure there. My friend, Doug Penrod (inset), played a big role in getting this event going through his "Computer Chess" newsletter (which will be a feature in Personal Computing magazine in the future).



Who says the camera never lies? In this photo, Bob Mullen (guess which one) appears as a thoughtful, contemplative, handsome and debonair designer of the only S-100 logic-probe/extender board and relay/opto-isolator control board on the market; his partner, Keith Britton, appears to be awake! (Hey, check into their new logic-probe/extender board. It uses a 7-segment display, and does the job nicely!) Mullen Computer Products, Box 6214, Hayward CA 94545.



Becky Sallume, of Vandenberg Data Products, was one of the most lively "flyer-hander-outers" at the Faire; but this photo was taken at the end of the last day! If you're in the market for a 16K S-100 board that runs cool, then send VDP some of your hard-earned money (\$330 kit; \$365 assembled). PO Box 2507, Santa Maria CA 93454.

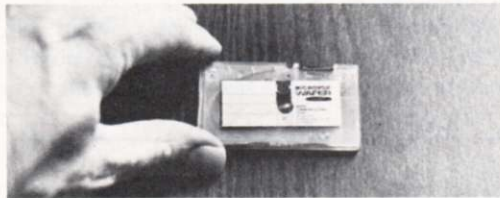


It never fails. At almost every computer convention you have at least one person go berserk and try to hit master reset and crash a system. I guess the strain was just too much for Nancy Millikin . . . and I sure hope she felt better after hitting that button! On the serious side, if you'd like some additional info on Meca's fantastic mass-storage system (with a voice prompt and response capability) write to them at: PO Box 696, 7026 Old Woman's Spring Rd., Yucca Valley CA 92284. (Ask for their mass-storage buyer's guide.)





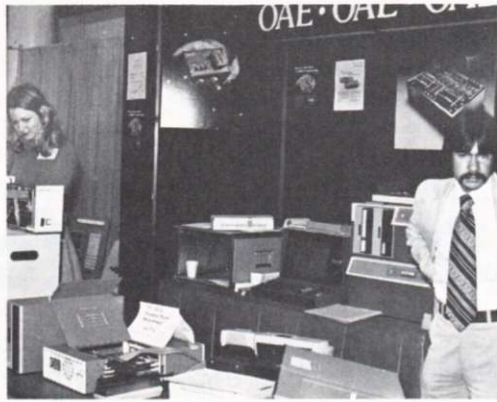
Wanna draw a crowd? Put up a Digital Research sign! I don't know whether you've noticed it or not, but there are two pieces of software playing a dominating role in this microcomputer industry; Microsoft BASIC... and Digital Research's CP/M Operating System! Heck, you can even get CP/M for the North Star drive (Lifeboat Associates, 164 W. 83rd St., New York NY 10024) and for the ICOM Frugal Floppy (Computer Mart of New Jersey, 501 Rt. 27, Iselin NJ 08830)! Digital Research has a new macroassembler and symbolic instruction debugger, both of which will be reviewed in an upcoming issue of Kilobaud. Version 1.4 of CP/M is out, too. Drop them a line for more info: PO Box 579, Pacific Grove CA 93950.



If you're in the market for a low-cost mass-storage system, then take a look at what the folks at Exatron have come up with! It's not called a cassette... it's a continuous-loop tape wafer (called the Stringy Floppy). Each wafer holds 40K bytes; and the transfer rate is an incredible 7200 kilobaud. Loads a 4K program in about 5 seconds. The system includes an S-100 controller board (with 4K monitor/assembler/editor) and the drive for \$289.50. (They also have a Tiny BASIC and a 5K BASIC available.) 1030 East Duane Ave., Suite 1, Sunnyvale CA 94086.



Once again I managed to chase off the crowds for a second to grab a shot of Dan Meyer, president of Southwest Technical Products (sporting a new beard). They have a new dual-drive disk system (the DMAF1) for business applications that has a file management system called FLEX. (Oh, the drives are double-sided... 600K bytes each.) Send for their new catalog, and include \$.25, OK? Box 32040, San Antonio TX 78284.



