INTERFACE™

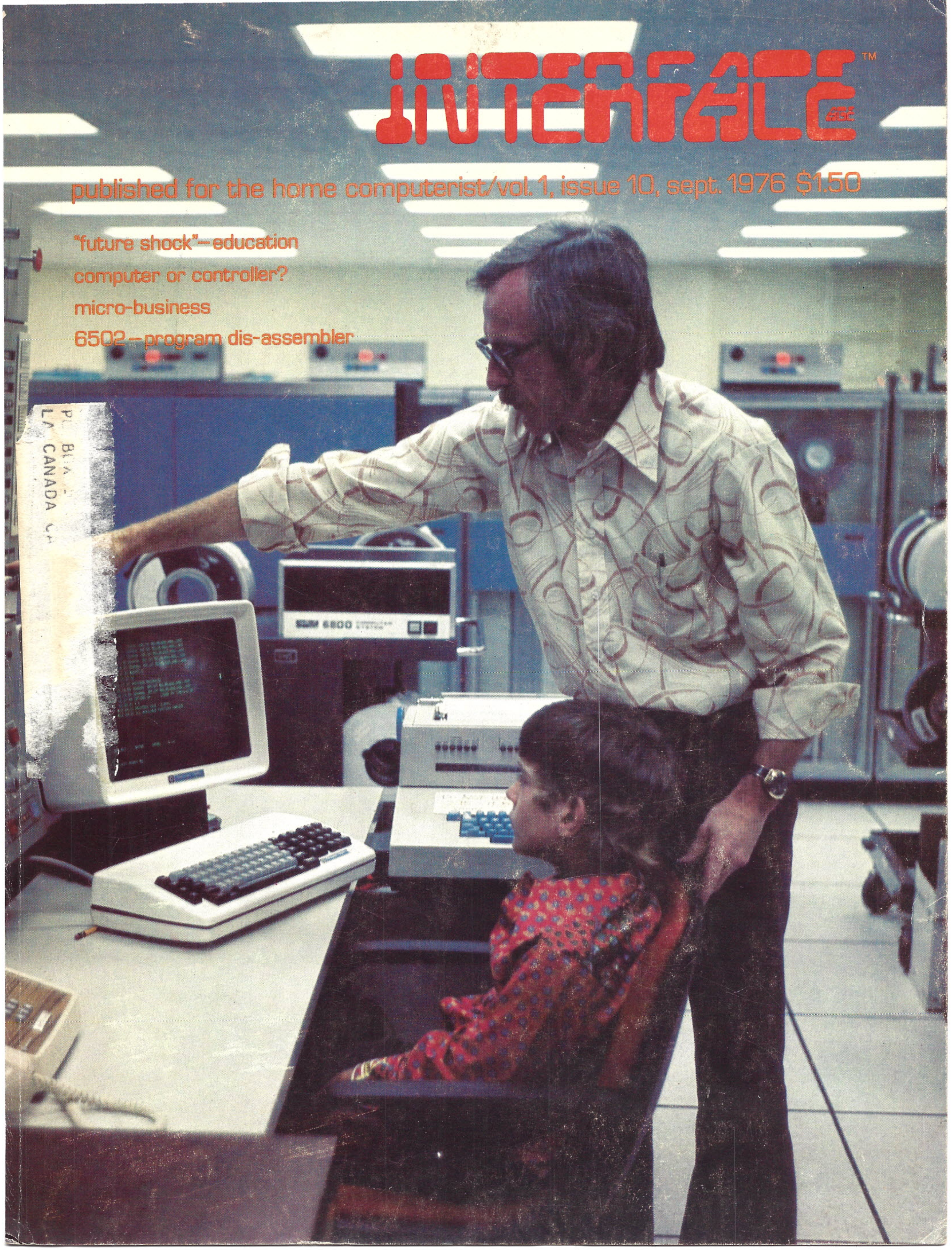
published for the home computerist/vol. 1, issue 10, sept. 1976 $1.50

"future shock"—education

computer or controller?

micro-business

6502—program dis-assembler



THERE IS NO QUESTION

Our computer is a bore—

There is simply no point in trying to hide it, everyone is going to find out sooner or later anyway. The Southwest Technical Products 6800 computer is a big bore. Discussions with customers and dealers have confirmed our worse suspicions.

At first people thought that perhaps owners of our system were just a bit shy because they were outnumbered at local computer club meetings. But then as the number of owners rose it became clear that this was not the problem. And it wasn't that they were unsociable or anything like that; they were simply just bored because they had nothing to talk about.

Here they were, just sitting there while all the other members with other brands of computers exchanged data on circuit board errors, secret schemes of adding extra bypass capacitors to make the thing reliable, tricks to keep the clock phases from overlapping, corrections to manual errors and other fun subjects. Can you imagine the frustration this caused? All our customers could do was to sit and be bored. They had nothing to talk about.

Our 6800 has an internal monitor ROM that automatically puts the bootstrap loader in memory and refers control to the terminal, when you power up. This feature deprives you of the chance to tell sad stories of how many times you had to go back and flip the console switches before you got the loader program in right. Since you can do machine language programs directly from your video terminal or teletype in hexidecimal form, you will not have a chance to exchange horror stories with your friends about how you forgot the last zero when you entered 10100110 from the console on your 374th Byte and messed up the program that had just taken you two hours to put into memory. It just isn't fair.

Since we use full buffering on all data, address and control lines on all boards in our system and since we use low power 2102 static memories in our system, there are no noise sensitivity problems that can lead to hours of fun trying to figure out why a program "bombed". Dynamic memories that some others use can drop bits, fail to refresh random cells, cause programs to do crazy things by going into a refresh cycle at the wrong moment and all kinds of interesting things. Our poor customers will never have a chance to have these interesting experiences.

Even our documentation and software is no help. Not only do we have the most complete and thorough set of instructions available for any system, we are supplying software either free, or at crazy low prices. Our big documentation notebook for instance is just full of information on the system. There are complete sections on software with sample programs and information on programming. We have no assembly instructions in that big yellow notebook. They are packed with the kits themselves. The notebook is completely devoted to instruction on using your computer system. You are therefore not going to be spending day after jolly day trying to find out how to put a program into your machine; researching all available outside literature in an attempt to discover just how you write software for the beast. Sorry about that folks, we didn't mean to spoil all your fun.

So please, have a heart, when you see those poor lonely souls that have purchased our systems say "hello". All they have to keep them interested in computers is writing and running programs. Our editor, assembler, 4K and 8K BASIC programs work so well that even this is quick and easy. So be kind to those poor bored SwTPC-6800 owners, it's not their fault that they have nothing to talk about.

SWTPc 6800

Computer System

with serial interface and 2,048 words of memory. $395.00

☐ **I don't like puzzles anyway and have no free time to be bored so send information on your 6800 computer system and peripherals.**

☐ **Thanks for warning me. Send names of manufacturers of "interesting" computers.**

NAME ____________________

ADDRESS ____________________

CITY __________ STATE ______ ZIP ______

Southwest Technical Products Corp., Box 32040, San Antonio, Texas 78284

INTERFACE AGE™

VOL. 1 NO. 10. SEPTEMBER 1976

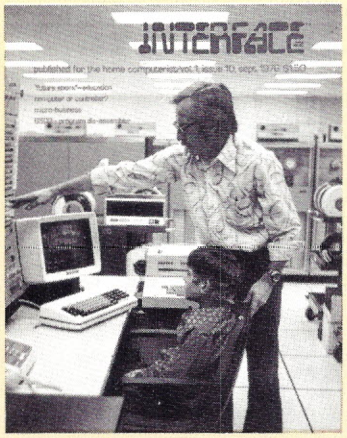


Photo by E-tronics
Culver City, CA.

COVER STORY

This month's issue deals mainly with educational impacts of a computer oriented world and its effects on people.

New and creative approaches both from institutional and industrial levels provide an awakening and a new direction to interfacing people and machines.

The personal interface shown on our cover depicts this integration of thinking, from an SWTPC 6800 to an IBM 360, from a young man to a learned professional.

Our thanks to Data Comp International, Costa Mesa, CA and Mr. Dave Shepoiser for allowing INTERFACE AGE *to use their facility for our cover photo. Special appreciation to A-Vid Electronics, Long Beach for supplying the SWTPC 6800.*

Pictured on the cover, Mr. Dave Shepoiser and Robert S. Jones, Jr.

FEATURES

FEATURETTES

DEPARTMENTS

INTERFACE AGE Magazine, published monthly by McPheters, Wolfe & Jones, 6515 Sunset Blvd., Suite 202, Hollywood, Calif. 90028. Subscription rates: U.S. $10.00, Canada/Mexico $12.00, all other countries $18.00. Opinions expressed in by-lined articles do not necessarily reflect the opinion of this magazine or the publisher. Mention of products by trade name in editorial material or advertisements contained herein in no way constitutes an endorsement of the product or products by this magazine or the publisher.
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INTERFACIAL

In This Issue

The industry has evolved many new microprocessors each finding its home within the confines of a designer's goal. Sometimes the software generated by others is equally confining if the user is unable to understand its origin and purpose. Offered here is a dis-assembler for the 6502, which will provide help in filling many a need, compliments of the people at Apple Computer Co.

"Micro-Business," a new series on the use of the microprocessor system in small business, should prove very valuable. Written by Mal Lockwood of ASI, Denver, CO., who deals in solving the day-to-day trials and tribulations found in small business accounting applications.

Bruce Scott continues BASIC part

Bruce Scott continues "BASIC," part II with an introduction to defined functions, standard functions and subroutines.

"Future Shock," by Niel Sclater, discusses the micro-educational gap and what some companies are doing about it. Education in micros and computer technology and its impact is found in two additional articles—"But It's Fun . . . But It's Educational," by Joanne Verplank, and "Computers in the Classroom," by Larry Press.

Terry Benson brings home the micro literally in application with his feature, "Computer or Controller."

William Sinclair offers a philosophical look at "FORTH: A Stack-Oriented Language."

On the lighter side of things, Phil Feldman and Tom Rugg present the game of Bluff. "Bluff or Not to Bluff," is rather timely considering the state of the world today and the others games that can be associated with it.

Computer got a cold? Scott Wilcox's "Hardware Report," presents some interesting insights into troubleshooting sick hardware. A handy little hardware address trap proves a mind saver and very useful in tracking down the source of problems.

Starting with this issue, *Interface Age* has changed its policy in the FIFO Flea Market with respect to personal ads. These ads will be placed FREE of charge on a first come space available basis. Remember this space is for non-commercial advertising and is subject to the editor's final judgment. Ads should be no longer than 10 lines (40 characters per line). It is our desire to keep this page open for your advantage and communication.

Editor

INTERFACE AGE

PUBLISHED BY
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Hollywood, CA 90028
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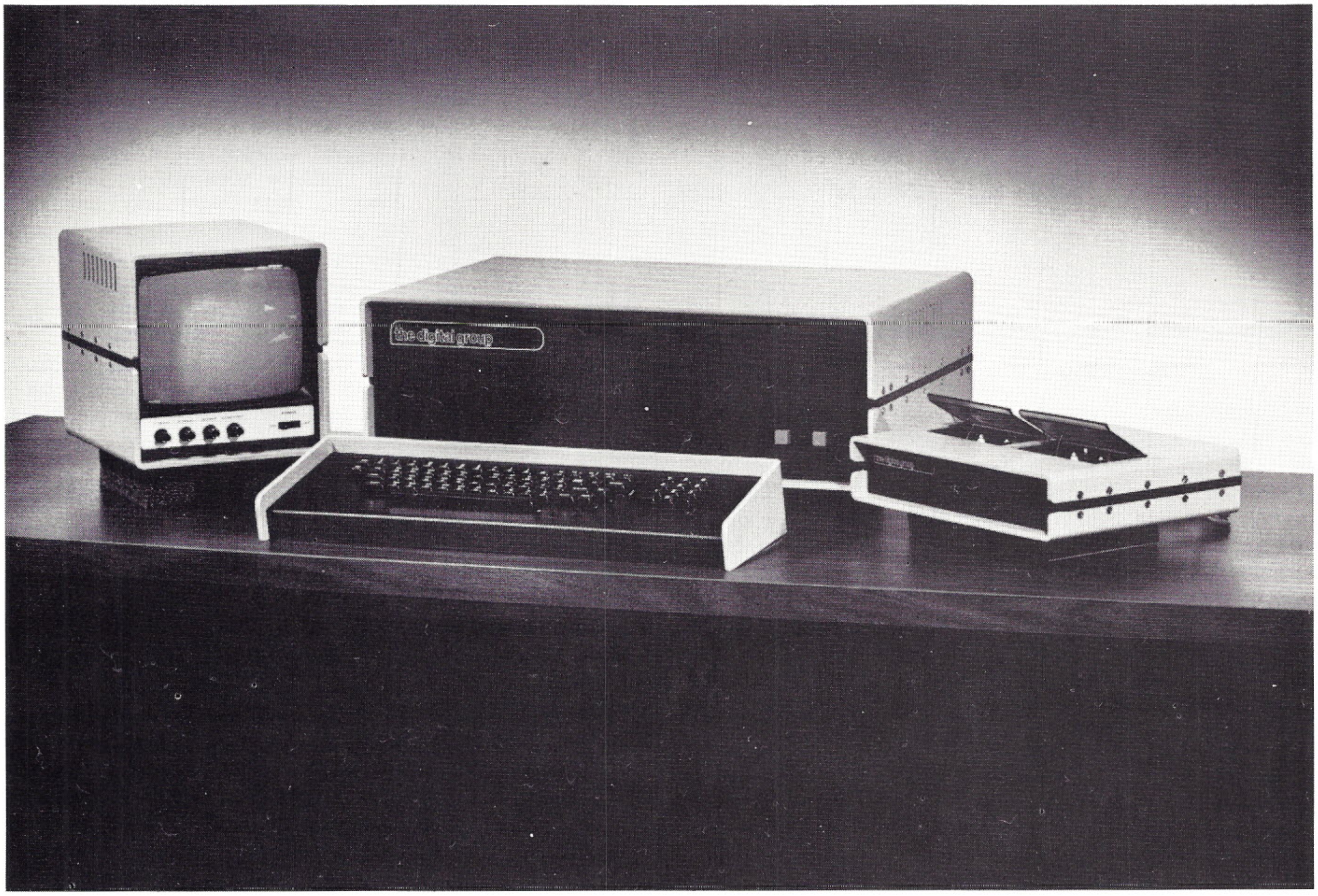
Direct all correspondence to the appropriate editor at: INTERFACE AGE magazine, P.O. Box 1234, Cerritos, CA 90701. Editorial contributions must be accompanied by return postage and will be handled with reasonable care, however, publisher asumes no responsibility for return or safety of manuscripts, art work, or models.

ADVERTISING INQUIRIES

Direct all advertising inquiries to: Advertising Department, INTERFACE AGE magazine, 61 South Lake Avenue, P.O. Box 4566, Pasadena, CA 91106—(213) 795-7002.

Cabinets clockwise from top: CPU, Dual-cassette drive, Keyboard, 9" Monitor.



The Digital Group covers up.

(Beautifully.)

For many months the Digital Group has been hard at work on the heart of our microcomputer system, insisting on quality where it counts in every product we've designed. Now, we have turned our attention to the outside and covered up . . . with a complete line of custom cabinetry that will enhance your Digital Group system for all the world to see. The result is beautiful.

Sleek and sophisticated, but rugged enough to take all the hard knocks you hand out, Digital Group cabinets are made to be used and not just admired. Extra-heavy-duty eighth-inch aluminum is utilized throughout with a special tough-texture commercial-grade paint in Computer Beige. All front panels are anodized aluminum in dark brown. Even the front panel switches are lighted.

The Digital Group offers a beautiful cover-up for each part of your system — from the CPU to the video monitor. What's more, every new Digital Group product will get covered, too, so each piece will maintain that unmistakable Digital Group image.

We're sure you've already fallen madly in love with our cover-ups, but just wait until you take a peek inside. That's where the real beauty lies.

Our video-based systems, including 8080, 6800 and the super new Z-80, are state-of-the-art, high quality and totally integrated designs. Digital Group systems are complete and fully featured and are specifically designed to be easy to use. Merely power on, load cassette and go! (And with our new cover-ups, you go in style.)

Best of all, Digital Group systems are available now. And affordable. Prices for a complete Z-80 based CPU start as low as $645, including the cover-up.

So write or call us for all the beautiful details. And then head for cover!

the digital group

The Digital Group
P.O. Box 6528
Denver, Colorado 80206
(303) 777-7133

CIRCLE NO. 2 ON INQUIRY CARD

UPdate

MEETINGS

SCCS MEETING—General Elections will be held on Saturday, September 28th, at 1:00 p.m. Doors will be open from 10:00 a.m. to 4:00 p.m. at the Roger Young Auditorium, 936 Washington Blvd. in Los Angeles.

SANTA MONICA BAY CHAPTER meets on the second Tuesday of the month at 7:15 p.m. They are located at the Veterans Administration Hospital in West L.A. and have access to electronic test equipment on the premises. Attendees are invited to bring hardware to demonstrate or to work on. Next meeting's plans include beginning the assembly of an Altair 680B kit. A software project has begun to build a table-driven assembler. Election of officers and collection of dues on an as-needed basis will take place. For information, call Larry Press at (213) 399-2083. Or attend the meeting in Room 125, Building 114, off the San Vicente Blvd. entrance.

NEW CLUBS

Southern New England Computer Society, formed in July, held their second meeting in Hartford, Conn., on August 22nd. Plans are still forming for the September meeting, perhaps to be located in New Haven. If you wish to know for certain, send $1 for the newsletter to "Yankee Bits," 267 Willow St., New Haven, CT 06511.

CENOACA in Oklahoma City meets the second Saturday of each month at 10 a.m. They publish a monthly newsletter called "Newsbits," and invite anyone interested to write to Box 2213, Norman, OK 13069, or call (405) 364-1071.

MICRO-8 NEWSLETTER, says editor Hal Singer, will continue until the end of this year. We think it might continue even longer if it gets the necessary subscription support. Hal has been trying to come up with viable solutions. One possibility is a volume of all Micro-8 newsletters in one package. He still has a quantity of back issues and would either produce a volume, or provide individual back issues to anyone asking. Let him know your feelings by writing MICRO-8 User Group, Cabrillo Computer Center, 4350 Constellation Rd., Lompoc, CA 93436.

CLASSES FOR BEGINNERS

Professor Richard C. McLaughlin of Cal State, Long Beach, has announced that he will be teaching three Saturday courses on computers for beginners. The purpose of the courses will be to acquire a functional understanding of computers which results in practical applications. The first five Saturdays (9/4-10/2) will constitute a course on the building of a microcomputer. No actual construction will be requried, but the class should be valuable to anyone using a micro or mini, or planning to build a kit. The Saturday sessions will go from 8:30 a.m. to 2:30 p.m. in the Liberal Arts Building 1, Room 210.

The second course will cover programming many types of computers including micros, minis and large time-sharing services. BASIC is the language to be taught. The dates are October 9-November 6, same time and place as the first class.

The third and last in the series of courses will cover the use of computer terminals and setting up work stations tailored to the end user's special needs. The dates for this class are November 13 to December 18. Fee for all three classes is $66 each. Contact CSULB, Office of Continuing Education, 1250 Bellflower Blvd., Long Beach, CA 90840, or call (213) 498-5561.

NEW STORES

HOBOKEN COMPUTER WORKS, P.O. Box M1055, Hoboken, NJ 07030 carries major brand kits, hardware, software, games, and literature.

COMPUTERWARE, 330 1st St., Suite B, Encinitas, CA 92024 features SWTP 6800, and Poly-88, as well as major brand accessories and used computers.

Dallas' first computer store opened June 19th. THE MICRO STORE, 634 S. Central Expressway, Richardson, TX is owned by Dr. Portia Isaacson and David Wilson. Demonstration systems are on display and major brand hardware products are on the shelves.

CONTESTS

TV DAZZLER Software Contest, sponsored by People's Computer Company ends September 30, 1976. The object is to develop a program resulting in a new display using the Cromemco TV Dazzler. Send entries to PCC, P.O. Box 310, Menlo Park, CA 94025.

WIN A MEMORY, a contest sponsored by E & U Engel Consulting is designed to produce the ideal memory and interface controller for hobbyists. They are challenging us to compete in the design contest in order to produce winning entries, and hence optimum products. Even if you are not design-experienced enough to enter the contest, Engel invites your response just to know what the optimum requirements would be for your system. Write for details and specifications to 1719 S. Carmelina Ave., Los Angeles, CA 90025.