Oliver Audio Engineering was looking good! Beautiful booth... and normally big crowds around it! By the way, did you know their new PROM programmer simply plugs into an existing PROM socket to do its thing (read, program, verify and duplicate)? Two models—and they both sell for \$295. OAE, 676 West Wilson Ave, Glendale CA 91203.



Hey... the folks at the Computer Room have a couple of beautiful business systems. The one Lawrence Grijalva is demonstrating in the photo is available with a cost-estimating package (for heavy-duty construction) and inventory control. They also have a Randall Data Systems machine with a BMI (Building Materials Industries) package... everything you need for running a lumber yard. 124 H Blossom Hill Rd., San Jose CA 95123.



TSC started off in the 6800 software business, but they're now offering some of the same packages (their text processing, in particular) in 8080 code. They would dearly love to send you a copy of their new '78 catalog. Technical Systems Consultants, Box 2574, W. Lafayette IN 47906.



If that dapper gentleman looks like Dick Milewski of The Software Works, there's a good reason for the resemblance! If you're looking for a North Star-based inventory-control program, they have one. (A review of the package is coming up in Kilobaud.) Drop them a line for more info: PO Box 4386, Mountain View CA 94040.



Well, that should do it for this time. We'll finish up our little tour of the Faire next month with Part 2: more of the people and products.—John.

Well, that should do it for this time. We'll finish up our little tour of the Faire next month with Part 2: more of the people and products.—John.

# Tiny BASIC Shortcuts

*Tom Pittman's Tiny BASICs (6502, 1802, etc.) are somewhat limited in capabilities. This is the first of several articles discussing methods to expand those capabilities.*

Charles R. Carpenter  
2228 Montclair Place  
Carrollton TX 75006

Writing small but useful programs in Tiny BASIC (to paraphrase Tom Pittman) is a practical reality. Getting the most out of your programs is easier if you work with the inter-

preter's limitations. The utility program in Fig. 1 shows how to work with some of these limitations. This program is titled "Loans," but it could be any comparison of WHAT-IF alternatives. Here's what we'll be working with (and without):

- Decimal numbers not allowed.
- Number range limited from -32768 to +32767.

- 72 characters maximum on Input lines.
- Implied statements and abbreviations to save bytes of memory.

(Note: Tom Pittman now has an experimenter's manual available that explains many of these features and how to work with them. They are not as simple as my approach. The manual is available from Itty

Bitty Computers, PO Box 23189, San Jose CA 95153.)

These are not significant handicaps if you're estimating the effect of several alternatives. Round numbers are usually acceptable if you only want to get on base in some specific ball park (cliches are fun once in a while).

## Byte-saving Tips

Saving bytes of memory is a practical approach if your computer has limited memory (I have 1250 bytes of free space now). Let's talk about the memory-saving part first.

Fig. 1 is an example of a program with no statement shortcuts; Fig. 2 uses all the implied and abbreviated statements possible in this Tiny BASIC interpreter. Memory in Fig. 1 is 492 bytes, an average of 17 bytes per line, while Fig. 2 uses 410 bytes for an average of 14 bytes per line. REM comments were added later and used 470 bytes.

Using implied statements causes the program to run

```

:
:LIST
10 REM TINY BASIC FOR KIM-1
11 REM 6502 V.1K BY T. PITTMAN.
12 REM
13 REM PROGRAMMED BY:
14 REM C.R. (CHUCK) CARPENTER W5USJ
15 REM 2228 MONTCLAIR PL.
16 REM CARROLLTON TX 75006
17 REM
18 REM THESE PROGRAMS ILLUSTRATE BYTE SAVING
19 REM TECHNIQUES IN LIMITED MEMORY SYSTEMS.
20 REM THE FIRST PROGRAM USED 492 BYTES. THE
21 REM OTHER USED 410 BYTES. AN INCREASE
22 REM (OR SAVING) OF 82 BYTES. IMPLIED
23 REM STATEMENTS AND ABBREVIATIONS ARE
24 REM THE REASON.
25 PR
26 PR
100 PRINT"LOANS : HOW MANY -"
110 INPUT N
115 PRINT
120 LET A=0
130 PRINT"INPUT: PRINCIPAL IN HUNDREDS (P)"
140 PRINT"      RATE IN PERCENT (R)"
150 PRINT"      TIME IN YEARS (T)"
160 PRINT"      PAYMENTS IN MONTHS (X)"
170 INPUT P,R,T,X
190 LET I=P*T*R
200 LET O=100*P+I
210 LET M=O/X
220 LET A=A+1
230 PRINT
240 PRINT"LOAN NUMBER -";A;"
250 PRINT"INTEREST IS $";I
260 PRINT
270 PRINT"MONEY OWED IS $";O
280 PRINT
290 PRINT"PAYMENTS ARE $";M
300 PRINT
310 LET N=N-1
320 IF N>0 THEN GOTO 170
360 PRINT
370 PRINT"DONE"
380 PRINT
390 END
:
:
:
:
:I=0
:I I=I+2
:2 GOSUB 1
:RUN
:
:
:
:
:END AT 1
:END
:PRINT"THESE ARE ";I;" BYTES LEFT"
THERE ARE 288 BYTES LEFT
:

```

Fig. 1. First program version using no shortcuts to write the program or save bytes. This program uses 492 bytes, exclusive of the REM statements. REM statements use 470 bytes. The short routine above illustrates how Tiny BASIC finds the number of bytes of free space remaining. The user's manual tells how to do it.

slower, but the increase in program lines is worth the loss of speed (if speed is your concern then Tiny BASIC may not be for you, anyway). Memory saving wasn't really necessary for this short program; but in a 100-line program over 200 bytes could be saved (12 to 15 lines' worth). Such significant savings allow you to write longer programs. The programs are still small, but even a few more lines make them more useful. And that's what we're trying to do. Bytes could be saved in a few more places, such as the spaces in the print input, lines 130 through 160, but in the interest of clarity, I left them alone.

#### Decimal Values

Calculations involving decimal numbers can be handled several ways. Anytime a percentage or a calculation resulting in a fraction occurs, a decimal number results. Dollars and cents are decimal numbers, too. Tiny BASIC truncates decimal numbers down to the next lower whole number. If the number is less than one, the result is zero. (For this

reason, accountants would probably not want to use Tiny BASIC.)

Lines 130 through 180 are the input lines for this program. I used principal in hundreds and rate in percent to avoid decimal percentage entry and to prevent dividing percent by 100 (to get back to a decimal percentage). The math comes out right when it's printed out in line 250. I then multiplied the total loan value by 100 in line 200 to make the right amount print in lines 270 and 290.

Principal input in hundreds also helps avoid the number-limitation problem. Keeping the numbers to be operated on small limits precision but keeps the multiplication results in range. Adding a statement in a print line to multiply (or divide, etc.) by some factor will put the answer back in the right magnitude. This is sort of like using engineering notation with a slide rule. The difference is the lack of decimal numbers.

An input-line limitation of 72 characters restricts the amount of data you can input. Two character spaces are used

by the prompting question mark and following space. This reduces actual data input to 70 characters, including the required commas between the data entries. With the loan amount in hundreds, I was able to input values for six loans instead of five. To overcome the limited data-input situation, write programs that will perform calculations, hold the results and return for more

data. I've done this on some data-processing routines with good results.

There's another way to accommodate more data than the line will hold. Simply input as many loan numbers (or WHAT-IFs) as needed in line 100. When the program has used the data entered, it will ask for more until the number of N entries is reached in line 320. Question marks will show up each time

```
:LIST
```

```
100 PR"LOANS : HOW MANY -"
110 INPUT N
115 PR
120 A=0
130 PR"INPUT: PRINCIPAL IN HUNDREDS (P)"
140 PR"    RATE IN PERCENT (R)"
150 PR"    TIME IN YEARS (T)"
160 PR"    PAYMENTS IN MONTHS (X)"
165 PR
170 INPUT P,R,T,X
190 I=P*T*R
200 O=100*P+I
210 M=O/X
220 A=A+1
230 PR
240 PR"LOAN NUMBER - ";A;" "
250 PR"INTEREST IS $";I
260 PR
270 PR"MONEY OWED IS $";O
280 PR
290 PR"PAYMENTS ARE $";M
300 PR
310 N=N-1
320 IF N>0 GOTO 170
360 PR
370 PR"DONE"
380 PR
390 END
```