CONVENTIONS AND CONFERENCES

COMPCON 76 FALL, the 13th IEEE Computer Society International Conference, will be held at the Mayflower Hotel, Washington, D.C., September 7-10. Two pre-conference tutorials, "Designing with Microprocessors: A Hands-on Workshop" and "Structured Programming," will be held Sept. 7th at 9 a.m. Advance registration fees for the conference are $65 for non-members and $50 for members. Advance registration fees for tutorial on structured programming are $65 and $50. And for "Designing with Microprocessors," $75 and $60. Complete program and registration information may be obtained by contacting COMPCON, P.O. Box 639, Silver Spring, MD 20901; (301) 439-7007.

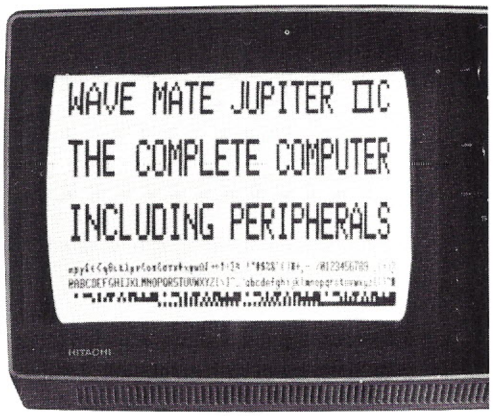
IEEE TUTORIALS, October 12th, will cover Software Design Techniques and Data Base Management preceding the Second International Conference on Software Engineering on October 13-15. Location is the Jack Tar Hotel in San Francisco. Register prior to October 1st by contacting Software Engineering, P.O. Box 639, Silver Spring, MD 20901.

The third in the series of INTERNATIONAL CONFERENCES ON PATTERN RECOGNITION will be held November 8-11 at the Del Coronado Hotel in Coronado, Ca. Registration closes October 4th, $70 for members and $85 for non-members. Contact Harry Hayman at the above IEEE address in Silver Spring.

TECHNIHOBBY-USA has been announced as an exposition for the sophisticated hobbyist. Sponsored by Marketing Ventures, Inc., Beltsville, MD, Technihobby-USA will feature exhibits of the latest advancements, symposiums, tutorials and auctions. A 4-city tour is slated beginning in Boston, November 4-6, then to Washington, D.C., November 12-14th, to Atlanta, November 19-21 and finally in Los Angeles, December 5-7. Club participation is invited by contacting Robert E. Harar, 5012 Herzel Place, Beltsville, MD 20705; (301) 937-7177.

Now we're on TV!

Wave Mate introduces Jupiter IIC, a complete computer system incorporating a monitor quality TV interface. This system provides everything you need to create and run application programs. Jupiter IIC includes a CPU with 8K dynamic RAM and 3K ROM memory, video terminal interface and keyboard, and dual audio cassette tape interface. The TV interface features upper and lower case and Greek character sets, and dot graphics. The dual audio cassette interface provides start/stop operation and operates at 300, 600, or 1200 baud. And of course we still provide these high-quality features: burn-in tested IC's, socketed IC's, complete documentation, and more.



ATTENTION: ORIGINAL EQUIPMENT MANUFACTURERS

Jupiter IIC provides OEMs with the tools to get systems into the field faster and at lower cost. (1) Use Jupiter IIC as your development system. Perfect for development of software and special hardware. (2) Use Jupiter IIC for prototype systems. Only Wave Mate provides the tools – wire wrap modules, universal modules, complete documentation – to easily tailor system logic and add customized interfaces within the basic Jupiter IIC package.

SOFTWARE

All Jupiter IIC systems feature a sophisticated monitor/debugger package including a versatile interrupt system and I/O monitor call instructions. A programmable macro editor and expanded assembler are also provided. Proposed ANSI standard BASIC is included with Jupiter IIC.

THE JUPITER IIC KIT: $2200

The kit includes the CPU, software debugger and monitor module, 8K dynamic memory, module cage, power supply, front panel, video interface, cassette interface, and all the documentation required to assemble, run, and understand the system as well as modification instructions for a black and white TV set.

THE JUPITER IIC ASSEMBLED SYSTEM: $3200

All components of the Jupiter IIC kit plus two audio cassette units and a 12-inch black and white TV set. The complete system is shipped with all components assembled and tested.

SPECIFICATIONS

CPU

MC 6800; eight-level interrupt, prioritized and maskable by level; single-cycle and block DMA

DUAL AUDIO CASSETTE

Complete paper tape replacement; start/stop motor control; 300, 600, or 1200 baud (crystal controlled); error correction

VIDEO TERMINAL INTERFACE

64 x 16 lines (32 lines optional); Upper and lower case, plus Greek alphabet; 7 x 12 format, 128 dot (hor.) x 48 dot (vert.) graphics (96 dot optional)

MEMORY

8K dynamic RAM; 3K ROM; 1K dual-port static RAM

KEYBOARD

Generates full 128-character ASCII set

☐ Send details on Jupiter II systems
☐ Have salesman call
Name ______
Title ______
Company ______
Address ______
City ______ State ______ Zip ______
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Wave Mate

WAVE MATE 1015 West 190th Street, Gardena, California 90248 Dept. 201 Telephone (213) 329-8941

CIRCLE NO. 3 ON INQUIRY CARD

CALL FOR PAPERS IN PERSONAL COMPUTING

The 1977 National Computer Conference will feature several events for personal computing enthusiasts including the Personal Computing Fair, exhibits of personal equipment by manufacturers, seminars and social events in addition to paper presentation.

Two days of Personal Computing papers and panel presentations are being planned. Papers in any subject of interest are sought including personal computer software, hardware designs and trends, innovative applications, influence of the movement on the computer industry and computer science education, standards, predictions of trends, all in personal computing.

'77 NCC expects this conference to be the largest gathering of data processing users and computer professionals with expected attendance of approximately 30,000. Comments and suggestions are invited. Contact Dr. Portia Isaacson, Conference Chairman, Mathematical Sciences, University of Texas at Dallas, Richardson, TX 75080.

8080 BASIC FROM LIVERMORE LABS

Information released in the July 19th *Electronic Engineering Times* created a flurry of excitement when the announcement was made that the Livermore Labs had written a stripped-down version of BASIC with floating point package and planned to put it in the public domain. The expected release was to have taken place at the end of July, according to the article. However, at this writing no definite news is available about its actual release. Since the Livermore Labs spokesman suggested they might donate the program to the Intel Users Library, we checked there, but nothing had been finalized as of the first week of August. Attempts to reach sources at Livermore Labs are yet unsuccessful, but we'll let you know what is available, when and where, just as soon as we know.

SEPTEMBER CALENDAR

Sept. 1 SCCS Valley Chapter Meeting, 7:15 p.m. at Harvard School Auditorium, 3700 Coldwater Canyon Ave., North Hollywood, CA. Call John Scott for more information at (213) 849-7111 days or (213) 849-4094 eves., or write P.O. Box 6545, Burbank, CA. 91510.

Sept. 3 8080 Users Group Meeting UCTI, Scotch Plaines, N.J. Write S. Libes, ACG-NJ at 1776 Raritan Rd., Scotch Plaines, NJ 07076 for more information.

Sept. 4 Hardware Clinic, SCCS Valley Chapter, 10 a.m. to 4 p.m. at Harvard SCCS facilities. Phone and address information listed above.

Sept. 4-Oct. 2 Class for beginners on building computers, Cal State, Long Beach, Saturdays, 8:30 a.m.-2:30 p.m. Conducted by Prof. Richard C. McLaughlin, Instructional Media Dept. Fee is $66, and class is good for 2 college units. Contact Office of Continuing Education, 1250 Bellflower Blvd., Long Beach, CA 90840 (213) 498-5561.

Sept. 7 AGCNJ Meeting Somerset County Voc/Tech. H.S. Write S. Libes at above address listed for 8080 User's Group.

Sept. 7-10 COMPCON 76, 13th IEEE Computer Society International Conference at Mayflower Hotel, Washington, D.C. For advance program and registration information, contact P.O. Box 639, Silver Spring, MD 20901, (301) 439-7007.

Sept. 8-10 Arrowhead Workshop, UCLA Conference Center, Lake Arrowhead, CA. Focus will be on reliability of integrated software/hardware computer systems and techniques for improving reliable computer architectures. Contact Dr. Ragnar Nilsen, Hughes Aircraft Co., Bldg. 262/B69, 8433 Fallbrook Av., Canoga Park, CA 91304.

Sept. 8 California Computer Show, 1 to 7 p.m. at Marriott Hotel in Los Angeles. Will feature DP equipment and Systems for OEM and end-user markets. For more information contact Norm DeNardi Enterprises, 95 Main St., Los Altos, CA 94022. (415) 941-8440.

Sept. 11 CENOACA, Central Oklahoma Amateur Computing Assn. meeting 10 a.m. at Oklahoma City Warr Acres Branch Library, N.W. 63rd and MacArthur, Oklahoma City. Write that address for more information or call (405) 364-1071.

Sept. 14 Santa Monica Bay Chapter of the SCCS meets 7:15 p.m. at Veterans Admin. Hospital in W. LA. For more information, contact Larry Press (213) 399-2083.

Sept. 15 SCCS Board of Directors Meets 7:30 p.m. at Harvard School Facilities.

Sept. 18 COLA Executive Board Meeting L.A. DWP, 111 N. Hope St., Los Angeles in room 1276 at 10 a.m. Contact P.O. Box 43677 L.A., CA 90043 for more information.

Sept. 20-22 IOSA 13th Annual U.S. Input/Output Systems Seminar in New York City. Contact C. A. Greathouse, IOSA, P.O. Box 1333, Stamford, CT 06904.

Sept. 22-24 APL 76, in Ottawa Canada. Contact conference chairman B. J. Daly, I.P. Sharp Assoc., Ltd., 210 Gladstone Av., Ottawa K2P OY6, Canada.

Sept. 24 SCCS General Meeting and Elections. 10 a.m. to 4 p.m. at the Roger Young Auditorium, 936 Washington Blvd., Los Angeles. For more information, call (213) 472-0388.

Sept. 25 Ventura County Computer Society meets 9:30 a.m. at Camarillo Library, 3100 Ponderos Dr., Camarillo, CA. For more information, send a stamped, self-addressed envelope to P.O. Box 525, Port Hueneme, CA 93041.

Sept. 26-29 IEEE's EASCON '76, Stouffer's National Center Inn, Arlington, VA. Contact A. J. Stanziano, Hazeltine Corp., 2001 Jefferson Davis Hwy, Suite 811, Arlington, VA 22202.

Sept. 28-30 Canadian Computer Show, Montreal Canada. Conference and show sponsored by Canadian Information Processing Society. Contact Canadian Computer Show, 481 University Av., Toronto, Canada M5W 1A7.

Sept. 28 San Gabriel Chapter of SCCS meets 7:30 p.m. at Pasadena Central Library Auditorium, 385 E. Walnut St. at Garfield. Send SASE for more information to P.O. Box 9459, N. Hollywood, CA. 91609.

Sept. 30 TV Dazzler Software Contest deadline. Sponsored by PCC, P.O. Box 310 Menlo Park, CA 94025.

Sept. 30 COLA Tour of L.A. Unified School District's Computing Center, 1425 S. San Pedro St., Los Angeles, CA at 4:30 p.m. Contact COLA, P.O. Box 43677, Los Angeles, CA 90043.

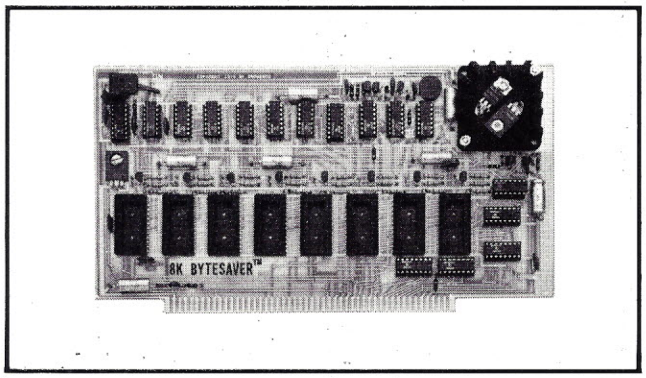
Educational Organization

COLA (Computer Organization of Los Angeles) is an assemblage of school teachers and administrators interested in advancing computer learning in the classroom. The organization meets regularly and publishes a monthly newsletter, and is preparing a quarterly journal called *Insight.* Some of the articles the journal will publish will be "Computer Assisted Instruction: Assessment and Evaluation" (Oct. 1976 issue); "Teaching a Programming Language: A Survey of the State of the Art" (Feb. 1977 issue); "Minicomputers in Education: Another Alternative in Computer Science" (May 1977 issue).

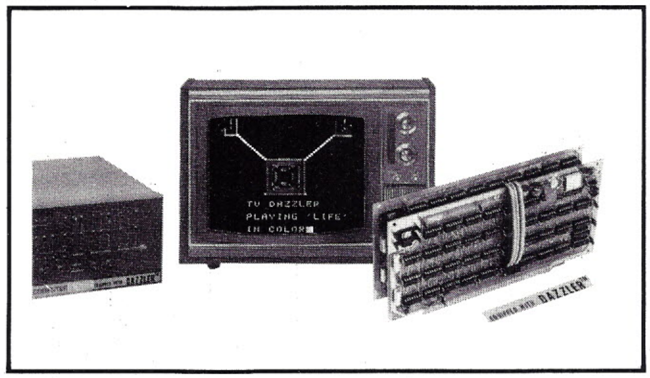
COLA solicits individual and group participation and invites papers for publication. They also invite commercial advertising. Anyone interested in knowing more about COLA and its publications may write president, Alyce Jackson, P.O. Box 43677, Los Angeles, CA 90043.

Four ways to get more out of (or into) your computer

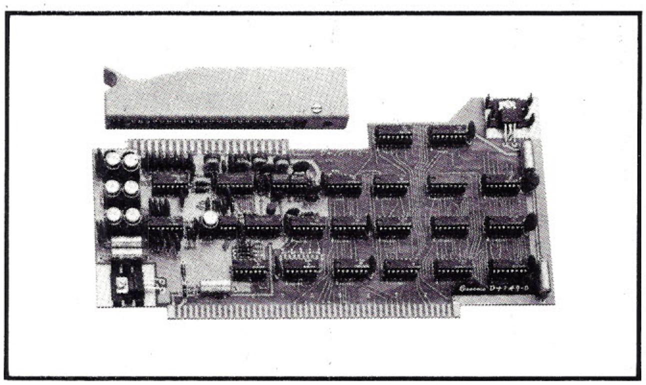
Here are four of our most popular computer peripherals. They let you do a lot more with your Altair 8800 or IMSAI 8080. They are simple to use and simple to install. And they all have the combined quality and low price that has made Cromemco the leading name in microcomputer peripherals. Cromemco's delivery is prompt, too.
Watch this space for other exciting new Cromemco products to come.



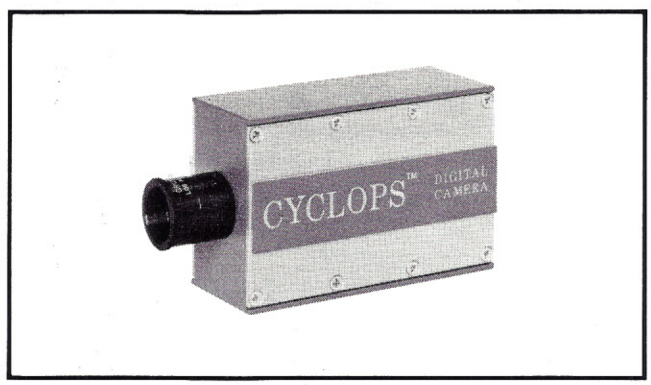
The easy way to put programs into PROM. Cromemco's Bytesaver™ gives you a **place** for up to 8K of PROM memory using 2704/2708 PROMs. **Also gives you a built-in PROM** programmer (saves buying one separately). Enough memory capacity to hold powerful programs such as 8K BASIC. Kit (Model 8KBS-K): $195. Assembled (Model 8KBS-W): $295.



Let your color TV be your display terminal. You can have a full-color computer display terminal at unbelievably low cost with the Cromemco TV Dazzler™. You can display multi-colored charts, graphs, educational material, games. Requires only 2K-byte memory for 128 x 128-element picture. Kit (Model CGI-K): $215. Assembled (Model CGI-W): $350.



Fast analog I/O with 7 channels. Couples your digital computer to an analog world. This advanced board lets you input 7 channels of analog to your computer **and** output 7 channels of analog to feed to output devices. Also has an 8-bit parallel I/O port. Very fast conversion — only 5 microseconds. Kit (Model D+7A-K): $145. Assembled (Model D+7A-W): $245.
JOYSTICK ALSO AVAILABLE: *Kit (Model JS-1-K): $65. Assembled (Model JS-1-W): $95.*



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BIORYTHMS: Art Childs, 335 N. Adams, #210, Glendale, Ca. 91206 (213) 243-5179

GAMES: George Tate, 3544 Dahlia Ave., Los Angeles, Ca. 90026 (213) 663-2604

MITS BASIC: Jon Walden, 11557 Sunshine Terrace, Studio City, Ca. 91604 (213) 769-6569

ELECTRONIC MUSIC: Prentiss Knowlton, 255 N. Madison Ave., Suite #4, Pasadena, Ca. 91101 (213) 449-6034

VOICE SYNTHESIS: D. Lloyd Rice, 821 Pacific, #4, Santa Monica, Ca. 90405 (213) 392-5230 (hm), (213) 825-2773 (bus).

ASTROLOGY AND ESP: Al Manning, ESP Laboratory, 7559 Santa Monica Blvd., Los Angeles, Ca. 90046 876-9984.

MARK-8 HARDWARE, CORRECTIONS, ADD-ONS, AND SOFTWARE: Ronald Carlson, 14014 Panay #255 Marina del Rey, Ca. 90291.

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CIRCLE NO. 5 ON INQUIRY CARD

New readers may wonder what coordinators do and where they come from, so let me offer a few words of explanation. The basic idea is to establish a central clearing house for information on a given topic—a place where people can go with questions and where people working in the area can share their experience. What an individual coordinator does is, of course, entirely up to him. As coordinator for biofeedback, I have corresponded with many people, have introduced people to a lot of people with common interests, and have occasionally written a paragraph or two for *INTERFACE*. I've also been getting together a mailing list, and will eventually send out a self-addressed, stamped envelope newsletter. Some day, we may have a special interest group with regular newsletters, and meetings.

Where do coordinators come from? They are all volunteeres. If you haven't all ready done so, please consider coordinating some topic. It's a good way to meet people, gather information, and help the hobbyist cause. You don't even have to be an expert—I signed up to coordinate biofeedback because I was curious to learn about it and I knew virtually nothing when I began.