Fig. 2. Second program version using implied statements and abbreviations to save bytes. This version uses 410 bytes.

```
LOANS : HOW MANY -
?6
```

```
INPUT: PRINCIPAL IN HUNDREDS (P)
      RATE IN PERCENT (R)
      TIME IN YEARS (T)
      PAYMENTS IN MONTHS (X)
```

```
?40,10,3,36,40,12,4,48,40,18,5,60,50,10,3,36,50,1
2,4,48,50,18,5,60
```

```
LOAN NUMBER - 1
INTEREST IS $1200
```

```
MONEY OWED IS $5200
```

```
PAYMENTS ARE $144
```

```
LOAN NUMBER - 2
INTEREST IS $1920
```

```
MONEY OWED IS $5920
```

```
PAYMENTS ARE $123
```

```
LOAN NUMBER - 3
INTEREST IS $3600
```

```
MONEY OWED IS $7600
```

```
PAYMENTS ARE $126
```

```
LOAN NUMBER - 4
INTEREST IS $1500
```

```
MONEY OWED IS $6500
```

```
PAYMENTS ARE $180
```

```
LOAN NUMBER - 5
INTEREST IS $2400
```

```
MONEY OWED IS $7400
```

```
PAYMENTS ARE $154
```

```
LOAN NUMBER - 6
INTEREST IS $4500
```

```
MONEY OWED IS $9500
```

```
PAYMENTS ARE $158
```

```
DONE
```

```
:
```

Fig. 3. Sample run. Simple interest calculations of two different loan values at three rates.

From Fig. 3 Simple Int			From Fig. 5 Compound Int		
Interest%	Years	Amount	Equiv-Int%	Years	Amount
1. 10	3	\$5200.00	11	3	\$5320.00
2. 12	4	5920.00	15	4	6400.00
3. 18	5	7600.00	26	5	9200.00

Mult	Actual Loan Value	Difference
1. 1.331	\$5324.00	+\$ 4.00
2. 1.574	\$6296.00	- 104.00
3. 2.288	\$9152.00	+ 48.00

Fig. 4. For a loan of \$4000.

line 170 runs out of data and line 320 is still greater than zero.

This program only calculates simple interest loans. Compound-interest calculations require decimal numbers and raising numbers to some power. The multiplier for compounding over  $n$  periods is  $(1 + I)^n$ , where  $I$  is the interest expressed as a decimal and  $n$  is the number of years (or periods).

You can use this multiplier to calculate the approximate equivalent while percentage over the term of the loan. Your calculated answer will result in a much more realistic loan evaluation. I made some of these calculations, and Fig. 4 has some examples.

In the program itself, there are no unusual or unique programming techniques. There are two counting loops—one starting at line 110 and the other at line 120. Whatever

value is input for  $N$  is decremented in line 310 until the data sets, input in line 170, are used up. The counter that starts in line 120 numbers the printed output each time a pass through the program is completed.

I tried to use  $N$  to do both, but could not without using more program lines. Otherwise, this is simply a fundamental program with input between lines 100 and 170, calculations between lines 190 and 220 and output between lines 240 and 290.

#### Summary

It is easy to save bytes of memory if you remember to use implied statements and statement abbreviations. The user's manual for Tiny BASIC shows what is, and is not, allowed. Both the decimal number and number range limitation can be handled by using software math techniques (multipliers, dividers, engineering notation,

```

LOANS : HOW MANY -
?3

INPUT: PRINCIPAL IN HUNDREDS (P)
      RATE IN PERCENT (R)
      TIME IN YEARS (T)
      PAYMENTS IN MONTHS (X)

?40,11,3,36,40,15,4,48,40,26,5,60

LOAN NUMBER - 1
INTEREST IS $1320

MONEY OWED IS $5320

PAYMENTS ARE $147

LOAN NUMBER - 2
INTEREST IS $2400

MONEY OWED IS $6400

PAYMENTS ARE $133

LOAN NUMBER - 3
INTEREST IS $5200

MONEY OWED IS $9200

PAYMENTS ARE $153

DONE
  
```

Fig. 5. Loan value two, rerun to show the effect of compound interest on the total loan value. Compare the results with the simple interest calculation.

etc.). Line input characters limited to 70 (72 with prompting question mark and space) can also be handled by programming techniques.