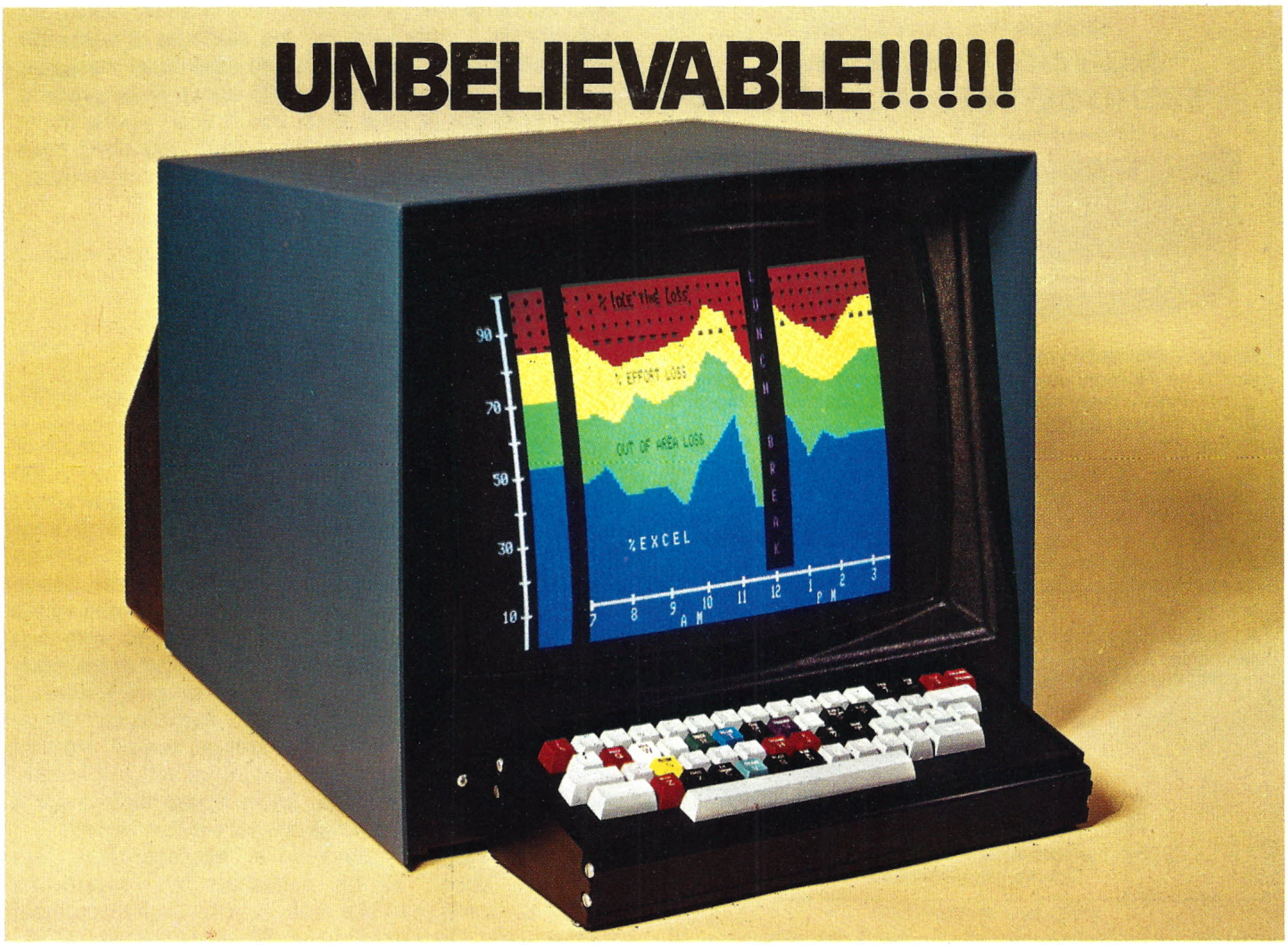
A GOOD BOOK

Faithful readers will recall that from time to time we digress into discussion of tutorial material for the beginner. I came across an excellent book recently, which combines tutorial information on electronics and construction with application-oriented material on electronic music: *Electronic Projects for Musicians* by Craig Anderton. It is available through the PCC Bookstore, P.O. Box 310, Menlo Park, CA 94025 for $6.95. The first five chapters cover theory and components, suppliers, tools and construction techniques. Anderton deals with the mechanical things such as connectors, drilling holes in chassis, making attractive enclosures and labels, etc., as well as electronics. Next come plans for 19 projects for musicians (all available in kit form from Godbout), and finally a neat chapter on troubleshooting. If all of this isn't enough, the book is very well written. It is clear, but not heavy—even humorous! I particularly liked the part where he stresses the importance of attitude, of having your head in a good place for troubleshooting—just like *Zen and the Art of Motorcycle Maintenance.*

EDUCATION

One thing which you may have done with your computer is show it to children—letting them play with it, explore its capabilities, and learn to control it. If you haven't done so yet, try it. You will be amazed at how quick kids are, how easily they get hooked on computers, and what a good time you'll have. If you really get into it, you might "go public" a little bit. Set your machine up in a branch library for an afternoon (I once left a terminal in a library for two years) or bring it by a grade school classroom.

There are even a number of child-oriented computer



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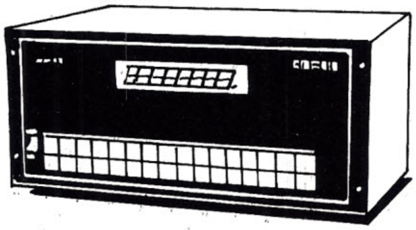

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CIRCLE NO. 7 ON INQUIRY CARD

centers around the country located in museums or libraries. The grandaddy of them all is the Community Computer Center (CCC) in Menlo Park, California. I had a chance to visit CCC last week and to meet Joanne Verplank, the director. What a nice place—about 400 kids come in every month to play games, learn about computers and learn to program. They come on field trips from schools, they come to classes, they come to buy terminal time on an hourly basis, they come for birthday parties, they come to potluck suppers, they come to paint huge dragons on the walls, etc. While I was there, I watched Joanne working with a group of kids and took some pictures of them. The kids don't even look up when you point a camera at them!

You should also know that, being oriented toward children, CCC has an extensive, ever-growing games library. They have published a large format book of BASIC games (*What to Do after You Hit Return,* $6.95) and they distribute game programs at a nominal cost. If you want some game playing program or if you would like to contribute one of yours to the public domain for distribution by CCC, contact them at 1919 Menalto Ave., Menlo Park, CA 94025. They are good people and we should help them and use them as a games repository.

You may recall that last month Art Armstrong took over as coordinator for micros in schools and I said a few words about his Altair assembly project at Venice High in Los Angeles. Since then, I have learned of similar projects in San Jose, Sunnyvale, Modesto, North Hollywood, and the San Lorenzo Valley (all in California). The June 1976 issue of *Byte* had an article on a school project in Somers, NY. In some cases, the schools have gotten kits for the students to assemble and in others they have purchased assembled machines. I am personally very enthusiastic about these projects and would like to hear from you if you have a micro in your school or are planning one. If you don't have one, start prodding your teachers, administrators, etc. to get one.

PROGRAMS WANTED

Here's an obvious twist on the applications exchange, but it took the loving genius of Dan Rosset to come up with it. Instead of telling what he has done or plans to do, Dan has a request. He wants an 8080 program to generate the set of alphabetic equivalents for a given telephone number. For instance, if your phone number were "478-2374," it would also be "GRUBERG" (check that out on the nearest phone dial). The problem is that it would also be equivalent to 2186 other strings. A lot of installations with fast line printers have programs to generate all of the equivalent permutations, but in order to be practical on a micro, a program would have to incorporate clever screening rules to eliminate strings which are not likely to be pronouncable (like strings with triple consonants or vowels). Let us know if you have such a program—if you don't, write one for old Dan Rosset.

Mitchell Waite is compiling a "Microcomputer Application Digest" to be published by Howard W. Sams & Company. The text is arranged by subject (Biorhythms, Electronic Music, Speech Analysis, RTTY, Terminals, Business Systems, Security, Video Art, Video Games, etc.). Each section will cover several real systems, a brief tutorial on the subject, block diagrams, list of components, and names of contributing parties. Sources of additional information will also be provided.

At this point, he is seeking inputs from all interested persons who wish to share their experience to increase the exchange of information in their application area.

Those who want to be in the book may drop him a postcard with their name, address, phone number, and a brief explanation of their application. You will then be sent a form to fill out which will have the information in a standard, easy to read format. This will be collated into the book.

Not all applicatoins need to be up and running to qualify for the text. Ideas, well thought out, are as valuable as finished systems.

If you wish our field to expand, Mitch urges you to take time to drop him a postcard. It's by spreading ideas that new ideas grow.

Write: Mitchell Waite, H. S. Dakin Company, 3101 Washington Street, San Francisco, Ca. 94115.

In closing, let me make a request of my own. Is anyone working on the conversion of the Huntington educational simulation programs to MITS BASIC? They are in the public domain, very well documented (DEC distributes the documentation at nominal cost), written in BASIC, and good. I would love to hear from anyone who is putting or plans to put the Huntingtons on an Altair.

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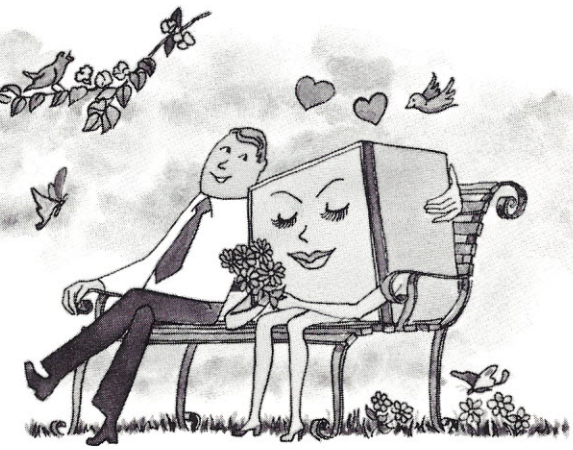

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Letters to the Editor

Dear Editor:

At present *INTERFACE* is running a series of articles on Maintenance of the ASR 33. At some future date please publish for sale the whole series under one cover. Since some back issues no longer exist, this will be the only way for some to go about getting the complete series.

Cliff Young
W. Columbia, SC

Back issues and reprints are in strong demand. Some back issues of INTERFACE Magazine are still available through publisher, McPheters, Wolfe & Jones. You'll find the address on the masthead of this magazine. The December, February and March issues are depleted, but computer stores who carry our magazine often have those issues on hand.

We have no plans to reprint Cliff Sparks' series on teleprinter maintenance at the moment . . . and we're sorry to disappoint so many of you.

Editor

Dear Editor:

I have just sent off a request for your available back issue of *INTERFACE*. I was out of the country until March of this year and did not find out about your fine publication until a month later. I have been getting my own subscription since the May installment, so this leaves a hole for the February and March issues. I feel that having a complete set of *INTERFACE* would be very useful to me in the future. You have quite a magazine established in such a short time! In light of this, could you suggest a method to obtain such material, perhaps by listing my request in *INTERFACE*.

Thanks for your help in completing my library and for the excellent work you put out to us each month.

Pat Snyder
RR#3
Fremont, NE 68025

Dear Editor:

In the June issue of *INTERFACE*, on page 49, there are three "navigational maps": compass, clock, and circle.

The compass and circle labels are reversed. In addition, they are numbered incorrectly. A compass conventionally has 0 degrees and 360 degrees at TOP of the circle. The circle type also should be numbered to a clock and a compass—with numbers originating from the top. Also, the compass is sometimes expressed in GRADS with a total circle being equal to 400 and each quadrant being equal to 100. (It is supposed to be easier to use than the 360 degree compass.) The GRADS COMPASS also originates at the TOP of the cirlce.

Because everyone who uses a compass is accustomed to this arrangement, it should be continued. It eases the transition. It would not be more difficult for others than the conventional compass arrangement since they have no prior experience to change.

Edward L. Tottle
Baltimore, MD

You bring up some excellent points in your letter, but the three navigational maps are labelled as we intended.

First, you must keep in mind that in that part of the article, we were surveying what has already been done in some Star Trek games, not what should be done.

We didn't call the 360 degree type of navigational map a "compass" type because of the reason you mention—it doesn't start at zero on the top. We used the circle name instead, to indicate that it ranges from zero to 360 degrees. The "compass" name was applied to the first type because the eight numbers indicate the eight points on a compass (east, northeast, north, etc.).

In either case, the names were arbitrary ones that we assigned to make it easier to visualize each navigational system. Perhaps we should have explained them in more detail.

Editor

Dear Editor:

By all means, resist replacement by a random number generator! Conversion to a servo-loop is far more sophisticated, provided you can avoid the following sub-routine CALL.

```
1   M = 1
1   DO 4
    WRITE (3,2)
2   FORMAT (//, LOX, "HELP, I AM
    TRAPPED IN A DO-LOOP!"
3   M = M + 1
4   CONTINUE
    GO TO 1
```

Seriously, keep up the good work!

F. W. Chesson
Waterbury, Conn.

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Combining the computer, video terminal and dynamic memory on a single board has resulted in a large reduction in chip count, which means more reliability and lowered cost. Since the Apple comes fully assembled, tested & burned-in and has a complete power supply on-board, initial set-up is essentially "hassle free" and you can be running within minutes. At $666.66 (including 4K bytes RAM!) it opens many new possibilities for users and systems manufacturers.

You Don't Need an Expensive Teletype.

Using the built-in video terminal and keyboard interface, you avoid all the expense, noise and maintenance associated with a teletype. And the Apple video terminal is six times faster than a teletype, which means more throughput and less waiting. The Apple connects directly to a video monitor (or home TV with an inexpensive RF modulator) and displays 960 easy to read characters in 24 rows of 40 characters per line with automatic scrolling. The video display section contains its own 1K bytes of memory, so all the RAM memory is available for user programs. And the Keyboard Interface lets you use almost any ASCII-encoded keyboard.

The Apple Computer makes it possible for many people with limited budgets to step up to a video terminal as an I/O device for their computer.

No More Switches, No More Lights.

Compared to switches and LED's, a video terminal can display vast amounts of information simultaneously. The Apple video terminal can display the contents of 192 memory locations at once on the screen. And the firmware in PROMS enables you to enter, display and debug programs (all in hex) from the keyboard, rendering a front panel unnecessary. The firmware also allows your programs to print characters on the display, and since you'll be looking at letters and numbers instead of just LED's, the door is open to all kinds of alphanumeric software (i.e., Games and BASIC).

8K Bytes RAM in 16 Chips!

The Apple Computer uses the new 16-pin 4K dynamic memory chips. They are faster and take ¼ the space and power of even the low power 2102's (the memory chip that everyone else uses). That means 8K bytes in sixteen chips. It also means no more 28 amp power supplies.

The system is fully expandable to 65K via an edge connector which carries both the address and data busses, power supplies and all timing signals. All dynamic memory refreshing for both on and off-board memory is done automatically. Also, the Apple Computer can be upgraded to use the 16K chips when they become available. That's 32K bytes on-board RAM in 16 IC's—the equivalent of 256 2102's!

A Little Cassette Board That Works!

Unlike many other cassette boards on the marketplace, ours works every time. It plugs directly into the upright connector on the main board and stands only 2" tall. And since it is very fast (1500 bits per second), you can read or write 4K bytes in about 20 seconds. All timing is done in software, which results in crystal-controlled accuracy and uniformity from unit to unit.

Unlike some other cassette interfaces which require an expensive tape recorder, the Apple Cassette Interface works reliably with almost any audio-grade cassette recorder.

Software:

A tape of **APPLE BASIC** is included free with the Cassette Interface. Apple Basic features immediate error messages and fast execution, and lets you program in a higher level language immediately and without added cost. Also available **now** are a dis-assembler and many games, with many software packages, (including a macro assembler) in the works. And since our philosophy is to provide software for our machines free or at minimal cost, you won't be continually paying for access to this growing software library.

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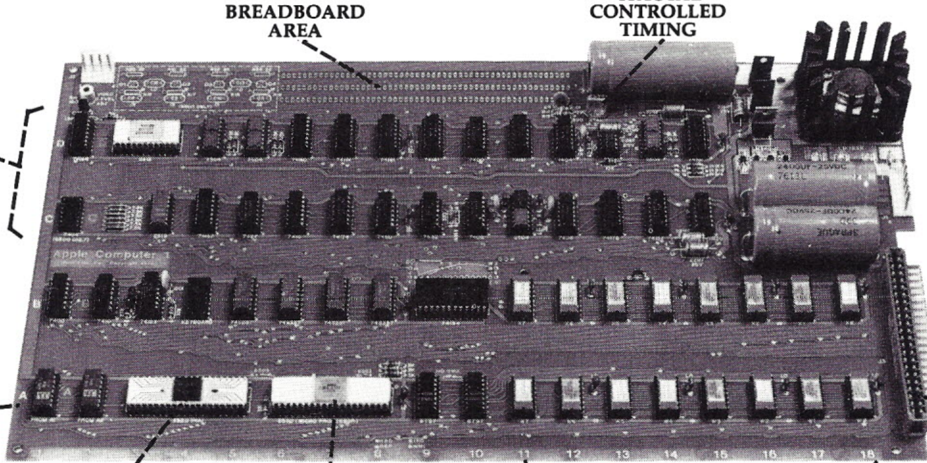
* includes 4K bytes RAM



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6502 DISASSEMBLER

by ALLEN BAUM &
STEPHEN WOZNIAK
Apple Computer Co.
Palo Alto, CA.

Description

This subroutine package is used to display single or sequential 6502 instructions in mnemonic form. The subroutines are tailored to disassemblers and debugging aids, but tables with more general usage (assemblers) are included. The subroutines occupy one page (256 bytes) and tables most of another. Seven page zero locations are used.

Features

Four output fields are generated for each disassembled instruction: (1) Address of instruction, in hexadecimal (hex); (2) Hex code listing of instruction, 1 to 3 bytes; (3) 3-character mnemonic, or "???" for invalid ops (which assume a length of byte); and (4) Address field, in one of the following formats.

Format	Address Mode
(empty)	Invalid, Implied, Accumulator.
$12	Page zero.
$1234	Absolute, Branch (*target* printed).
#$12	Immediate
$12, X	Zero page, indexed by X.
$12, Y	Zero page, indexed by Y.
$1234, X	Absolute, indexed by X.
$1234, Y	Absolute, indexed by Y.
($1234)	Indirect
($12, X)	Indexed Indirect.
($12), Y	Indirect Indexed.

Note that unlike MOS TECHNOLOGY assemblers, which use "A" for accumulator addressing, the APPLE disassembler outputs an empty field to avoid confusion and facilitate byte counting.

Usage

The following subroutine entries are useful:

(a) DSMBL: Disassembles and displays 20 sequential instructions beginning at the address specified by the page zero variables PCL and PCH. For example, if called with $D2 in PCL and $38 in PCH, 20 instructions beginning at address $38D2 will be disassembled. PCL and PCH are updated to contain the address of the last disassembled instruction. Must be called with 6502 in hexadecimal mode ('D' status bit clear). All processor registers are altered (except S—stack pointer). Uses INSTDSP and PCADJ.

(b) INSTDSP: Disassembles and displays a single instruction whose address is specified by PCL and PCH. Must be called in hexadecimal mode. All processor registers (except S) are altered. Uses PCADJ3, PRPC, PRBLNK, PRBL2, PRNTAX, PRBYTE, and CHAROUT.

(c) PRPC: Outputs a carriage return, 4 hex digits corresponding to PCH and PCL, a dash, and 3 blanks. Alters A, clears X. Uses PRNTAX and CHAROUT.

(d) PRNTX: Outputs the contents of X as two hex digits. Alters A. Uses CHAROUT.

(e) PRNTAX: Outputs two hex digits for the contents of A, then two hex digits for the contents of X. A is altered. Uses CHAROUT.

(f) PRNTYX: Same as PRNTAX except that Y and X are output. Alters A. Uses CHAROUT.

(g) PRBLNK: Outputs 3 blanks. Alters A, clears X. Uses CHAROUT.

(h) PRBL2: Outputs the number of blanks specified by the contents of X (0 for 256 blanks). Alters A, clears X. Uses CHAROUT.

(i) PRBL3: Outputs a character from the A register followed by X-1 blanks. In other words, X specifies the total number of characters output. (0 for 256 blanks). Alters A, clears X. Uses CHAROUT.

(j) PCADJ: (PCL, PCH) + 1 + (contents of page zero variable LENGTH) →Y & A (low order byte in Y). For example, if PCL = $D2, PCH = $38, and LENGTH = 1 (corresponding to a 2 byte instruction), PCADJ will leave Y = $D4 and A = $38. X is always loaded with PCH.

(k) PCADJ2: Same as PCADJ except that A is used in place of LENGTH.

(l) PCADJ3: Same as PCADJ2 except that the increment (+1) is specified by the carry (set = +1, clear = +0).

Running as a Program

The following program will run a disassembly.

```
9F0     20    0     8     JSR DSMBL
9F3     4C    1F    FF    JMP MONITOR
```

Supplied on APPLE-1 cassette tapes.

First, put the starting address of code you want disassembled in PCL (low order byte) and PCH (high order byte). Then type 9F0 R CR (on APPLE-1 system). 20 instructions will be disassembled. Hitting R CR again will give the next 20, etc.

Cassette tapes supplied for the ACI-1 (APPLE Cassette Interface) are intended to be loaded from $800 to $9FF.

Non-APPLE Systems

Source and object code supplied occupies page 8 and 9. All code is on page 8, tables on page 9. These tables may be relocated at will: MODE, MODE2, CHAR1, CHAR2, MNEML, and MNEMR. The code may also be relocated. Be careful if you use pages 0 or 1. Page 1 is the subroutine return stack and page 0 must contain 7 variables (to use DSMBL). These may be relocated on page 0 but PCL must always immediately precede PCH for (Z-page) Y addressing.

locations used by supplied code	$40	FORMAT	Used by INSTDSP, DSMBL
	$41	LENGTH	
	$42	LMNEM	
	$43	RMNEM	
	$44	PCL	Used by PCADJ, INSTDSP, DSMBL
	$45	PCH	
	$46	COUNT	Used by DSMBL only

Modifications

(a) To change '#' to '=' for immediate mode change location $955 (on code enclosed) from a $A3 to a $BD.

(b) To skip the '$' (meaning hex) preceding disassembled values make the following changes:

```
946: 01   (was 81)
947: 02   (was 82)
94C: 11   (was 91)
94D: 12   (was 92)
94E: 06   (was 86)
95C: 05   (was 85)
951: 1D   (was 9D)
95B: 00   (was A4)
95C: 00   (was A4)
```

(c) To have address field of accumulator-addressed instructions print as 'A'.

(1) Must skip $ preceding disassembled values by making modification (b) above.
(2) Change the following locations.

```
949: 80   (was 00)
957: C1   (was A4)
```

(d) To add ROR and addressing modes change the following locations:

```
991: 9C   (was 00)     919: 02   (was 00)
9D1: 26   (was 00)     91A: 45   (was 40)
                       91B: B3   (was B0)
                       91D: 08   (was 00)
                       91F: 09   (was 00)
```

BROWN-OUT PROOF your ALTAIR 8800

With the unique **Parasitic Engineering** constant voltage power supply kit. A custom engineered power supply for your Altair. It has the performance features that no simple replacement transformer can offer:

*BROWN-OUT PROOF: Full output with the line voltage as low as 90 volts.
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*HIGH OUTPUT: 12 amps @ 8 volts; **2 amps total** @ ± 16 volts. Enough power for an 8800 full of boards.
*STABLE: Output varies less than 10% for any load. Regulators don't overheat, even with just a few boards installed.
*CURRENT LIMITED: Overloads can't damage it.
*EASY TO INSTALL: All necessary parts included.

Now more output

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Don't let power supply problems sabatoge your Altair 8800

PARASITIC ENGINEERING

PO BOX 6314 **ALBANY CA 94706**

CIRCLE NO. 10 ON INQUIRY CARD

```
                              XREF
                     FORMAT   EQU    $40
                     LENGTH   EQU    $41
                     LMNEM    EQU    $42
                     RMNEM    EQU    $43
                     PCL      EQU    $44
                     PCH      EQU    $45
                     COUNT    EQU    $46
                     PRBYTE   EQU    $FFDC
                     CHAROU   EQU    $FFEF
                              ORG    $800
0800 A9 13           DSMBL    LDA    #$13          COUNT FOR 20 INSTR DSMBLY.
0802 85 46                    STA    COUNT
0804 20 12 08        DSMBL2   JSR    INSTDSP       DISASSEMBLE AND DISPLAY INSTR.
0807 20 EF 08                 JSR    PCADJ
080A 85 44                    STA    PCL           UPDATE PCL,H TO NEXT INSTR.
080C 84 45                    STY    PCH
080E C6 46                    DEC    COUNT         DONE FIRST 19 INSTRS.?
0810 D0 F2                    BNE    DSMBL2        * YES, LOOP.  ELSE DSMBL 20TH.
0812 20 D3 08        INSTDS   JSR    PRPC          PRINT PCL,H.
0815 A1 44                    LDA    (PCL,X)       GET OP CODE.
0817 A8                       TAY
0818 4A                       LSR    A             * EVEN/ODD TEST.
0819 90 0B                    BCC    IEVEN
081B 4A                       LSR    A             *  TEST B1.
081C B0 17                    BCS    ERR           *  XXXXXX11 INSTR INVALID.
081E C9 22                    CMP    #$22
0820 F0 13                    BEQ    ERR           *  10001001 INSTR INVALID.
0822 29 07                    AND    #$7           MASK 3 BITS FOR ADDRESS MODE &
0824 09 80                    ORA    #$80          *  ADD INDEXING OFFSET.
0826 4A              IEVEN    LSR    A             * LSB INTO CARRY FOR
0827 AA                       TAX                  * LEFT/RIGHT TEST BELOW.
0828 BD 00 09                 LDA    MODE,X        INDEX INTO ADDRESS MODE TABL.
082B B0 04                    BCS    RTMODE        IF CARRY SET USE LSD FOR
082D 4A                       LSR    A             * PRINT FORMAT INDEX.
082E 4A                       LSR    A
082F 4A                       LSR    A             * IF CARRY CLEAR USE MSD.
0830 4A                       LSR    A
0831 29 0F           RTMODE   AND    #$F           MASK FOR 4-BIT INDEX.
0833 D0 04                    BNE    GETFMT        $0 FOR INVALID OPCODES.
0835 A0 80           ERR      LDY    #$80          SUBSTITUTE $80 FOR INVALID OP,
0837 A9 00                    LDA    #$0           SET PRINT FORMAT INDEX TO 0.
0839 AA              GETFMT   TAX
083A BD 44 09                 LDA    MODE2,X       INDEX INTO PRINT FORMAT TABLE.
083D 85 40                    STA    FORMAT        SAVE FOR ADDRESS FIELD FORMAT.
083F 29 03                    AND    #$3           MASK 2-BIT LENGTH.  0=1-BYTE,
0841 85 41                    STA    LENGTH        *  1=2-BYTE, 2=3-BYTE.
0843 98                       TYA                  * OP CODE.
0844 29 8F                    AND    #$8F          MASK IT FOR 1XXX1010 TEST.
0846 AA                       TAX                  * SAVE IT.
0847 98                       TYA                  * OP CODE TO A AGAIN.
0848 A0 03                    LDY    #$3
084A E0 8A                    CPX    #$8A
084C F0 0B                    BEQ    MNNDX3
084E 4A              MNNDX1   LSR    A
084F 90 08                    BCC    MNNDX3        FORM INDEX INTO MNEMONIC TABL.
0851 4A                       LSR    A
0852 4A              MNNDX2   LSR    A             * 1XXX1010 -> 00101XXX
0853 09 20                    ORA    #$20          * XXXYYY01 -> 00111XXX
0855 88                       DEY                  * XXXYYY10 -> 00110XXX
0856 D0 FA                    BNE    MNNDX2        * XXXYY100 -> 00100XXX
0858 C8                       INY                  * XXXXX000 -> 000XXXXX
0859 88              MNNDX3   DEY
085A D0 F2                    BNE    MNNDX1
085C 48                       PHA                  * SAVE MNEMONIC TABLE INDEX.
```

```
085D B1 44       PROP    LDA   (PCL),Y
085F 20 DC FF            JSR   PRBYTE
0862 A2 01               LDX   #$1
0864 20 E6 08    PROPBL  JSR   PRBL2
0867 C4 41               CPY   LENGTH        PRINT INSTR (1 TO 3 BYTES)
0869 C8                  INY                 *  IN A 12-CHARACTER FIELD.
086A 90 F1               BCC   PROP
086C A2 03               LDX   #$3           CHAR COUNT FOR MNEMONIC PRINT.
086E C0 04               CPY   #$4
0870 90 F2               BCC   PROPBL
0872 68                  PLA                 * RECOVER MNEMONIC INDEX.
0873 A8                  TAY
0874 B9 5E 09            LDA   MNEML,Y
0877 85 42               STA   LMNEM         FETCH 3-CHAR MNEMONIC.
0879 B9 9E 09            LDA   MNEMR,Y       *  (PACKED IN 2 BYTES)
087C 85 43               STA   RMNEM
087E A9 00       PRMN1   LDA   #$0
0880 A0 05               LDY   #$5
0882 06 43       PRMN2   ASL   RMNEM
0884 26 42               ROL   LMNEM         SHIFT 5 BITS OF CHAR INTO A.
0886 2A                  ROL   A             *   (CLEARS CARRY)
0887 88                  DEY
0888 D0 F8               BNE   PRMN2
088A 69 BF               ADC   #$BF          ADD '?' OFFSET.
088C 20 EF FF            JSR   CHAROUT       OUTPUT A CHARACTER OF MNEMONIC
088F CA                  DEX
0890 D0 EC               BNE   PRMN1
0892 20 E4 08            JSR   PRBLNK        OUTPUT 3 BLANKS.
0895 A2 06               LDX   #$6           COUNT FOR 6 PRINT FORMAT BITS.
0897 E0 03       PRADR1  CPX   #$3
0899 D0 12               BNE   PRADR3        IF X=3 THEN PRINT ADDRESS VAL.
089B A4 41               LDY   LENGTH
089D F0 0E               BEQ   PRADR3        NO PRINT IF LENGTH=0.
089F A5 40       PRADR2  LDA   FORMAT
08A1 C9 E8               CMP   #$E8          HANDLE REL ADDRESSING MODE
08A3 B1 44               LDA   (PCL),Y       SPECIAL (PRINT TARGET ADR)
08A5 B0 1C               BCS   RELADR        *   (NOT DISPLACEMENT)
08A7 20 DC FF            JSR   PRBYTE        OUTPUT 1- OR 2-BYTE ADDRESS.
08AA 88                  DEY                 *  MORE SIGNIFICANT BYTE FIRST
08AB D0 F2               BNE   PRADR2
08AD 06 40       PRADR3  ASL   FORMAT        TEST NEXT PRINT FORMAT BIT.
08AF 90 0E               BCC   PRADR4        IF 0, DON'T PRINT
08B1 BD 51 09            LDA   CHAR1-1,X     *  CORRESPONDING CHARS.
08B4 20 EF FF            JSR   CHAROUT       OUTPUT 1 OR 2 CHARS.
08B7 BD 57 09            LDA   CHAR2-1,X     *  (IF CHAR FROM CHAR2 IS 0,
08BA F0 03               BEQ   PRADR4        *     DON'T OUTPUT IT)
08BC 20 EF FF            JSR   CHAROUT
08BF CA          PRADR4  DEX
08C0 D0 D5               BNE   PRADR1
08C2 60                  RTS                 *RETURN IF DONE 6 FORMAT BITS.
08C3 20 F2 08    RELADR  JSR   PCADJ3        PCL,H + DISPL + 1 TO A,Y.
08C6 AA                  TAX
08C7 E8                  INX
08C8 D0 01               BNE   PRNTYX        *     +1 TO X,Y.
08CA C8                  INY
08CB 98          PRNTYX  TYA
08CC 20 DC FF    PRNTAX  JSR   PRBYTE        PRINT TARGET ADR OF BRANCH
08CF 8A          PRNTX   TXA                 *  AND RETURN
08D0 4C DC FF            JMP   PRBYTE
08D3 A9 8D       PRPC    LDA   #$8D
08D5 20 EF FF            JSR   CHAROUT       OUTPUT CARRIAGE RETURN.
08D8 A5 45               LDA   PCH
08DA A6 44               LDX   PCL
08DC 20 CC 08            JSR   PRNTAX        OUTPUT PCH AND PCL.
08DF A9 AD               LDA   #$AD
08E1 20 EF FF            JSR   CHAROUT       OUTPUT '-'
08E4 A2 03       PRBLNK  LDX   #$3           BLANK COUNT.
08E6 A9 A0       PRBL2   LDA   #$A0
08E8 20 EF FF    PRBL3   JSR   CHAROUT       OUTPUT A BLANK.
```

```
08EB CA             DEX
08EC D0 F8          BNE     PRBL2       LOOP UNTIL COUNT = 0.
08EE 60             RTS
08EF A5 41   PCADJ  LDA     LENGTH      0=1-BYTE, 1=2-BYTE, 2=3-BYTE.
08F1 38      PCADJ2 SEC
08F2 A4 45   PCADJ3 LDY     PCH
08F4 AA             TAX                 * TEST DISPL SIGN (FOR REL
08F5 10 01          BPL     PCADJ4      *   BRANCH).  EXTEND NEG
08F7 88             DEY                 *   BY DECREMENTING PCH.
08F8 65 44   PCADJ4 ADC     PCL
08FA 90 01          BCC     RTS1        PCL+LENGTH (OR DISPL) +1 TO A.
08FC C8             INY                 *  CARRY INTO Y (PCH)
08FD 60      RTS1   RTS
                    ORG     $900
0900 40      MODE   DFB     $40
0901 02             DFB     $2
0902 45             DFB     $45
0903 03             DFB     $3
0904 D0             DFB     $D0
0905 08             DFB     $8
0906 40             DFB     $40
0907 09             DFB     $9
0908 30             DFB     $30         XXXXXXZ0 INSTRS.
0909 22             DFB     $22
090A 45             DFB     $45         *  Z=0, LEFT HALF-BYTE
090B 33             DFB     $33         *  Z=1, RIGHT HALF-BYTE
090C D0             DFB     $D0
090D 08             DFB     $8
090E 40             DFB     $40
090F 09             DFB     $9
0910 40             DFB     $40
0911 02             DFB     $2
0912 45             DFB     $45
0913 33             DFB     $33
0914 D0             DFB     $D0
0915 08             DFB     $8
0916 40             DFB     $40
0917 09             DFB     $9
0918 40             DFB     $40
0919 00             DFB     $0
091A 40             DFB     $40
091B B0             DFB     $B0
091C D0             DFB     $D0
091D 00             DFB     $0
091E 40             DFB     $40
091F 00             DFB     $0
0920 00             DFB     $0
0921 22             DFB     $22
0922 44             DFB     $44
0923 33             DFB     $33
0924 D0             DFB     $D0
0925 8C             DFB     $8C
0926 44             DFB     $44
0927 00             DFB     $0
0928 11             DFB     $11
0929 22             DFB     $22
092A 44             DFB     $44
092B 33             DFB     $33
092C D0             DFB     $D0
092D 8C             DFB     $8C
092E 44             DFB     $44
092F 9A             DFB     $9A
0930 10             DFB     $10
0931 22             DFB     $22
0932 44             DFB     $44
0933 33             DFB     $33
0934 D0             DFB     $D0
0935 08             DFB     $8
0936 40             DFB     $40
```

BRANCH to . . . pg. 20

Rickey's tackling the SDK-80 microcomputer kit for his next science project.

Rickey likes soccer, lizards, hot fudge sundaes, skateboards and microscopes. He can't decide if he'd rather be Franco Harris, Bobby Fischer or Jonas Salk.

When his Dad brought home the Intel SDK-80 microcomputer systems kit, Rickey helped him put it together. It took only four hours. Everything was there. The 8080 CPU, RAM, PROM, programmable, I/O, a printed circuit board with all those capacitors and resistors and the other things that go with it. The best part was the instruction manuals. Every step was clearly explained. It was easy. The programming part looked especially interesting. So simple. Just imagine talking to a computer.

The big thrill came on Saturday when they went to his Dad's office to use a terminal. When they connected the SDK-80 to the teletypewriter they got a printout. That was exciting. Within an hour they were talking to the computer, then inventing games. They stayed all day.

Now Rickey is building a microcomputer of his own. He may be the first kid on his block with his own computer. Thanks to a $350 low interest loan from his Dad.

If you're interested in being the first on your block to have a microcomputer, contact your Intel distributor: Almac/Stroum, Component Specialties, Components Plus, Cramer, Elmar, Hamilton/Avnet, Industrial Components, Liberty, Pioneer, Sheridan, or L. A. Varah.

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CIRCLE NO. 11 ON INQUIRY CARD

```
0937 09          DFB    $9
0938 10          DFB    $10
0939 22          DFB    $22
093A 44          DFB    $44
093B 33          DFB    $33
093C D0          DFB    $D0
093D 08          DFB    $8
093E 40          DFB    $40
093F 09          DFB    $9
0940 62          DFB    $62
0941 13          DFB    $13              YYXXXZ01 INSTRS.
0942 78          DFB    $78
0943 A9          DFB    $A9
0944 00   MODE2  DFB    $0               ERR
0945 21          DFB    $21              IMM
0946 81          DFB    $81              Z-PAG
0947 82          DFB    $82              ABS
0948 00          DFB    $0               IMPL
0949 00          DFB    $0               ACC
094A 59          DFB    $59              (Z-PAG,X)
094B 4D          DFB    $4D              (Z-PAG),Y
094C 91          DFB    $91              Z-PAG,X
094D 92          DFB    $92              ABS,X
094E 86          DFB    $86              ABS,Y
094F 4A          DFB    $4A              (ABS)
0950 85          DFB    $85              Z-PAG,Y
0951 9D          DFB    $9D              REL
0952 AC   CHAR1  DFB    $AC              ','
0953 A9          DFB    $A9              ')'
0954 AC          DFB    $AC              ','
0955 A3          DFB    $A3              '#'
0956 A8          DFB    $A8              '('
0957 A4          DFB    $A4              '$'
0958 D9   CHAR2  DFB    $D9              'Y'
0959 00          DFB    $0
095A D8          DFB    $D8              'X'
095B A4          DFB    $A4              '$'
095C A4          DFB    $A4              '$'
095D 00          DFB    $0
095E 1C   MNEML  DFB    $1C              XXXXX000 INSTRS.
095F 8A          DFB    $8A
0960 1C          DFB    $1C
0961 23          DFB    $23
0962 5D          DFB    $5D
0963 8B          DFB    $8B
0964 1B          DFB    $1B
0965 A1          DFB    $A1
0966 9D          DFB    $9D
0967 8A          DFB    $8A
0968 1D          DFB    $1D
0969 23          DFB    $23
096A 9D          DFB    $9D
096B 8B          DFB    $8B
096C 1D          DFB    $1D
096D A1          DFB    $A1
096E 00          DFB    $0
096F 29          DFB    $29
0970 19          DFB    $19
0971 AE          DFB    $AE
0972 69          DFB    $69
0973 A8          DFB    $A8
0974 19          DFB    $19
0975 23          DFB    $23
0976 24          DFB    $24
0977 53          DFB    $53
0978 1B          DFB    $1B
0979 23          DFB    $23
097A 24          DFB    $24
097B 53          DFB    $53
```

```
097C 19          DFB   $19
097D A1          DFB   $A1
097E 00          DFB   $0          XXXYY100 INSTRS.
097F 1A          DFB   $1A
0980 5B          DFB   $5B
0981 5B          DFB   $5B
0982 A5          DFB   $A5
0983 69          DFB   $69
0984 24          DFB   $24
0985 24          DFB   $24
0986 AE          DFB   $AE         1XXX1010 INSTRS.
0987 AE          DFB   $AE
0988 A8          DFB   $A8
0989 AD          DFB   $AD
098A 29          DFB   $29
098B 00          DFB   $0
098C 7C          DFB   $7C
098D 00          DFB   $0
098E 15          DFB   $15         XXXYYY10 INSTRS.
098F 9C          DFB   $9C
0990 6D          DFB   $6D
0991 00          DFB   $0
0992 A5          DFB   $A5
0993 69          DFB   $69
0994 29          DFB   $29
0995 53          DFB   $53
0996 84          DFB   $84         XXXYYY01 INSTRS.
0997 13          DFB   $13
0998 34          DFB   $34
0999 11          DFB   $11
099A A5          DFB   $A5
099B 69          DFB   $69
099C 23          DFB   $23
099D A0          DFB   $A0
099E D8    MNEMR DFB   $D8         XXXXX000 INSTRS
099F 62          DFB   $62
09A0 5A          DFB   $5A
09A1 48          DFB   $48
09A2 26          DFB   $26
09A3 62          DFB   $62
09A4 94          DFB   $94
09A5 88          DFB   $88
09A6 54          DFB   $54
09A7 44          DFB   $44
09A8 C8          DFB   $C8
09A9 54          DFB   $54
09AA 68          DFB   $68
09AB 44          DFB   $44
09AC E8          DFB   $E8
09AD 94          DFB   $94
09AE 00          DFB   $0
09AF B4          DFB   $B4
09B0 08          DFB   $8
09B1 84          DFB   $84
09B2 74          DFB   $74
09B3 B4          DFB   $B4
09B4 28          DFB   $28
09B5 6E          DFB   $6E
09B6 74          DFB   $74
09B7 F4          DFB   $F4
09B8 CC          DFB   $CC
09B9 4A          DFB   $4A
09BA 72          DFB   $72
09BB F2          DFB   $F2
09BC A4          DFB   $A4
09BD 8A          DFB   $8A
09BE 00          DFB   $0          XXXYY100 INSTRS
09BF AA          DFB   $AA
09C0 A2          DFB   $A2
```

```
342  09C1 A2         DFB   $A2
343  09C2 74         DFB   $74
344  09C3 74         DFB   $74
345  09C4 74         DFB   $74
346  09C5 72         DFB   $72
347  09C6 44         DFB   $44         1XXX1010 INSTRS.
348  09C7 68         DFB   $68
349  09C8 B2         DFB   $B2
350  09C9 32         DFB   $32
351  09CA B2         DFB   $B2
352  09CB 00         DFB   $0
353  09CC 22         DFB   $22
354  09CD 00         DFB   $0
355  09CE 1A         DFB   $1A         XXXYYY10 INSTRS.
356  09CF 1A         DFB   $1A
357  09D0 26         DFB   $26
358  09D1 00         DFB   $0
359  09D2 72         DFB   $72
360  09D3 72         DFB   $72
361  09D4 88         DFB   $88
362  09D5 C8         DFB   $C8
363  09D6 C4         DFB   $C4         XXXYYY01 INSTRS.
364  09D7 CA         DFB   $CA
365  09D8 26         DFB   $26
366  09D9 48         DFB   $48
367  09DA 44         DFB   $44
368  09DB 44         DFB   $44
369  09DC A2         DFB   $A2
370  09DD C8         DFB   $C8
371                  END
 END PASS 2    0 ERRORS

CROSS REFERENCE TABLE    46 SYMBOLS  DEFINED

CHAR1    0952    0231   0108
CHAR2    0958    0237   0110
CHAROU   FFEF    0010   0090   0109   0112   0126   0131   0134
COUNT    0046    0008   0013   0018
DSMBL    0800    0012
DSMBL2   0804    0014   0019
ERR      0835    0041   0026   0028
FORMAT   0040    0002   0045   0099   0106
GETFMT   0839    0043   0040
IEVEN    0826    0031   0024
INSTDS   0812    0020   0014
LENGTH   0041    0003   0047   0070   0097   0138
LMNEM    0042    0004   0079   0085
MNEML    095E    0243   0078
MNEMR    099E    0307   0080
MNNDX1   084E    0055   0064
MNNDX2   0852    0058   0061
MNNDX3   0859    0063   0054   0056
MODE     0900    0149   0033
MODE2    0944    0217   0044
PCADJ    08EF    0138   0015
PCADJ2   08F1    0139
PCADJ3   08F2    0140   0116
PCADJ4   08F8    0144   0142
PCH      0045    0007   0017   0127   0140
PCL      0044    0006   0016   0128   0144   0021   0066   0101
PRADR1   0897    0095   0114
PRADR2   089F    0099   0105
PRADR3   08AD    0106   0096   0098
PRADR4   08BF    0113   0107   0111
PRBL2    08E6    0133   0069   0136
PRBL3    08E8    0134
PRBLNK   08E4    0132   0093
PRBYTE   FFDC    0009   0067   0103   0122   0124
PRMN1    087E    0082   0092
```