Remember, if you input more than a total of 72 characters in a single line, the program will stop. Nothing more will happen

until you reset your system. If you have to reset and want to save the program already in memory, then reenter the interpreter at the soft entry point. The Tiny BASIC user's manual explains how to do this, too. A program does not have to be big to be useful. ■

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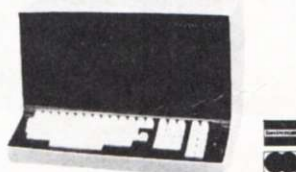
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KB/6/78

# Baudot . . . er . . . Murray, Meet the H8

*There is an inexpensive way of obtaining reliable and quiet hard copy for your home system; and an old five-level code teletypewriter is the answer.*

Publisher's note: *The Baudot referred to in this article is actually Murray code as per my remarks on page 4. Have we all been the victim of a dastardly French revisionism plot?*

**B**audot teleprinters, frequently available as surplus for next to nothing, can be used with the driver described here as a listing device for your

H8 system. Baudot printers use five information bits, rather than the seven bits used by ASCII printers, to print 52 characters. Even though ASCII teleprinters can print many more characters than Baudot machines, there are only a few programming characters lacking in the five-level printer.

By assigning arbitrary sym-

bols to cover the desirable ASCII characters not available in the Baudot set, the missing characters can be accommodated. The following assignments have been made in this driver:

Back Space	=	X
Percent (%)	=	(C)
Asterisk (*)	=	(X)
Plus (+)	=	(P)
Less Than (<)	=	(L)
Equal (=)	=	(E)
Greater Than (>)	=	(G)
At (@)	=	(A)
Left Bracket ([)	=	(B)
Reverse Slant (\)	=	(R)
Right Bracket (])	=	(B)
Up Arrow (^)	=	(U)
Underline (_)	=	(-)

You can make arbitrary assign-

ments by modifying the lookup table used in the driver program to convert ASCII characters generated in the computer to Baudot characters.

## Hardware

The ASCII/Baudot driver was written for the Heath H8 computer system. This documentation assumes that the interface to the teleprinter will be made via an H8-2 parallel I/O port. Since Heath software makes no distinction between serial and parallel ports, an H8-5 serial port can be used. However, you will normally have a CRT console already connected to a serial I/O port, with the second port on the board automatically committed to the

Integrated Circuits			
U1	AY-5-1013A	UART	-12 Required on Pin 2
U1 (Alt.)	AY-3-1015	UART	-12 Not Required
U2	NE555V	Timer	
U3	SN7404N	Hex inverter	
Resistors			
R 1	18k, 1/4 W		
R 2	50k, 10 Turn	Potentiometer	
R 3	47k, 1/4 W		
R 4	1k, 1/4 W		
Capacitors			
C 1	.01 uF Disk Ceramic		
C 2	.01 uF Polystyrene (High Stability)		
Power Supply (not shown)			
A power supply capable of providing +5, -12, and Loop current (if required) is necessary to operate the interface circuitry. A suitable supply, having, in addition to the above, a +12 volt regulator, loop keying transistor, transformer and solid state motor control relay, is available in fit form from Eclipse Communications, 5 Westwood Drive, San Rafael CA 94901. The RP-400 Power Supply Kit can be obtained for \$71.25 (plus tax in California) plus \$2 postage and handling.			

*Table 1. Interface parts list.*

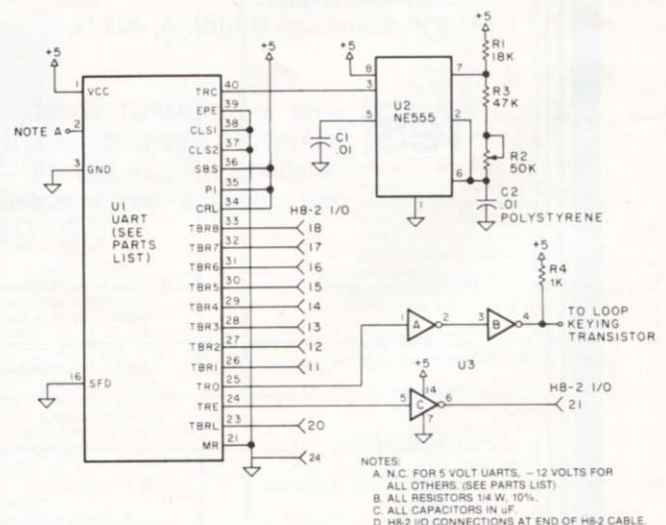


Fig. 1. H8-2 to external UART interface.

in the same way as for an H10.

### Software

The ASCII/Baudot driver uses a lookup table to convert the ASCII character being sent to the system console to a Baudot character compatible with a five-level teleprinter. The routine is placed at the upper end of user RAM, just below the stack, where provisions have been included in Heath software to allow user memory space.

The Heath software must be reconfigured to allow the ASCII/Baudot driver to be used. The changes include: (1) redefining the high-memory limit as detailed in Table 3; (2) changing five memory locations in each Heath program, as shown in Table 4.

Once the Heath software has been reconfigured, the ASCII/Baudot routine is loaded with the Heath program. The ASCII/Baudot driver need only be loaded once when going from one Heath reconfigured pro-

### H8-2 Interface

Function	Pin	Wire Color
Data 0	1	White-Black
Data 1	2	White-Brown
Data 2	3	White-Red
Data 3	4	White-Orange
Data 4	5	White-Yellow
Data 5	6	White-Green
Data 6	7	White-Blue
Data 7	8	White-Violet
Ground	9	White-Gray
Data Taken	10	Red-Black
Take Data	11	Red-Yellow
Device Cntrl	12	Red-Green
Device Rdy	13	White-Black-Red
Device Cntrl	14	Pink
Send Data	15	Tan
Data Sent	16	White
Ground	17	Gray
Data 7	18	Violet
Data 6	19	Blue
Data 5	20	Green
Data 4	21	Yellow
Data 3	22	Orange
Data 2	23	Red
Data 1	24	Brown
Data 0	25	Black

### UART Interface

Signal Flow	Pin	Function
→	11	TBR1
→	12	TBR2
→	13	TBR3
→	14	TBR4
→	15	TBR5
→	16	TBR6
→	17	TBR7
→	18	TBR8
	24	GND
←	21	TRE
→	20	TBRL

Table 2. H8-2 to UART interface.

cassette tape I/O. A second serial I/O board could be used, but an unusable tape I/O port would result.

A universal asynchronous receiver transmitter (UART), hex-inverter integrated circuit, Baudot clock and 60 mA loop circuitry are required to complete the interface. A schematic and parts list for this out-board circuitry are given in Fig. 1 and Table 1, respectively.

The baud-rate potentiometer, R2, should be adjusted to a frequency 16 times the teleprinter baud rate. If the teleprinter has 60 wpm gears, the clock rate should be 727 Hz; if the machine has 100 wpm gears, the baud-rate clock should be adjusted to 1187 Hz.

Table 2 shows the connections that must be made between the interface circuitry and the H8-2 parallel I/O connector. The parallel I/O cable is wired as recommended by the H8-2 parallel I/O manual for the H10 tape reader/punch. Finally, the jumpers on the parallel I/O channel should be configured