PRMN2	0882	0084	0088	
PRNTAX	08CC	0122	0129	
PRNTX	08CF	0123		
PRNTYX	08CB	0121	0119	
PROP	085D	0066	0072	
PROPBL	0864	0069	0075	
PRPC	08D3	0125	0020	
RELADR	08C3	0116	0102	
RMNEM	0043	0005	0081	0084
RTMODE	0831	0039	0034	
RTS1	08FD	0147	0145	

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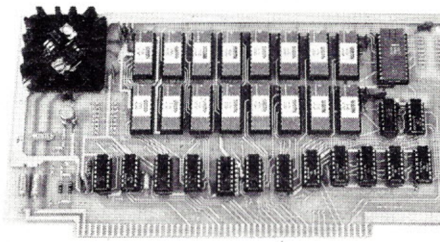

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CIRCLE NO. 12 ON INQUIRY CARD

DIGITAL DATA RECORDER

MODEL CC-7 SPECIFICATIONS:

A. Recording Mode: NRZ or tape saturation binary. This is not an FSK or Home type recorder. No voice capability. No Modem.
B. Two channels (1) Clock, (2) Data. OR, Two Data channels providing four (4) tracks on the cassette. Can also be used for Bi-Phase, Manchester codes, etc.
C. Inputs: Two (2). Will accept TTY, TTL or RS 232 digital.
D. Outputs: Two (2). Board changeable from RS 232 to TTY or TTL digital.
E. Runs at 2400 baud or less with high grade audio tape. Synchronous or asynchronous. Runs at 3.1"/sec. Speed regulation ±.5% (wow + flutter).
F. Compatability: Will interface any computer or terminal with a serial I/O. (Altair, Sphere, M6800, PDP8, LSI11, etc.)
G. Other Data: (110-220 V), (50-60 Hz); 3 Watts total; UL listed 955D; three wire line cord; on/off switch; audio, meter and light operation monitors. Remote control of motor optional. Four foot, seven conductor remoting cable provided.
H. Warrantee: 90 days. All units tested at 110 and 2400 baud before shipment. Test cassette with 8080 software program included. This cassette was recorded and played back during quality control.

ALSO AVAILABLE: CC-7A with variable speed motor, uses electronic speed control at 4"/sec. or less. Speed regulation ±.2%. Runs at 4800 baud without external circuitry. Recommended for quantity users who exchange tapes. Comes with speed adjusting tape to set exact speed.

FOR COMPUTER or TELETYPE USE
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Model CC7A . . . $169.95

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MICRO-BUSINESS

LOW-COST SMALL BUSINESS/MICROCOMPUTER SYSTEMS WHAT ARE THEY, AND WHAT CAN THEY DO FOR YOU?

by MAL LOCKWOOD
ASI, Denver, CO.

In this, the first article of a series on the use of microcomputers in the business environment, we present the writer's thoughts on what a low-cost microcomputer can and should be doing to provide the small business entrepreneur a better insight into the detailed operation of his company and to allow him to gain a tighter control over all aspects of his business.

Introduction

Today a microprocessor chip, measuring the size of a postage stamp, sells for $20 and is finding its way into innumerable products that we use daily. It is therefore quite natural to expect that this ubiquitous device will one day be as common and as indispensible to a business office environment as a typewriter and telephone. Just as the microprocessor is a smaller brother of the large-scale computer, the small business system is a little brother to the large data processing system made by people like IBM and Burroughs. The small business microcomputer may be programmed to implement all of the functions performed by its larger brothers, but with significant savings in price. Some features, of course, like multiple simultaneous on-line users and foreground-background processing, are a bit impractical to implement on a microcomputer, due to the limitations imposed by the speed of the hardware and the CPU/peripheral resources that are available. Yet jobs like calculating payroll for up to 1,000 employees, accounts receivable for up to 2000 accounts, accounts payable for up to 2000 vendors, inventory control with up to 2000 items, or general ledger for up to 650 accounts may be implemented easily and inexpensively with a single microcomputer. The small business microcomputer system is not limited to the above functions—it can perform virtually any record keeping operation you are now performing, and even some things that you would currently find almost impossible to do manually.

Typically, a small business microcomputer system consists of a central processing unit (CPU), solid-state (volatile) memory, some form of bulk program data storage like floppy discs or cassette tapes, a keyboard entry terminal such as a cathode ray tube (CRT) terminal or teletype, and a hard-copy output device such as a character printer, line printer or teletype. Such a system, with 16K bytes of main memory and one-half million bytes of bulk memory, would be fully capable of handling the bookkeeping capacities noted and would carry a hardware price tag of from $5,000 to $10,000 (depending on the type of peripherals chosen). The input/output peripherals would adequately keep up with a single operator and the overall system through-put would satisfy most businesses with 10 to 200 employees (or 0.5 to 4 million dollars in annual revenue per year).

When it is found that the work load cannot be handled by such a system (usually not because of the speed of the processor, but mainly due to the limitations of the system's input and output peripherals), the businessman wouldn't have to scrap his present system and run to the open, often greedy, arms of the "big boys" with their $100,000 to $500,000 systems. He would simply add faster peripherals or additional complete microcomputer systems at $5,000 to $10,000 each. Thus one system could handle payroll, accounts payable and general ledger, and another could handle accounts receivable, inventory control and job cost analysis. It would be necessary for the two systems to talk to each other so that data entries would automatically ripple through the correct journals and ledgers. This could be made possible through a simple RS-232 interface and some communication routines. Whether a single or multiple processor system is required, a small businessman would be better off financially using a microprocessor-based system instead of changing to a system made by the "big boys."

The small business microcomputer system, if purchased in a "turnkey" fashion (i.e., delivered with all necessary hardware and software), should be very simple to operate (normally an office clerk would be assigned as the operator). The skills required to become proficient in the use of the system are a little greater than those required to operate a standard typewriter, but not as great as those necessary to operate an offset printing press.

The system should be purchased with all necessary programs, tailored to the unique functional requirements of each business. It should not be necessary for the user to become proficient in computer programming, nor should a programmer be required in order to enter or retrieve normal business information. Of course, if a user wishes to program the computer himself, he should have available to him a high-level compiler/interpreter which allows him to efficiently enter and run his programs. The system should be physically small (no larger than a standard filing cabinet), and should not require any special electrical or environmental conditions in which to operate.

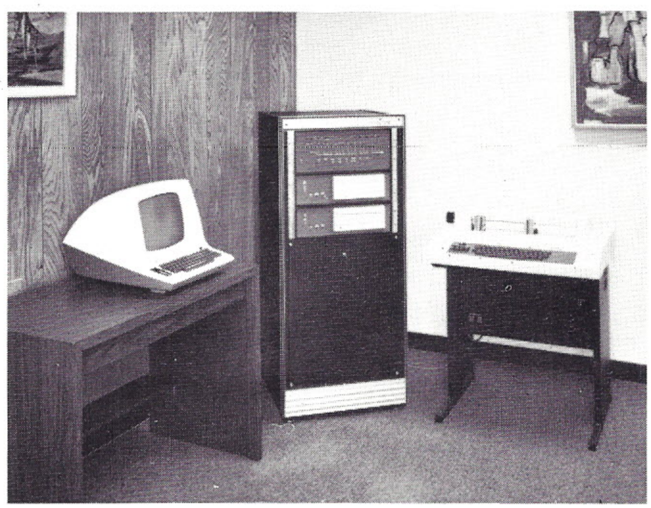
Who Can Use A Small Microcomputer System?

Any and all small business can profit from using a microcomputer system for the five general accounting functions (accounts receivable, accounts payable, general ledger, inventory control and payroll). In addition, organizations such as manufacturers can perform job costing, work in process and cash flow analyses. Retail and wholesale firms can maintain tight inventory/procurement control, handle cyclic billing operations, and obtain detailed sales analyses. Construction companies can maintain accurate estimating procedures, keep better equipment inventories and have more timely labor/materials cost analyses available to them. Sales organizations can perform word processing functions plus keep up-to-date mailing lists. These are just a few examples.

If the computer system is used effectively, each user should achieve increased profits due to improved customer service, reduced inventories and increased production efficiency. Management will have instantaneous reports and analyses available which allow better and tighter operational control over all aspects of the enterprise.

What Does A Small Business Microcomputer Actually Do?

The small business microcomputer is a machine which processes transactional data entered by the businessman and produces reports, statements, and analyses required by the business. A rather glib, yet accurate, statement is that the microcomputer can do anything that the user is presently doing manually and, moreover, can perform some functions that cannot economically be performed by manual methods. We will restrict our attention in this article to the more mundane matters, such as accounting operations, the most common of which are general ledger, accounts receivable, accounts payable, inventory control, and of course, the one we all need and love—payroll.



Typical Small Business System . . . PHASE/ONE, a low-cost microcomputer system designed by Administrative Systems, Incorporated—ASI, Denver, Colorado, represents a typical array of equipment needed to perform general accounting functions for a small business. It is made up of a MITS 8800 processor with 16K bytes of memory, two floppy disks, an ADM-3 CRT terminal and an LA-36 printer terminal. This configuration is sufficient to run ASI's business software for accounts receivable, accounts payable, inventory, payroll, general ledger, and other required functions.

Each accounting function can be broken down into numerous input, output, and calculating operations, and therefore it is advisable to design each one as a separate software module. It is imperative that all appropriate modules communicate with each other when a complete accounting system is installed. This not only reduces data entry, but also greatly reduces the possibility of human error. For example, in an integrated accounting system, a single sales order entry is designed to automatically ripple through the necessary journals and ledgers in such modules as accountings receivable, inventory and finally general ledger, without any human intervention. Audit trails must be provided in all programs to show the user where each entry went, in case an "out-of-balance" condition ever exists.

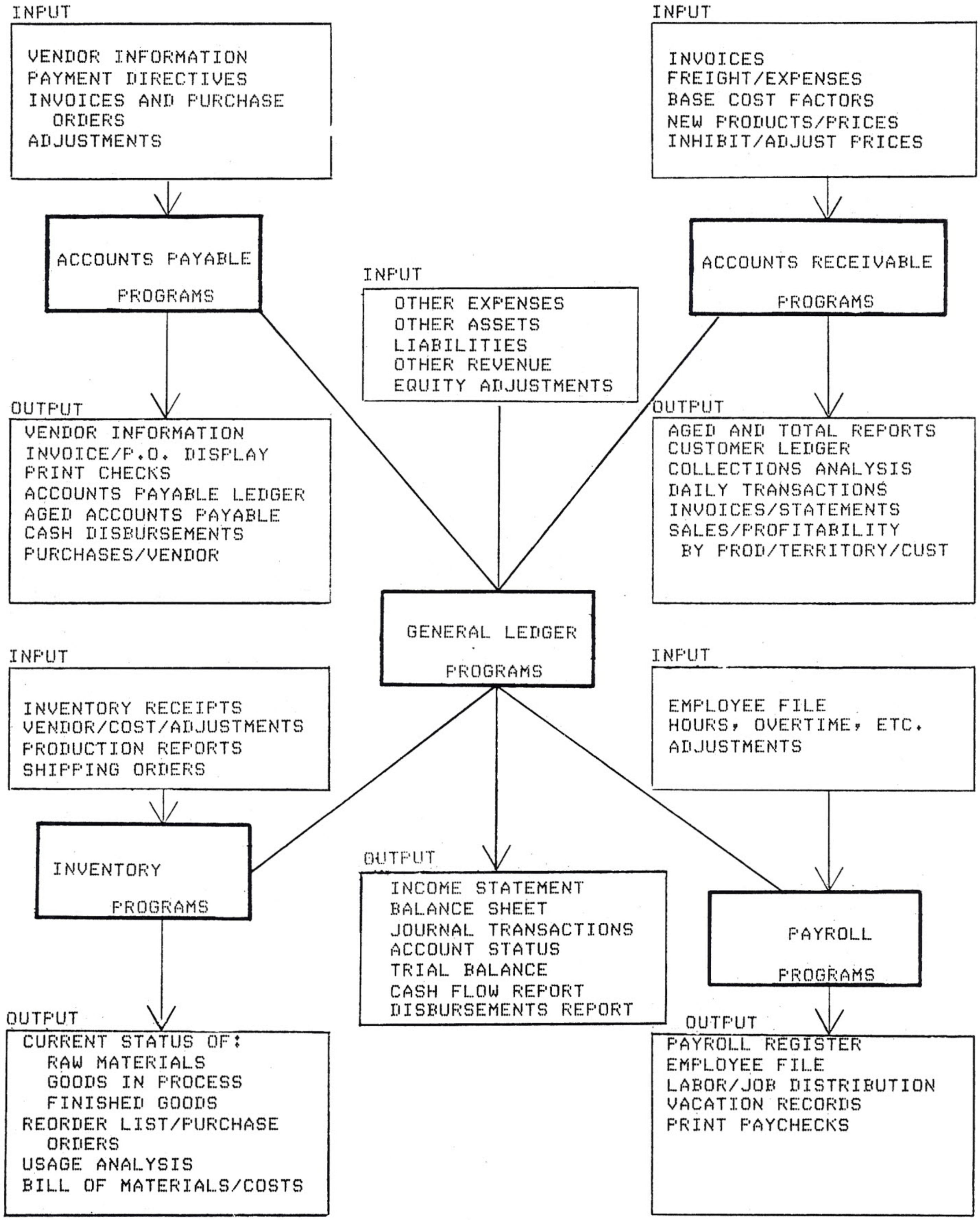


Figure 1
ASI Software Configuration

Figure 1 depicts a typical complete acounting system with each module's inputs and outputs shown together with the interaction between modules. It is impossible, in this short article, to describe the detailed make-up of each of the five functional modules. All that will be attempted is to outline the typical computer outputs of each module; susequent articles will delve into each module in more depth.

A measure of excellence in a computer program is always the flexibility it offers the user. Throughout this presentation, it should be assumed that no two companies will ever require an identical set of reports, nor that the particular reports that are furnished would have the same format. It is therefore imperative to make sure that, whatever system you contemplate purchasing, it has the flexibility to provide the number and type of re-

EVERYBODY'S WIDGET COMPANY
BALANCE SHEET AS OF
JUNE 30, 1976

ASSETS				
CURRENT ASSETS				
CASH		$ 1,455.50		3.6%
INVENTORY		25,544.50		63.9%
TOTAL CURRENT ASSETS			$ 27,000.00	67.5%
FIXED ASSETS				
EQUIPMENT	$ 13,900.00			34.8%
LESS ACCUMULATED DEPRECIATION	900.00	$ 13,000.00		32.5%
TOTAL FIXED ASSETS			13,000.00	32.5%
TOTAL ASSETS			$ 40,000.00	100.0%
LIABILITIES				
CURRENT LIABILITIES				
ACCOUNTS PAYABLE		$ 3,200.00		8.0%
TAXES PAYABLE		800.00		2.0%
TOTAL CURRENT LIABILITIES			$ 4,000.00	10.0%
LONG-TERM LIABILITIES				
NOTES PAYABLE		$ 2,719.00		6.8%
TOTAL LONG-TERM LIABILITIES			2,719.00	6.8%
TOTAL LIABILITIES			$ 6,719.00	16.8%
STOCKHOLDER EQUITY				
CONTRIBUTED CAPITAL				
COMMON STOCK	$ 3,000.00			7.5%
PREMIUM ON COMMON STOCK	12,000.00			30.0%
TOTAL CONTRIBUTED CAPITAL		$ 15,000.00		37.5%
RETAINED EARNINGS				
FROM PRIOR PERIODS	$ 3,000.00			7.5%
CURRENT RETAINED EARNINGS	15,281.00			38.2%
TOTAL RETAINED EARNINGS		18,281.00		45.7%
TOTAL STOCKHOLDER EQUITY			33,281.00	83.2%
TOTAL LIABILITIES & STOCKHOLDER EQUITY			$ 40,000.00	100.0%

Figure 2. A typical balance sheet output from the general ledger module. This report must be fomatted to the individual user's type of business and requirements.

ports you need today and also allows expansion and simple modification as your company grows.

Beginning at the end, as it were, Figure 2 shows the balance sheet of Everybody's Widget Company, as generated by the general ledger package. This, of course, represents a picture of the company's financial position as of a particular date. Figure 3A shows an income statement, also generated by the general ledger program module. Note the comparison of each item with some user-defined budget or goal. Obviously the budget column could be replaced with last year's balances, allowing a comparison of performance to be made quickly. Figure 3B presents the income performance for the current month, with year-to-date totals. Figure 4 helps to provide that peek into the future that all businesses desire, assuming of course, that they have less than infinite operating capital.

EVERYBODY'S WIDGET COMPANY
INCOME STATEMENT WITH VARIATIONS FROM BUDGET
FOR MONTH ENDED JUNE 30, 1976

	ACTUAL	BUDGET	VARIATION
REVENUES			
SALES	$ 50,000.00	$ 56,000.00	$ -6,000.00
TOTAL REVENUES	$ 50,000.00	$ 56,000.00	$ -6,000.00
COST OF GOODS SOLD			
MATERIALS	$ 7,350.00	$ 7,400.00	$ -50.00
TOTAL COST OF GOODS SOLD	$ 7,350.00	$ 7,400.00	$ -50.00
GROSS PROFIT FROM SALES	$ 42,650.00	$ 48,600.00	$ -5,950.00
OPERATING EXPENSES			
ADMINISTRATIVE	$ 15,000.00	$ 16,000.00	$ -1,000.00
SALARIES	7,000.00	6,500.00	+500.00
TOTAL OPERATING EXPENSES	$ 22,000.00	$ 22,500.00	$ -500.00
NET INCOME OR (LOSS)	$ 20,650.00	$ 26,100.00	$ -5,450.00

Figure 3A. An output from the general ledger module, showing an income statement. The budget column could be replaced with last year's balances, allowing a direct comparison of performance.

EVERYBODY'S WIDGET COMPANY
INCOME STATEMENT FOR PERIOD ENDED JUNE 30, 1976

	MONTH OF JUNE			YEAR TO DATE		
REVENUES						
SALES	$ 55,000.00		110.0%	$ 104,000.00		109.5%
LESS RETURNS & ALLOWANCES	5,000.00		10.0%	9,000.00		9.5%
TOTAL REVENUES		$ 50,000.00	100.0%		$ 95,000.00	100.0%
COST OF GOODS SOLD						
MATERIALS	$ 7,000.00		14.0%	$ 25,000.00		26.3%
FREIGHT IN	350.00		.7%	1,000.00		1.1%
TOTAL COST OF GOODS SOLD		7,350.00	14.7%		26,000.00	27.4%
GROSS PROFIT FROM SALES		$ 42,650.00	85.3%		$ 69,000.00	72.6%
OPERATING EXPENSES						
ADMINISTRATIVE	$ 15,000.00		30.0%	$ 40,000.00		42.1%
SALARIES	7,000.00		14.0%	20,000.00		21.1%
TOTAL OPERATING EXPENSES		22,000.00	44.0%		60,000.00	63.2%
NET INCOME BEFORE TAXES		$ 20,650.00	41.3%		$ 9,000.00	9.5%
INCOME TAXES		5,369.00	10.7%		2,340.00	2.5%
NET INCOME OR (LOSS)		$ 15,281.00	30.6%		$ 6,660.00	7.0%

Figure 3B. Another presentation of the income statement showing current month and year-to-date format.