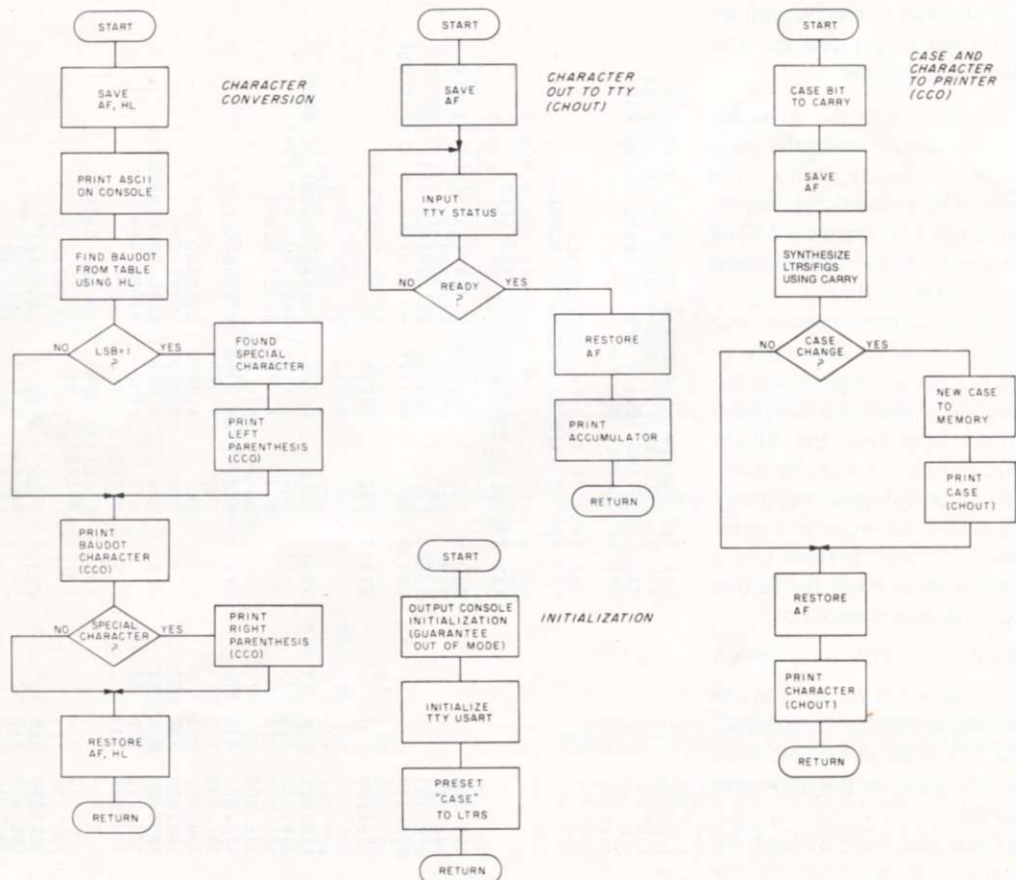
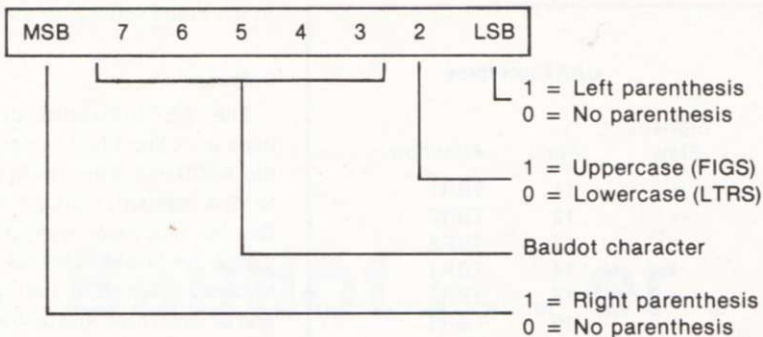


Fig. 2. Program flowcharts.



**Examples:**

1. Assume A is the ASCII character. Binary byte for A is 00001100. Octal equivalent of binary byte is 1400. Baudot machine prints A.
2. Assume = is the ASCII character. Binary byte for = is 10000101. Octal equivalent of binary byte is 2050. Baudot machine prints (E).
3. Assume 5 is the ASCII character. Binary byte for 5 is 01000010. Octal equivalent of binary byte is 1020. Baudot machine prints 5.

Fig. 3. Lookup table byte structure.

gram to another. For example, the following describes a typical use of the driver with the H8 editor and assembler.

1. Load ASCII/Baudot driver from cassette tape.
2. Load reconfigured H8 editor.
3. Push GO. The Baudot printer will now print each character sent to the CRT, with substitutions where required.
4. Write and/or edit source code.
5. Save source code on cassette tape.
6. Load reconfigured H8 assembler.
7. Push GO. The assembly will proceed normally, with all information printed on the Baudot teleprinter.

Flowcharts for the driver are given in Fig. 2, while the complete assembly listing (as printed by a model 28 teleprinter) is given in Program A. The program requires approximately 270 RAM locations.