EVERYBODY'S WIDGET COMPANY
CASH FLOW PROJECTION
FROM 7/01/76 TO 6/30/77

	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
SOURCES:												
PREVIOUS BALANCE	1,500	6,500	11,500	51,500	21,500	1,500	31,500	61,500	126,500	201,500	296,500	406,500
SALES	70,000	80,000	100,000	130,000	150,000	200,000	200,000	210,000	220,000	240,000	260,000	280,000
LOAN	0	0	100,000	0	0	0	0	0	0	0	0	0
TOTAL SOURCES	71,500	86,500	211,500	181,500	171,500	201,500	231,500	271,500	346,500	441,500	556,500	686,500
USES:												
ADMINISTRATIVE	30,000	40,000	60,000	60,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000	70,000
INVENTORY	35,000	35,000	100,000	100,000	100,000	100,000	100,000	75,000	75,000	75,000	80,000	90,000
TOTAL USES	65,000	75,000	160,000	160,000	170,000	170,000	170,000	145,000	145,000	145,000	150,000	160,000
ENDING BALANCE	6,500	11,500	51,500	21,500	1,500	31,500	61,500	126,500	201,500	296,500	406,500	526,500

Figure 4. A typical requirement of most companies, a cash flow forecast. It is sometimes the timely production of this general ledger report alone that picks the "men from the boys" in terms of success or failure of an enterprise.

Figures 5A through 5D summarize the type of reports that would be required of a good accounts receivable package. Figure 5A shows an aging report for each customer; 5B shows a collection analysis which depicts how well the business is collecting receivables; 5C records the daily transactions that were entered into the system; 5D details the contents of the ledger file which the system is carrying on any or all customers.

Figure 5A. Shows an aging report format. The amount due is broken into current due, as well as 30, 60 and 90 days overdue.

ACCOUNTS RECEIVABLE AGING REPORT
JULY 19, 1976

ACCT#	NAME	DATE LAST PAYMENT	YTD PAYMENTS	BALANCE DUE	CURRENT	30 DAYS	60 DAYS	90/OVER
10001	JOSHUA ALBERTS	04/21/76	100.00	250.00	100.00	100.00	0.00	50.00
10123	FRED'S FINE FOODS	05/03/76	25.00	25.00	25.00	0.00	0.00	0.00

Figure 5B. The collections analysis shows how well the company collects the money it is owed.

COLLECTION ANALYSIS
JULY 19, 1976

MONTH	ACCOUNTS RECEIVABLE VALUE			CURRENT MONTH				CURRENT PAYMENTS BY ACCOUNT AGE			
	TOTAL	DELINQUENT	%	CHARGES	PAYMENTS	%	NET ADJ	CURRENT	30 DAYS	60 DAYS	90/OVER
5	850.00	23.00	2.7%	1275.50	458.75	36.0%	-25.00	250.00	100.00	75.75	33.00
					100.0%			54.5%	21.8%	16.5%	7.2%

Figure 5C. All daily transactions are listed on this report.

ACCOUNTS RECEIVABLE DAILY TRANSACTIONS
JULY 19, 1976

DATE	ACCT#	ACCOUNT NAME	PRODUCT CODE	DESCRIPTION	QUANTITY	CHARGE	CREDIT	BALANCE
07/11/76	10001	JOSHUA ALBERTS	52	WIDGET #2222	2	56.00	0.00	316.00
07/12/76	10123	FRED'S FINE FOODS	01	CASH PAYMENT		0.00	25.00	0.00

Figure 5D. A detailed report showing everything contained in a customer's file may be printed by calling for the ledger report.

ACCOUNTS RECEIVABLE LEDGER
JULY 19, 1976

ACCT#	ACCOUNT NAME & ADDRESS	TELEPHONE	YTD PAYMENTS	TRANSACTIONS					
				DATE	PRODUCT	QUANTITY	CHARGE	CREDIT	BALANCE
10001	JOSHUA ALBERTS	399-1255	100.00		BALANCE FORWARD		150.00	0.00	150.00
	1345 CLINTON			07/02/76	WIDGET #0134	3	90.00	0.00	240.00
	DENVER, COLORADO 80010			07/10/76	PAYMENT		0.00	40.00	200.00
				07/12/76	WIDGET #9945	1	50.00	0.00	250.00

Figures 5A through 5D show a variety of reports which can be generated by an accounts receivable package.

Figures 6A, through 6E present some of the typical reports which are available from an inventory control package. Figure 6A provides a usage report, indicating quantities and amounts sold and produced; this can be itemized for each month or, as shown in Figure 6A, for current month, together with the year-to-date activity. Figure 6B shows what goes into each product from a manufacturer's point of view. Figure 6C shows the inventory status of raw materials on hand, together with the vendor, for this material and the last price paid for it. Figure 6D presents the results of a file search wherein the computer looks for inventory items which have quantities less than some user-defined level. Not only does the report flag the items which must be reordered, but it tells the user the economic reorder quantity, and will even list the possible sources and prices, if desired. Figure 6E summarizes the sales situation in terms of quantities sold and the resulting profits.

Figure 6A. Provides a detailed look at what has been sold in the current month, as well as year-to-date.

FINISHED PRODUCT USAGE REPORT

JULY 19, 1976

PRODUCT#	PRODUCT DESCRIPTION	MONTH					YEAR-TO-DATE				
		#UNITS-BEGIN	#UNITS-END	#PRODUCED	#SOLD	%S/P	#UNITS-BEGIN	#UNITS-END	#PRODUCED	#SOLD	%S/P
1001	GIDGET #A	100	75	40	65	162.50	20	75	200	145	72.50
1004	SUPER GIDGET	50	60	30	20	66.66	15	60	90	45	50.00

Figure 6B. Allows a manufacturer to identify easily which raw materials go into each product, and thereby provides an accurate means of keeping track of current product costs.

BILL OF MATERIALS

JULY 19, 1976

PRODUCT#	PRODUCT DESCRIPTION	ITEM	MATERIAL#	MATERIAL DESCRIPTION	QUANTITY
1001	GIDGET #A	1	1015	WIDGET #A10B	3
		2	1098	WIDGET #XXXX	10
		3	1234	SUPER WIDGET ABC	12

Figure 6C. Provides an indication of the current status of each item in inventory, together with information on the supplier and his prices.

RAW MATERIALS INVENTORY STATUS

JULY 19, 1976

MATERIAL#	MATERIAL DESCRIPTION	TOTAL NUMBER UNITS	TOTAL COST	VENDOR COST STATUS		
				VENDOR	COST/UNIT	#UNITS
1098	WIDGET #XXXX	600	2000.00	WIDGETS SUPPLY HOUSE	3.00	400
				EVERYBODY'S WIDGETS CO	4.00	200

Figure 6D. This program flags all items that have gone below some predetermined level, so that the user is automatically reminded to reorder the item. Note that the user is informed of the economic reorder quantity, as well as being notified if an order has been placed and has not yet been received.

RAW MATERIALS RE-ORDER REPORT

JULY 19, 1976

MATERIAL#	MATERIAL DESCRIPTION	#UNITS ON HAND	RE-ORDER NUMBER	ERQ VALUE	RE-ORDER STATUS
1098	WIDGET #XXXX	600	700	500	YES
1234	SUPER WIDGET ABC	850	300	250	

Figure 6E. Provides a sales analysis showing what has been sold and gives resulting profits for the current month and year-to-date.

SALES ANALYSIS

JULY 19, 1976

PRODUCT#	PRODUCT DESCRIPTION	MONTH						YEAR-TO-DATE					
		#UNITS	$AMOUNT	$MATERL	$MISC	$COMMSN	$MARGIN	#UNITS	$AMOUNT	$MATERL	$MISC	$COMMSN	$MARGIN
1002	GIDGET #BB	35	350.00	105.00	55.00	35.00	155.00	150	1200.00	400.00	200.00	150.00	450.00
1050	SUPER GIDGET #XX	10	500.00	300.00	100.00	50.00	50.00	180	900.00	500.00	250.00	50.00	100.00

Figures 6A through 6E outline typical reports available from an inventory control package.

Figures 7A through 7D present the major outputs of a typical package of payroll programs. Figure 7A shows a payroll register for each employee for a particular date; 7B provides a list of all checks written (by the system); 7C summarizes the total payroll account; 7D shows the accruals for each of serveral categories for the current quarter, as well as year-to-date figures.

Figure 7A. Shows a payroll resister for each employee on a particular date.

PAYROLL REGISTER

JULY 19, 1976

ACCT#	EMPLOYEE NAME	EARNINGS				DEDUCTIONS						PAYMENT	
		SALARY	HOURLY	MSC PAY	GROSS	FITW	SITW	FICA	H INS	L INS	MSC DED	NET PAY	CHECK#
10001	ALFRED Q. LIPSCHITZ	800.00	0.00	0.00	800.00	165.50	47.00	24.80	3.00	0.00	0.00	559.70	10450
10002	MARSHA MOONSHINE	0.00	450.00	100.00	550.00	60.00	15.60	7.00	0.00	0.00	45.00	422.40	10451

Figure 7B. Itemizes the checks which were actually written by the system.

CHECK REGISTER

JULY 19, 1976

CHECK#	EMPLOYEE NAME	NET PAY
10450	ALFRED Q. LIPSCHITZ	559.70
10451	MARSHA MOONSHINE	422.40
10452	NATHANIEL O'LEARY	624.30

Figure 7C. Summarizes the overall payroll for a particular pay period.

PAYROLL SUMMARY

JULY 19, 1976

GROSS PAY		
SALARIES	$ 45,000.00	
HOURLY WAGES	23,540.50	
OTHER PAY	3,640.00	
TOTAL GROSS PAY		$ 72,180.50
DEDUCTIONS		
FEDERAL INCOME TAX	$ 13,768.75	
STATE INCOME TAX	4,330.00	
FICA	8,578.50	
OTHER DEDUCTIONS	5,500.00	
TOTAL DEDUCTIONS		32,177.25
NET PAY		$ 40,003.25

Figure 7D. Shows quarterly and year-to-date accruals in several categories.

PAYROLL RECORD

JULY 19, 1976

ACCT#	EMPLOYEE NAME	CURRENT QUARTER						YEAR TO DATE					
		GROSS	FITW	SITW	FICA	MSC DED	NET PAY	GROSS	FITW	SITW	FICA	MSC DED	NET PAY
10001	ALFRED Q. LIPSCHITZ	1800.00	360.00	110.00	145.50	0.00	1184.50	3600.00	720.00	220.00	291.00	30.00	2339.00
10002	MARSHA MOONSHINE	2150.00	397.40	95.00	123.50	102.00	1432.10	5239.00	765.23	234.66	310.19	102.00	3826.92

Figures 7A through 7D present the major outputs of the payroll package of programs.

Finally, Figures 8A through 8E show the types of reports generated by an accounts payable system. Figure 8A lists all purchases from a particular vendor; 8B shows at a glance the total amounts paid (checks written by the system) over a particular period of time; 8C indicates the invoices that will come due and payable within some definable period of time; 8D shows that which was purchased, and from whom it was purchased; 8E shows how much is owed and gives an aging analysis of the outstanding amounts.

Figure 8A. Lists all purchases from a particular vendor over some period of time.

ACCOUNTS PAYABLE LEDGER

JULY 19, 1976

ACCT#	ACCOUNT NAME	TRANSACTIONS								
		DATE	CODE	DESCRIPTION	QUANTITY	DUE DATE	DEBIT	DISCOUNT	CREDIT	BALANCE
1005	SUPER SUPPLIES, INC	07/02/76	535	PENS, WHITE BOND		07/31/76	50.00	0.00	0.00	50.00
		07/10/76	101	DESK LAMP		07/31/76	15.00	2.00	0.00	63.00

Figure 8B. Itemizes all checks that were written by the system (as directed by the user).

CASH DISBURSEMENTS JOURNAL

JULY 19, 1976

DATE	CHECK#	PAYEE	CASH CREDIT
07/03/76	1001	A&Z DISTRIBUTORS	250.00
07/04/76	1002	MOUNTAIN BELL TELEPHONE	145.00

Figure 8C. The cash required in order to meet the user's obligations is shown in this report. It also displays items purchased.

CASH REQUIREMENT REPORT

JULY 15, 1976

DATE DUE	ACCT#	PAYEE	CODE	DESCRIPTION	AMOUNT
07/31/76	1005	SUPER SUPPLIES, INC	535	PENS,WHITE BOND	50.00
07/31/76	1005	SUPER SUPPLIES, INC	101	DESK LAMP	13.00

Figure 8D. What was purchased, who sold the items, and how much was paid is summarized in this report.

PURCHASE ANALYSIS

JULY 19, 1976

ACCT#	VENDOR	PURCHASE DATE	ITEM	QUANTITY	COST/ITEM	DISCOUNT	TOTAL COST
1235	OMEGA EQUIPMENT CO	07/14/76	WIDGET #A34C	100	7.50	0.00	750.00
1003	CAMPTON COMPANY	07/15/76	WIDGET VERSION #3	25	5.00	10.00	110.00

Figure 8E. How well the company's obligations are met is vividly shown in this accounts payable aging report.

ACCOUNTS PAYABLE AGING

JULY 19, 1976

ACCT#	ACCOUNT NAME	DATE LAST PAYMENT	YTD PAYMENTS	BALANCE DUE	CURRENT	30 DAYS	60 DAYS	90/OVER
1100	WESTERN LOAN, INC	05/01/76	400.00	200.00	75.00	75.00	50.00	0.00
1134	WELCOMERS WESTERN WEAR	06/13/76	35.00	50.00	0.00	50.00	0.00	0.00

BRANCH to . . . pg. 80

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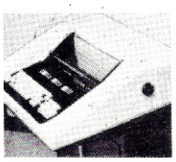

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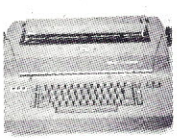

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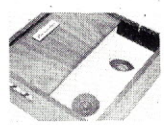

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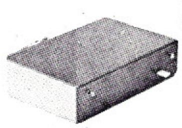

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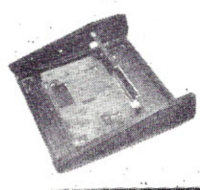

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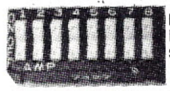

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CIRCLE NO. 14 ON INQUIRY CARD

BASIC

This is the second installment of a tutorial that will introduce you to the BASIC programming language. Last month, we took a quick look at enough of the language to enable you to write simple programs. We ended that installment with an invitation to write your own program around a mathematical expression that we provided.

This month we will look at the program and introduce you to defined functions, standard functions and sub-routines. In the near future, *Interface* will publish George Hockney's discussion on BASIC text manipulation. Understanding these articles and practicing your own program writing will put you thoroughly into BASIC.

Last month's writing assignment was to use the expression for capacitive reactance, *X* is equal to the reciprocal of $2\pi fc$, in a program. The program was to input frequency and capacity, print reactance, use a flag stop to allow repetitive calculations, and guard against division by zero.

Figure 1 shows one program that will do this.

```
LIST
 10   INPUT "FREQUENCY (HERTZ) = ";F
 20   IF F = 0 THEN 10
 25   IF F <0 THEN 80
 30   INPUT"CAPACITY (FARADS) =";C
 40   IF C = 0 THEN 30
 50   LET X = 1/(2*3.14159*F*C)
 60   PRINT"REACTANCE =";X;"OHMS"
 70   GO TO 10
 80   END

RUN
 (computer)                         (user)
 FREQUENCY (HERTZ)=?                3E3
 CAPACITY (FARADS)=?                50E-6
 REACTANCE = 1.06103 OHMS
 FREQUENCY (HERTZ)=?                30E3
 CAPACITY (FARADS)=?                0
 CAPACITY (FARADS)=?                50E-6
 REACTANCE = .106103 OHMS
 FREQUENCY (HERTZ)=?                -3

 READY
```

Figure 1

This program is similar to the Ohm's law program in the first installment. One subtle difference is that the input variable is separated from the text with a semi-colon. We used a comma last month. The options here are: no punctuation mark, a semi-colon, or a comma. Figure 2 shows the difference.

The question mark is not part of the implied text string. The computer uses it to request data from the user. Where a question mark appears, it is a function of the punctuation mark that you select.

```
LIST
10 INPUT "FREQUENCY="f
20 INPUT "FREQUENCY=";f
30 INPUT "FREQUENCY=",f

RUN
FREQUENCY =
?
FREQUENCY =?
FREQUENCY =  ?
```

Figure 2

Take another look at the program in Figure 1. Notice the parentheses on line 50. Appropriate use of parentheses tells the computer how to evaluate mathematical expressions.

The BASIC programming language associates the priorities shown in Figure 3 with the evaluation of mathematical expressions.

PRIORITY	OPERATION
First	Parenthetical Expressions
Second	Exponentiation
Third	Multiplication and Division
Fourth	Addition and Subtraction

Figure 3

Multiplication and division have the same priority. The computer will perform the first one that it comes to as it reads the line from left to right. To be certain that the computer will evaluate expressions the way that you want them evaluated, use parentheses. Do not write ½*3 if you mean 1/(2*3). The use of the parentheses gives the multiplication operation priority over the division operation as suggested by the priority listing in Figure 3.

Line 50 in Figure 1 uses the numerical value of π, 3.14159 in the calculation of capacitive reactance. This is such an important constant that some versions of BASIC provide us with a handy substitute that makes it unnecessary to write out 3.14159 each time we need the value of π. On the PDP 11-45 that I use this constant is identified as PI. Writing the word PI into your program flags the computer. Any time that the computer encounters the word PI it automatically substitutes 3.14159 into the expression it is evaluating. We call PI a standard function.

The BASIC interpreter permits us to define any expression by a name of our choice and then use it

An Easy Programming Language

Part 2

by Bruce A. Scott

as easily as we use PI. We call these terms "defined functions." We can use line 50 in Figure 1 as a defined function by telling the computer that it is a defined function that we have chosen to call FNX. Figure 4 shows the line in a BASIC program that would define the function. There are two terms here that may be new, the DEF and the FNEND. The DEF defines the function. The FNEND tells the computer where the definition ends.

```
100 DEF FNX: FNX=1/(2*PI*F*C) :FN END
```

Figure 4

The FN END statement must be used if the function definition includes embedded colons or if the length of the definition is more than one line. Once the function has been defined it can be used as easily as we used PI in place of 3.14159. The name that we choose to call the function is arbitrary. It is FN followed by any legal BASIC variable name as FNX, FNA1, FNF8.

Standard functions are those that have proven so popular over time that the interpreter writer provides them to us without being asked. Unfortunately, there is some disagreement over which standard functions should be provided. Consequently, not all versions of the BASIC interpreter offer the same standard functions.

Permit me to list those standard functions that are available on the computer that I use. The list is fairly representative. You will have to refer to the support information that pertains to the BASIC interpreter you use to find out which standard functions you have.

CALL	REPORTS	EXAMPLE
ABS(X)	SIZE OF X WITHOUT THE SIGN	ABS(−3.45) = 3.45
SGN(X)	SIGN OF X	SGN(−3.45) = −1
INT(X)	WHOLE NUMBER PORTION OF X	INT(8.45) = 8
SQR(X)	SQUARE ROOT OF X (X MUST BE POSITIVE)	SQR(9) = 3
LOG10(X)	LOGARITHM OF X TO BASE 10	LOG10(1000) = 3
LOG(X)	LOGARITHM OF X TO BASE e	LOG(2.71828) = .999999
EXP(X)	BASE e RAISED TO X POWER	EXP(1) = 2.71828
SIN(X)	SIN OF ANGLE X (X IN RADIANS)	SIN (PI/6) = .5
COS(X)	COSINE OF ANGLE X (X IN RADIANS)	COS (PI/3) = .5
TAN(X)	TANGENT OF ANGLE X (X IN RADIANS)	TAN (PI/4) = 1
ATN(X)	ANGLE (IN RADIANS) WHOSE TANGENT IS X	ATN (1) = .785397
PI	USED AS A CONVENIENCE TO REPRESENT 3.14159.	

Figure 5

An easy way to become familiar with standard functions is to write a few into program lines. I'll give you two examples and then you can try your hand at it.

Example One

The quadratic expression is

$$\frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$$

BASIC lines:

```
100 R1 = (−B+SQR(ABS(B↑2 − 4*A*C)))/(2*A)
110 R2 = (−B−SQR(ABS(B↑2 − 4*A*C)))/(2*A)
```

Notice that the ABS function is used to avoid taking the square root of a negative number. Notice also the use of the parentheses. Finally, be aware that division by 0 is still not permitted. The program would have to include a check for A = 0 before line 100 or 110 was performed.

Example Two

One of the integral calculus relationships is that for the integral of the secant. It isn't important here except as an example of nesting standard functions.

SECANT(X) dX = LN|SEC(X) + TAN(X)|+ C

We have to realize that BASIC is similar to conventional mathematical notation, not identical to it. We have to know the similarities and the differences if we are going to employ our standard functions successfully.

In this example we need to know the following equivalence,

Math Notation	Basic Equivalent
LN	LOG(X)
|. . .|	ABS(X)
SEC(X)	1/COS (X)
TAN(X)	TAN (X)

BASIC line:

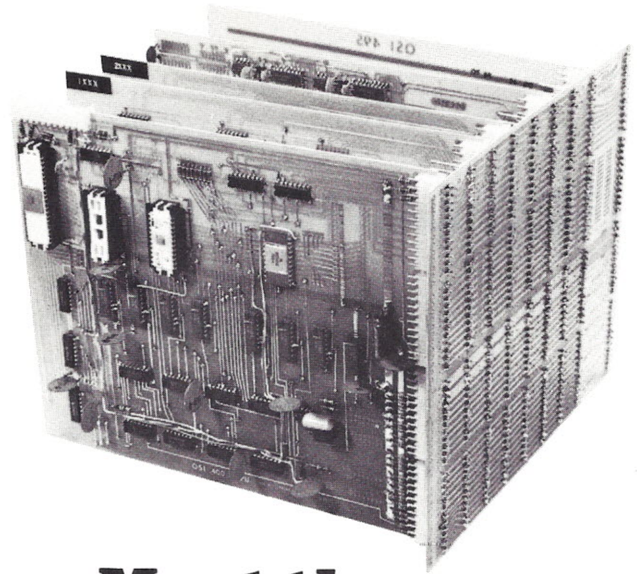
```
200 S1=LOG(ABS(1/COS(X) + TAN (X))) + C
```

Now it's your turn. Write BASIC lines for each of the relationships in Figure 6.

1. COTANGENT(X) = COSINE(X)/SINE(X)
2. HYPOTENUSE = $\sqrt{A^2 + B^2}$
3. AREA = ½BC SIN(X)
4. SIN(X) = $\sqrt{1 - COS^2(X)}$
5. TANH(X) = $\frac{e^X - e^{-X}}{e^X + e^{-X}}$

Hint: Problem 5 employs EXP(X) extensively.

Figure 6



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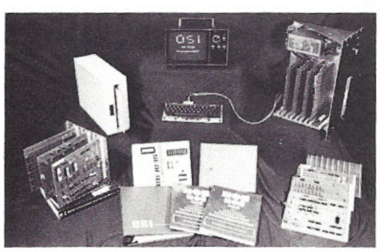

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The corresponding BASIC lines appear at the conclusion of this article.

We started our discussion of functions with the goal of having repeated access to a few lines of programming. Suppose that we had wanted to have repeated access to something a little more complicated; for instance, we wanted our main program to perform the routine in Figure 1 at several different places.

We refer to a routine used in this way as a subroutine and we introduce two new terms: the GOSUB and the RETURN. The routine in Figure 1 starts on line 10. We can cause the program to branch there by writing GOSUB10 anywhere in the main program. We can get back to the next line below the GOSUB10 instruction by changing line 80 of Figure 1 to read RETURN. That is all that there is to it. GOSUB gets us there and RETURN gets us back. This may be a little clearer if you consider the diagram in Figure 7.

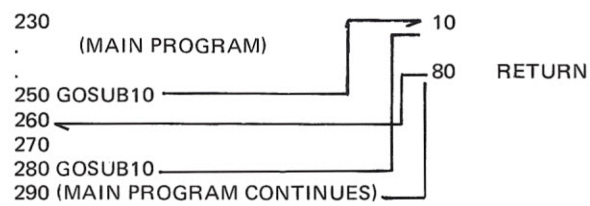

Figure 7

This concludes our quick peek at BASIC programming. I have glossed over some information, omitted other, and implied more than I have said. Please bear in mind that books have been written on BASIC. I only hope that my few short comments will get you started.

The following are BASIC lines for the writing exercises provided in Figure 6.

1. 100 C = COS(X)/SIN(X)
2. 110 H = SQR(A↑2 + B↑2)
3. 120 A = (B*C*SIN(X))/2
4. 130 S = SQR(1—COS(X)↑2)
5. 140 T = (EXP(X)—1/EXP(X))/(EXP(X)+1/EXP(X))

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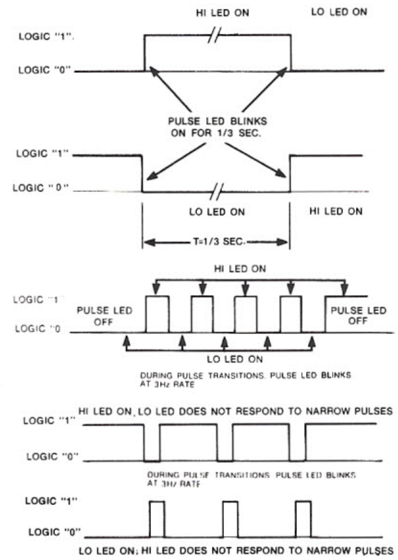

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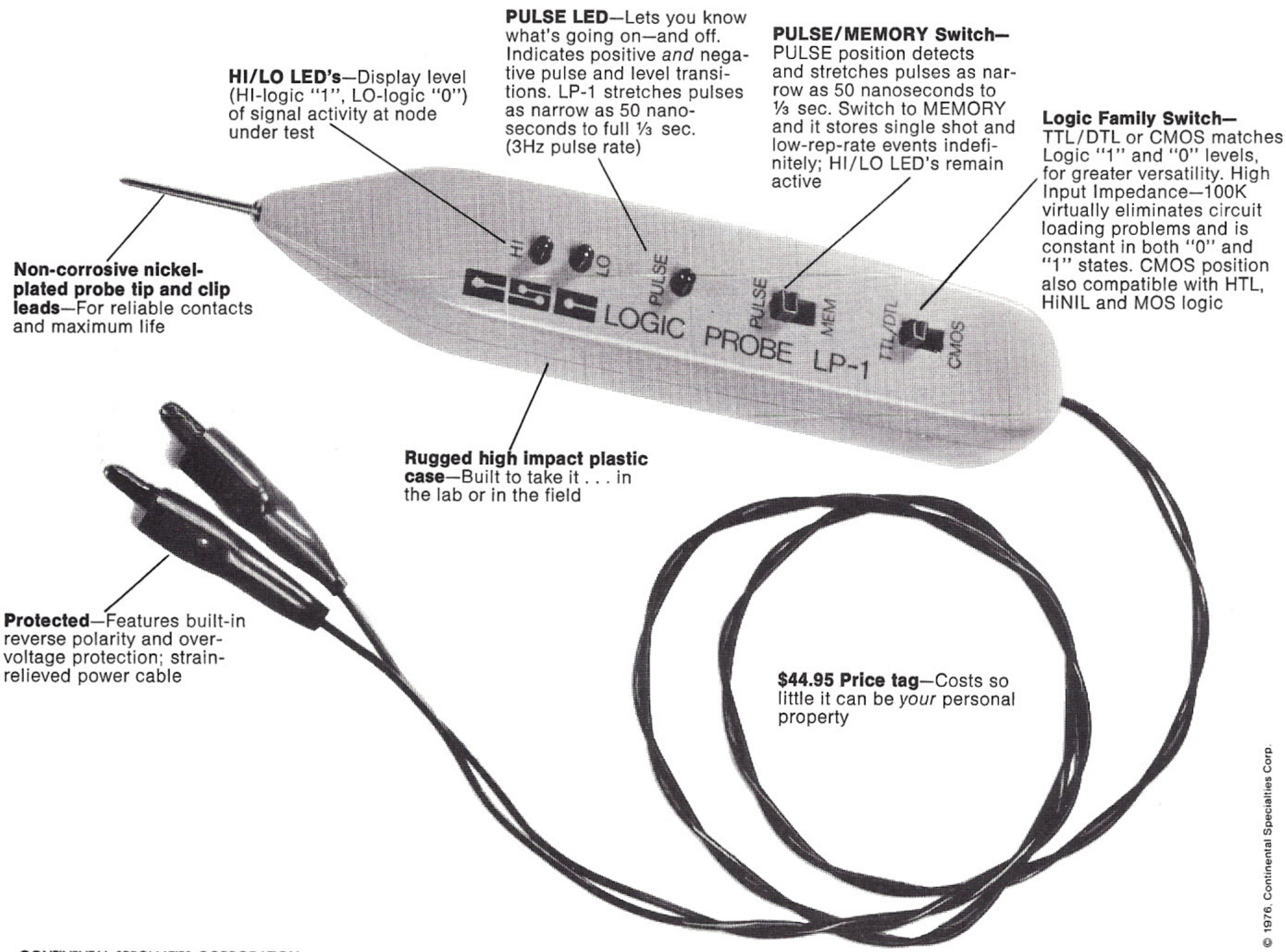

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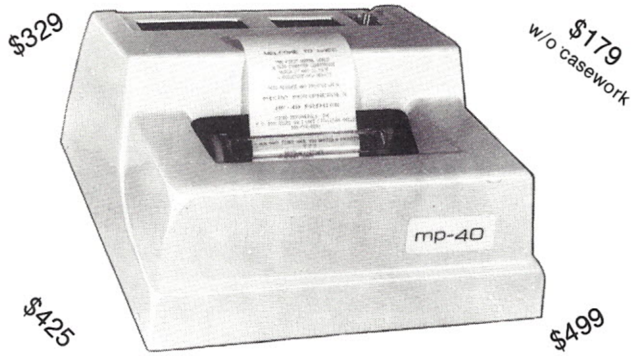

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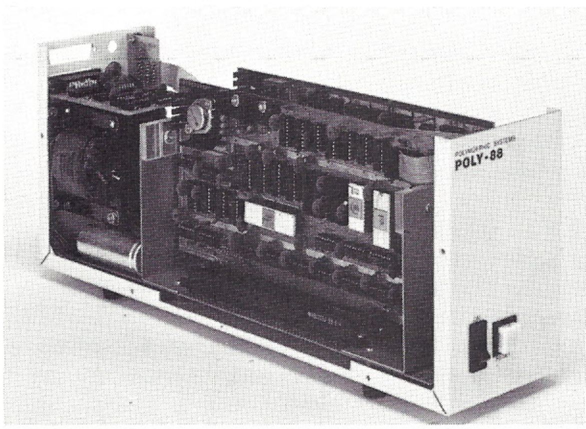

and single-step logic that allows the processor to execute one instruction at a time.

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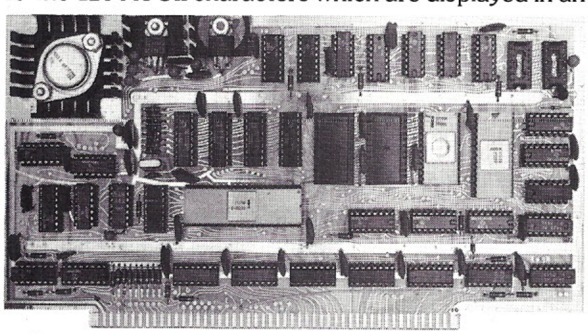

easy-to-read 7x9 font, there are 64 graphic characters available for plotting on a 48 x 128 contiguous grid.

These two circuit cards fit into a compact "Altair-compatible" chassis with room for up to five cards. A 6 amp power supply is built right on the mother board. The front panel consists of just two switches, on/off and reset; the monitor software with video screen and keyboard eliminates the need for a hardware front panel. As your system grows, you can plug chassis together for easy expansion. (The expansion connector also eliminates the need for an extender card.) Cassette, RS-232, and current loop interfaces are available which connect via ribbon cable to the CPU board and mount on the backpanel.

The Software: Supplied with the POLY 88 microcomputer is a 1024-byte monitor on ROM. The program is there when the power is turned on, so you don't need to key in a loader. The monitor is designed to use a keyboard entry and TV display, with a casstte or paper tape as the storage medium.

With the monitor you can: load data into memory in hex, display memory in hex, dump or read data from a storage device, and execute program one step at a time, displaying the contents of each of the 8080 registers as well as the values in memory at the address of each of the registers. All of these functions

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FUTURE SHOCK

No time for formal education in today's high speed technological race

by NIEL SCLATER

The microprocessor is forcing technical educators to re-appraise the traditional methods for teaching digital electronics and computer programming due to the convergence in course content. The "Computer-on-a-chip" has created a demand for new teaching aids and texts to satisfy people of all ages and experience levels who want to understand the computer, but have neither the time nor desire to master all the formal engineering prerequisite courses.

Special microcomputer seminars have seized the initiative and have combined the essentials of digital logic, computer architecture and programming into one unified course suitable for everyone from beginning hobbyists to seasoned professional circuit designers seeking an update in the new technology.

The focal point of this revolution in education is the self-contained, desk-top microcomputer built around a popular microprocessor central processing unit (CPU) chip and a matched set of interface, memory and control chips. They may be purchased factory-built or assembled and wired from kits.

Some of these microcomputers are being offered by the semiconductor device manufacturers or their distributors in an effort to increase the market for their products; others, more oriented toward education (classroom teaching or self-instruction) are being offered by manufacturers who have no affiliations with semiconductor manufacturers. Both kinds may be used for system prototyping or design aids.

A completely assembled unit with keyboard, status lamps, power supply and a reasonable amount of read/write and read-only memory will typically sell for less than $500. Some have provision for breadboarding for interface experimentation. The student will be able to write and carry out simple programs to solve mathematical problems or even control motors, relays or lamps. The trainer is a simple, yet functionally-complete computer that is easier to comprehend than a minicomputer and gives the student complete control over both hardware and software.

Crucial issues in the selection of these training aids are the quality and educational level of the accompanying instructional text and the provisions for "hands-on" experience in interfacing the microcomputer with external system components. Some trainers are "closed" systems, essentially limiting computational results to a display of lamps. Some are also accompanied by manuals or handbooks largely devoted to the internal workings of the chips and are incomprehensible except to those with current knowledge of large-scale integration device specifications.

Professional educators favor the systems that can be employed both as classroom instruction aids for demonstration purposes and for self-instruction where existing curriculums do not permit formal in-

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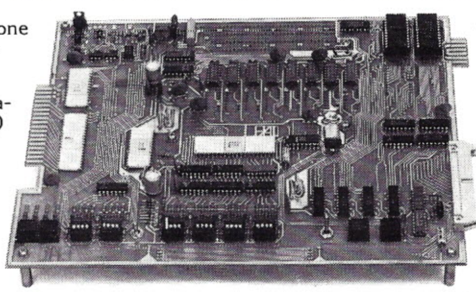

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struction. High marks are being given to those systems that give a student an opportunity to gain an overall appreciation of the microprocessor and microcomputer with little or no tutorial help other than the texts supplied.

The most effective hardware not only helps the student to become proficient in microprocessor interfacing and programming, but also permits him to design, develop and implement small practical systems, sometimes before he has completed any formal computer courses.

Microcomputer trainers are turning up at all levels of education from high school to graduate school. They are being used as demonstrators in formal lectures, as bench equipment in computer science and electronics laboratory courses, and as the central hardware in informal two- to five-day accelerated "crash" courses sponsored by professional societies, semiconductor manufacturers and schools.

Educators have become increasingly critical of the traditional linear approach to teaching computers in which the student must progress through a number of theoretical courses on devices and analog circuits before being introduced to digital technology and the fundamental logic elements of the computer. Moreover, the subject of programming is still considered independently.

This time-consuming approach may be excellent preparation for the student planning a career in electornic design, but it puts off the whole matter of overall comprehension of the computer and what it will accomplish until well along in the curriculum. Moreover, it ignores the reality of the desire of many people, regardless of their academic interests or career goals, to attain at least a minimal level of competence with the computer. Most people are fulfilling their desire for appreciation of the computer with the informal seminars that by-pass much of the material being offered in the rigid traditional courses.

Some professors are reporting that even their ablest engineering students are having trouble "tying together" their background knowledge in hardware and software to permit them to make effective use of the microcomputer in actual

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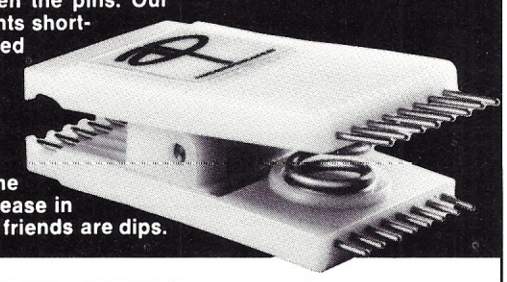

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system design work due to the rapid changes in technology. Thus even the best students in engineering and computer science admit to feelings of "future shock."

One of the equipment manufacturers that has tried to keep its training aids and supporting text material current in this climate of change is E & L Instuments. They have kept in touch with instructors and professors in various schools and colleges throughout the country.

As a result of continuing dialogs with these professional educators, it has been found that microcomputer training is taking place on at least four levels in formal courses or informal seminars:

1. Transition training for experienced electronic circuit designers who wish to learn the specifics of MPU chip sets and interfacing, as well as a working knowledge of programming so they can design microprocessor-based systems. This training is most often carried out in seminar sessions.

2. Supplementary training for engineering and physical science majors who wish to learn to apply the microcomputer. This is often given as part of formal lecture or laboratory instruction.

3. Introductory courses to undergraduates lacking electronics or engineering backgrounds regardless of concentration or vocational interest. These are essentially appreciation courses presented for credit.

4. Informal seminars or training sessions of two to five days duration open to all interested persons. These are most likely to be sponsored by professional societies, semiconductor manufacturers or their distributors, or educational equipment makers. Offered at low cost, they are attracting hobbyists of all ages and experience levels as well as persons who intend to apply the knowledge gained in their own occupations.