The driver can be easily modified to be compatible with your H8 system. Program A will run with 16K of RAM. If your system differs from this, the BEGIN EQU statement must be modified to reflect your high-memory limit in offset octal. For example, if your system has a total of 8K of RAM, the BEGIN EQU statement would be:

```
BEGIN EQU 76000A
```

from Table 3. If you wish to use an output port other than 700, the TTY EQU statement must be changed to the new port number.

Once you have defined the changes to be made to the ASCII/Baudot driver, the source-code listing can be changed

1. Load Distribution Tape.
2. Change High Memory using Reconfigured High Memory below.
3. Change Pad from 4 to 1 (optional).
4. Record Heath program using "SAVE."
5. Proceed to instructions on Table 4.

Total User RAM	Actual Decimal Limit	Actual Octal Limit	Begin Equ	Reconfigured High Memory
4K	12287	057377A	056000A	11775
8K	16383	077377A	076000A	15871
12K	20479	117377A	116000A	19967
16K	24575	137377A	136000A	24063
20K	28671	157377A	156000A	28159
24K	32767	177377A	176000A	32255
28K	36863	217377A	216000A	36351
32K	40959	237377A	236000A	40447

Table 3. Reconfiguring Heath programs.

- (X) THE FOLLOWING PROGRAM ALLOWS A STANDARD (X) 5-LEVEL BAUDOT TELEPRINTER TO BE USED AS (X) A LISTING DEVICE FOR SOFTWARE USING THE (X) H8 CONSOLE DRIVER, V 1.1.
- (X) THIS H8 ASCII/BAUDOT DRIVER (X) WAS WRITTEN BY HOWARD L. NURSE.

(X) SYMBOLIC CONSTANTS:

```

BEGIN EQU 136000A 511 BYTES BELOW HI MEM
TTY EQU 0700 TTY PORT
$COUT EQU 40111A H8 CONSOLE DATA OUT
$CISO EQU 40117A H8 CONSOLE IN STATUS OUT

START ORG BEGIN

INIT CALL $CISO GUARANTEE OUT OF MODE
OUT TTY(P)1 SAME FOR TTY PORT
MVI A,1000 RESET USART
OUT TTY(P)1
MVI A,1160 MODE SET
OUT TTY(P)1
MVI A,0050 COMMAND SET
OUT TTY(P)1
MVI A,370 CASE TO LTRS
STA CASE STORE SAME
RET

(X) SAVE ACTIVE REGISTERS AND OUTPUT
(X) CHARACTER TO H8 CONSOLE.

ENTRY PUSH PSW SAVE AF
PUSH H SAVE HL
CALL $COUT CONSOLE CHARACTER

(X) CONVERT ASCII CHARACTER USING TABLE.

TABLE LXI H,TBL ESTABLISH POINTER BY ASCII
ADD L OFFSET POINTER BY ASCII
JNC H NO CARRY AFTER ADD
MOV L,A WAS CARRY AFTER ADD
RRR L, A COMPLETE TABLE ADDRESS
RRR H, A GET BAUDOT CHRCTR
CC IF SPECIAL CHARACTER
CALL LFT PRINT LEFT PARENTHESIS
CALL CCO
ANI 400 IF NOT A SPECIAL CHRCTR
JZ DONE EXIT
RGT SPECIAL CHRCTR REQUIRES
CALL RGT RIGHT PARENTHESIS
POP H RESTORE HL AND AF
DONE PSW RET

(X) CONVERT ASCII CHARACTER USING TABLE.
TABLE LXI H,TBL ESTABLISH POINTER BY ASCII
ADD L OFFSET POINTER BY ASCII
JNC H NO CARRY AFTER ADD
MOV L,A WAS CARRY AFTER ADD
RRR L, A COMPLETE TABLE ADDRESS
RRR H, A GET BAUDOT CHRCTR
CC IF SPECIAL CHARACTER
CALL LFT PRINT LEFT PARENTHESIS
CALL CCO
ANI 400 IF NOT A SPECIAL CHRCTR
JZ DONE EXIT
RGT SPECIAL CHRCTR REQUIRES
CALL RGT RIGHT PARENTHESIS
POP H RESTORE HL AND AF
DONE PSW RET

```

Program A. Assembly listing.