The informal sessions generally have as their objectives: (1) The introduction of the student to the concept of a software-based electronic circuit through actual "hands on" experience with a well known MPU chip set; and (2) The attainment of a comprehension level of the language and literature of computers and programming that will

BRANCH to . . . pg. 76

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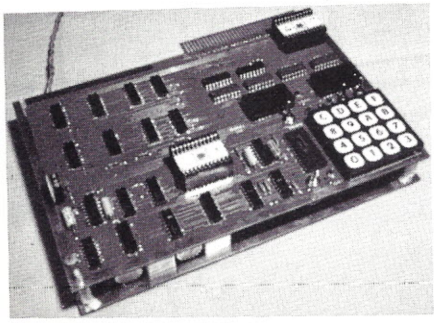

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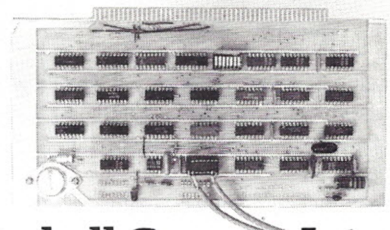

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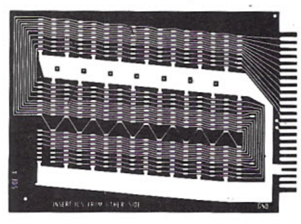

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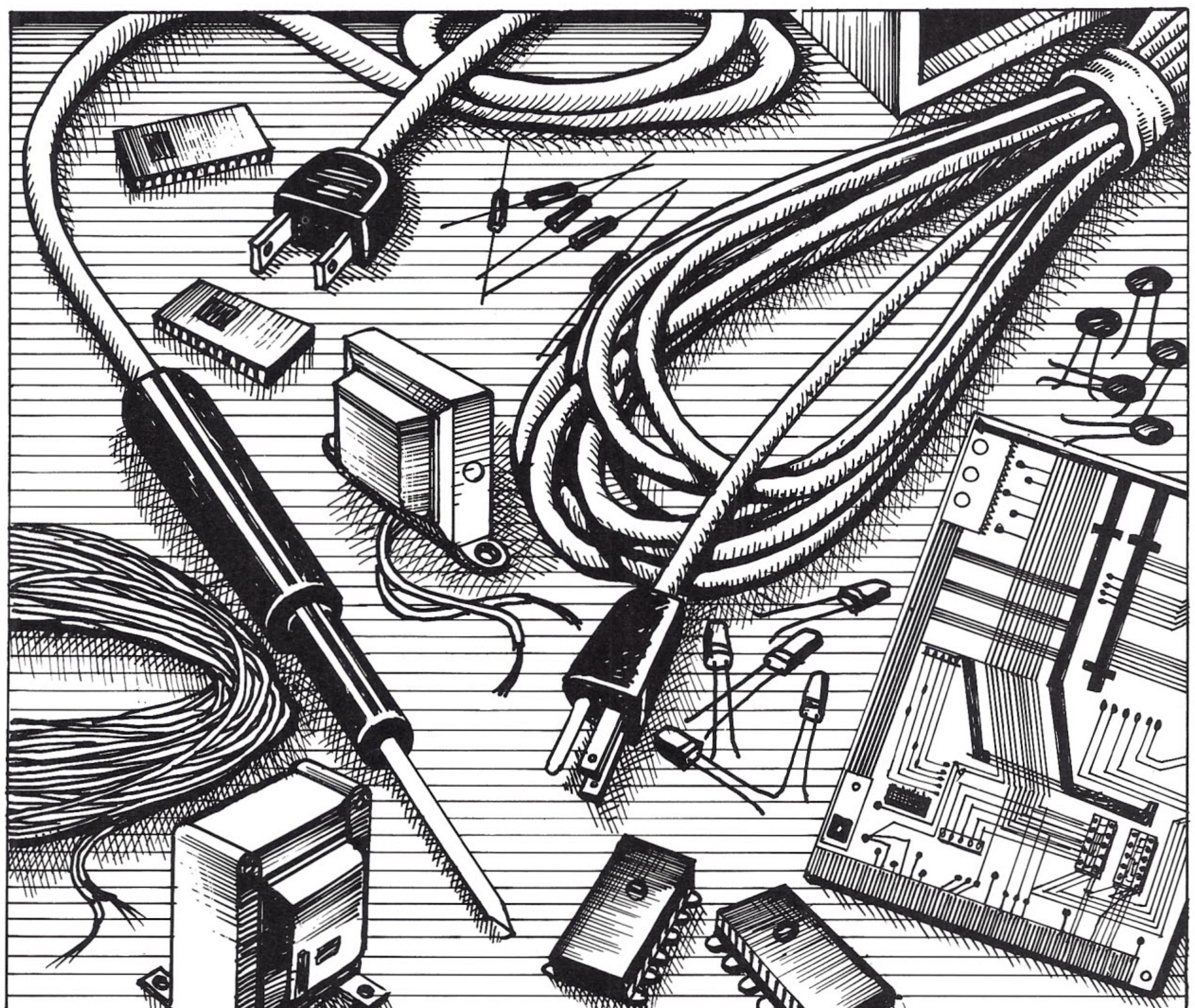
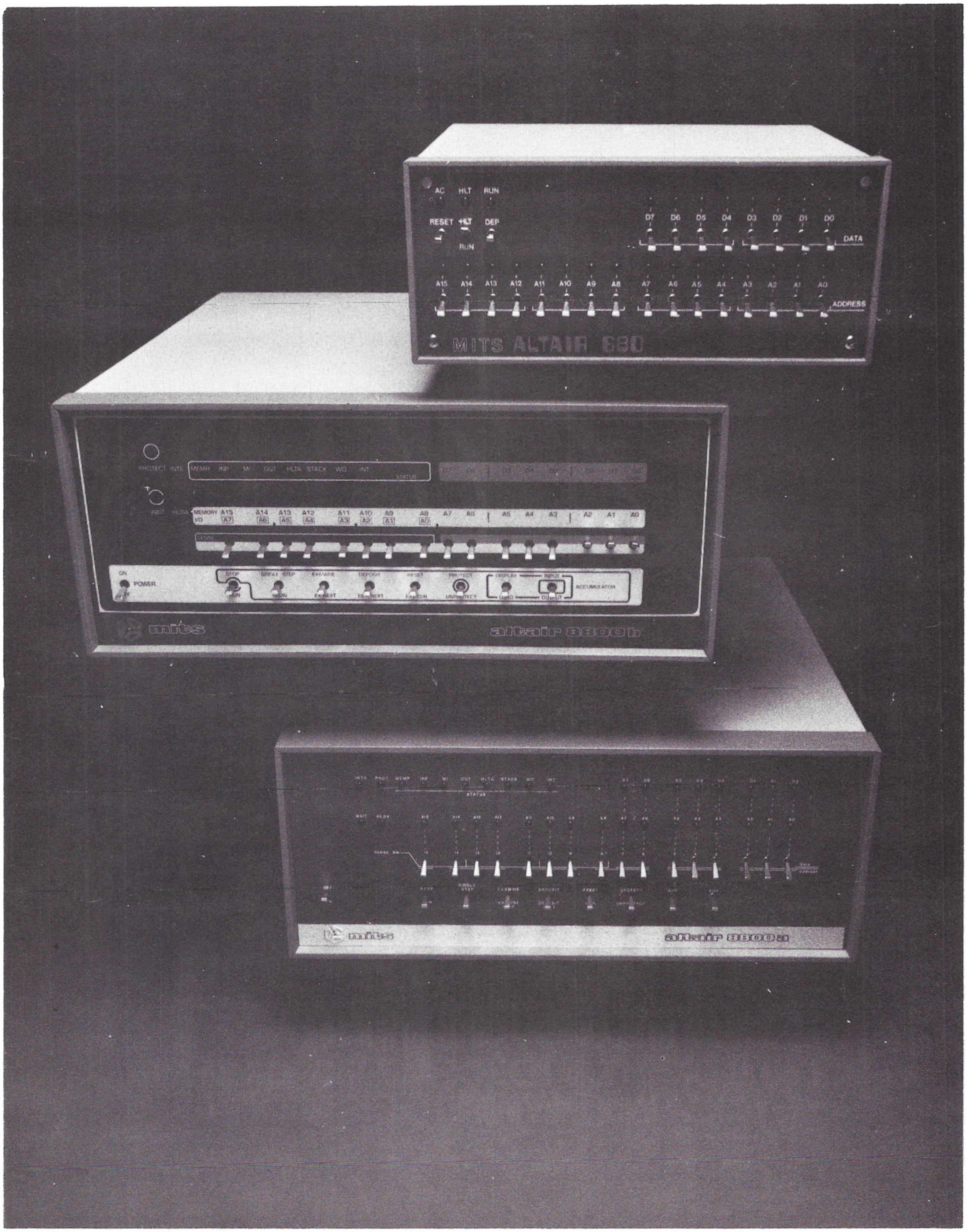
We have set up an Altair kit-a-month payment desk to service your needs. When writing or calling the factory for information about your shipment or account, just refer to the "kit-a-month payment desk."




AC
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2. The kit-a-month plan has been set up to proceed in order and we cannot deviate from that order. You can help us by noting with your payment what month you are on.

3. When calling or sending in orders, refer to your customer name on the original order and also your Mits order number.

4. If you change your address, keep your name as it is on the original order to keep records straight.

5. Please note special instructions for Alaska, Hawaii, APO, FPO and Canadian customers. If these are not followed, it could result in delays in processing your order.

6. The Kit-a-Month desk has been set up to help expedite your orders because of the overwhelming response we've had with previous time payment plans. Please feel free to use this service whenever you have questions. When writing letters to Mits, simply note "Kit-a-Month desk" on the outside of the envelope.

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CIRCLE NO. 24 ON INQUIRY CARD

MICROCOMPUTER:

COMPUTER OR CONTROLLER

by TERRY BENSON
Field Applications Engineer,
INTEL Corp.

The "home-computer" has come to be the ultimate extension of the electronic hobbiest market and some "homists" are trying to find practical applications for this lavish hobby. The *Popular Electronics* cover in January, 1975, made the electronic hobbiest aware of a "super" electronic gadget—the microcomputer. (At that time few hobbyists had even heard of the microcomputer—it was barely four years old.) Since then, hams, hobbyists, and home-brew computerists have expanded the microcomputer activity to such an extent that clubs are forming at a rate that exceeds the number of new companies offering microcomputer kits. These clubs offer a base for application exchanges and education.

Many of the new microcomputer users are developing programs that allow them to demonstrate their computers to friends. (Is "Star Trek" used for demonstration?) Many other programs are becoming available that let the microcomputer perform tasks that were previously handled by mini or larger computer systems. Financial systems, inventory control and other similar data processing operations are now being programmed for microcomputer systems.

The home computer is also functional in the education of beginners in the computer field, and numerous low-cost kits are making it easy for the novice to educate himself in computer programming. For the more experienced computer architects and programmers it has become possible to amass computer systems for whatever they have "always dreamed about."

One simple fact that many of these hobbyists are overlooking is that, due to its inherent low cost, the microprocessor can also effectively replace a number of logic elements within a microcomputer system. In the majority of microcomputer applications (commercial and industrial products), the microcomputer system, like any computer, executes program steps. However, the program functions frequently involve no "data processing functions." In these applications, the microcomputer is being used to replace logic elements. A microcomputer system comprised of ten parts can replace 100 to 200 integrated circuits. These applications are implemented with microcomputers, primarily because of the cost reduction of the overall system. Another significant advantage which the hobbyists well know is that data processing functions can also be added to a previously "dumb" system at a very low cost.

Logic Replacement

Since these logic functions are available, it is quite easy for the hobbyist to take advantage of these functions and add to his microcomputer repertoire. In this article, I will review some basics in logic design and illustrate how the microcomputer can be programmed to perform some basic logic functions. Hopefully, the logic functions discussed will help you incorporate your system into applications that are unrelated to data processing—control functions. (For a review of some of the basics of logic design, refer to "Designing Logic Circuits—Boolean Algebra" by Bruce Scott that appeared in the July 1976 issue of *Interface*.)

As a review, I have illustrated four basic logic elements (Figure 1). These functions are available in standard 74XX TTL packages and probably are even incorporated into your microcomputer system. In order to illustrate the operations of these functions, let's take a simple example and show how an Intel 8080 can be programmed to implement and, therefore, replace some of these logic elements.

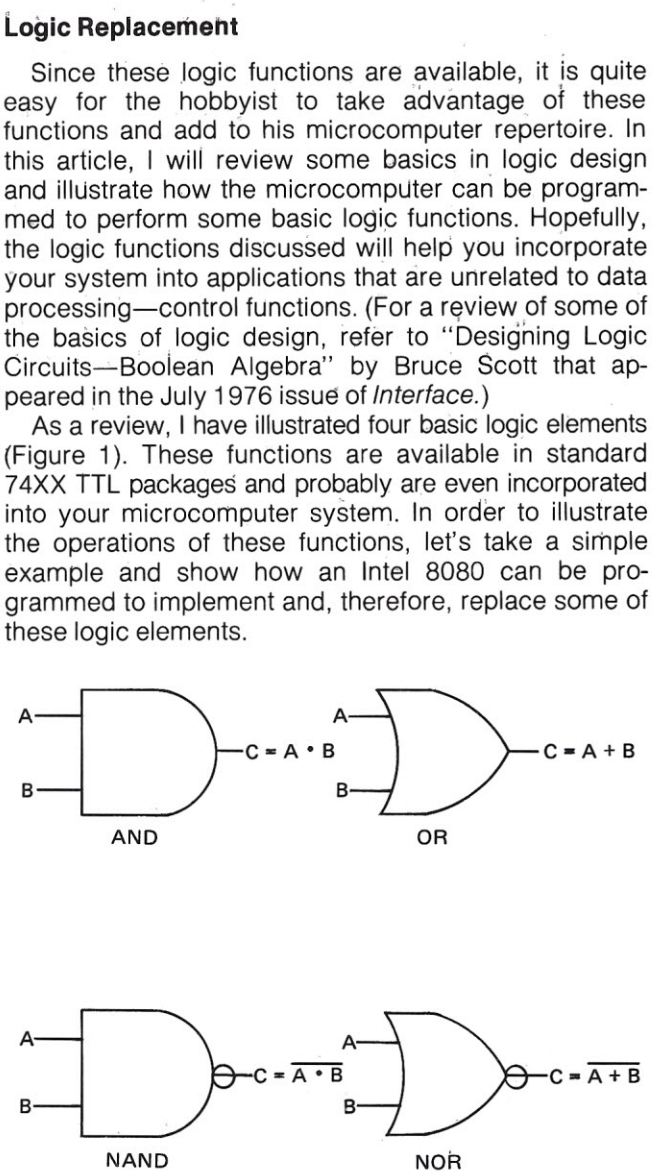


Figure 1

(In the examples which follow, many of the logic instructions of the 8080 will be used. The descriptions of these instructions are adequately covered in other programming documentation[1] and will not be specifically discussed here. It is the intention of this article to show

how these functions can be incorporated into actual logic functions such as may be found in logic replacement applications.)

The schematic shown in Figure 2 will be used in the logic examples which follow. Each switch is considered on when it makes contact with ground (a "zero"); if the switch is off, the input will be a "one." The switches are read on port F4 hex (0F4H); the value of switch "A" is available on bit 0. The other switches are connected as shown.

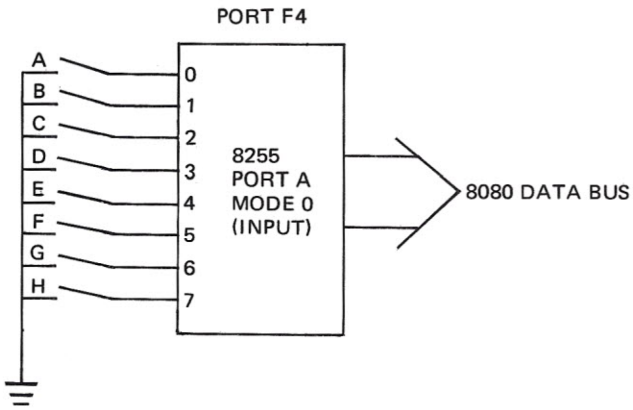


Figure 2

AND/NAND Functions

Application:

Turn a lamp on if switch "D" is on *and* switch "G" is on.

Program Steps:

```
1) IN 0F4H          ;GET DATA
2) ANI 01001000B    ;MASK OFF ALL BITS EXCEPT
                    SWITCH D & G
3) JZ LAMP          ;IF BOTH SWITCH VALUES = 0
                    (ON), TURN LAMP ON, OTHER-
                    WISE TURN LAMP OFF
```

In statement 1, we read the values of all 8 bits on port F4. In statement 2, we perform an "AND" function within the processor to ignore the undesired 6 bits. The two remaining bits represent the values of switches D and G. Thus, after this instruction, the accumulator will contain zeros in bit positions 0,1,2,4,5, and 7. Bits 3 and 6 will represent the values of D and G, respectively. If switch D is on, bit 3 will be zero and, conversely, if switch D is off, bit 3 will be one; likewise for switch G on bit 6.

This means that if both D *and* G are on, both bits 3 *and* 6 will be zero along with all the other 6 bits. In this case, since all bits are zero, the "zero" flag from the accumulator will be set. Then, in statement 3, if this flag is set, we jump to a routine that outputs the signal that will cause the light to turn on. (A "NAND" function would simply require the "JZ" to be changed to a "JNZ.")

This is a specialized case and I think it is easy for you to expand this concept to more than two switches. But what about the case where one input must be inverted? Should you add an inverter gate at the input port? No, of course not! Let's generate the program steps to solve the equation: $LAMP = D \cdot \overline{G}$. If switch D is on *and* switch G is off, turn the lamp on:

```
1) IN 0F4H          ;GET ALL 8 SWITCH VALUES
2) ANI 01001000B    ;MASK ALL BITS EXCEPT 3 AND 6
3) XRI 01000000B    ;INVERT BIT 6
4) JZ LAMP
```

In line 3, bit 6 (switch G) is inverted and, in line 4, the proper switch arrangement is checked.

The incorporation of the "XRI" instruction allows checking for any combination of switches as selected by the ANI instruction. To expand on this, let's monitor 4 switches, A, B, C, and D, and solve the following equation:

$$LAMP = A \cdot \overline{B} \cdot C \cdot \overline{D}$$

Program Steps:

```
IN   0F4H
ANI  00001111B
XRI  00001010B
```

Note that the four bits of interest (D,C,B,A) are simply the inverted sense of the desired function (0101). (This is due to the fact that a "true" is actually a zero condition.)

OR/NOR Functions

Application:

Turn alarm on if switch "B" or "C" or "H" is on.

Program Steps:

```
1) IN 0F4H          ;GET ALL 8 SWITCH VALUES
2) ANI 10000110B    ;MASK OFF OTHER BITS
                    ;(HGFEDCBA)
3) XRI 10000110B    ;INVERT B, C AND H
4) JNZ ALARM
```

At step 3, the three-bit positions of interest are inverted. If any one of the three switches is on, that bit will be a "zero" in step 2 and change to a "one" in step 3, thus causing the accumulator to be non-zero.

Practical Uses

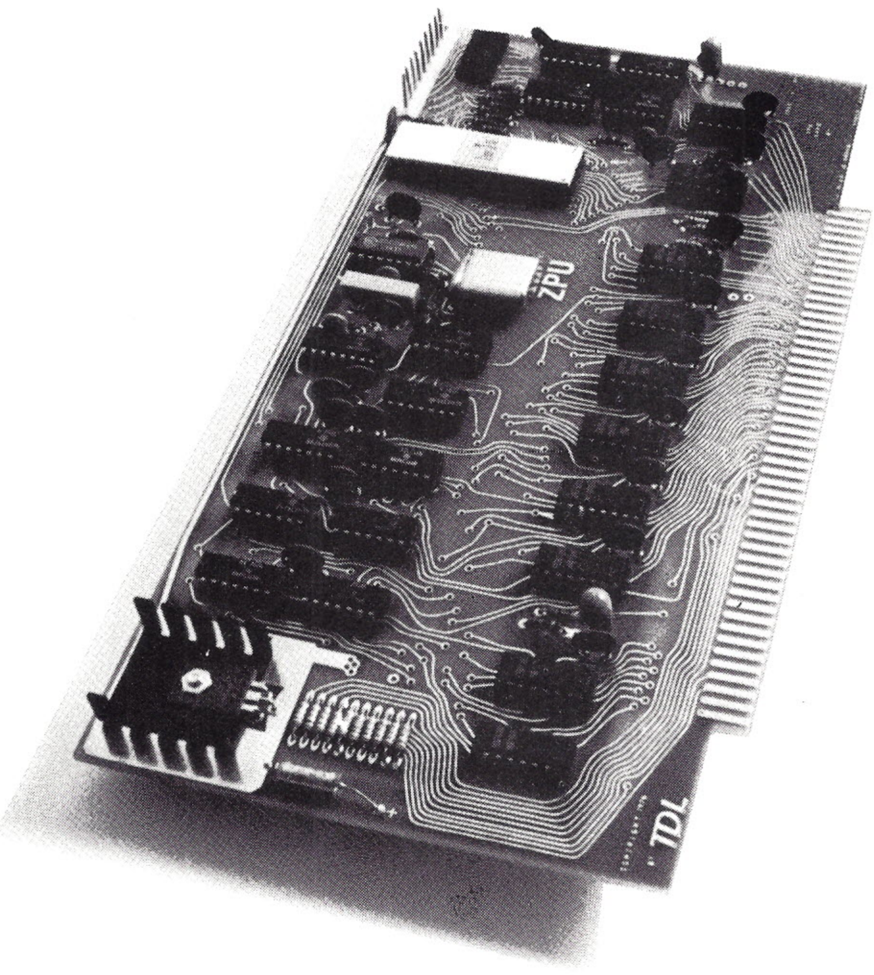
We should now be able to incorporate these examples into everyday applications around the house. As a simple application, let's assume that there are 8 switches in your house that are to be monitored by your microcomputer system. (Of course, you may add as many as required by expanding the number of ports and adding additional program steps to support the added switches.)

Figure 2 will be used as the switch input port. The switches correspond to the following table:

Switch	*Bit*	*Function*
A	0	Light switch on back porch
B	1	Front door alarm switch
C	2	Back door alarm switch
D	3	Light switch in living room
E	4	Master alarm switch
F	5	Light switch in bedroom
G	6	Photo cell detector
H	7	Window alarm switch

The output port will be port F5 (port B on the 8255)

We've got it! Z-80 power for the Altair bus.



Here it is, TDL's ZPU™ the highest point of technology for an Altair/IMSAI system. Now, you can multiply your present capabilities without creating costly obsolescence. Take advantage of the wide range of existing hardware backup for your current system. The ZPU is compatible and dependable with many plus features you'll want to know about.

To further round out your system we also have available the fastest and lowest power static ram boards going (from 4 to 16K with expansion) and a system monitor board with a Z-80 monitor, powerful I/O and audio casette features.

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ZPU Kit $269.00
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HOW TO ORDER Just send check or money order, or use your BankAmericard or Mastercharge, and your orders will be shipped to you postpaid. COD orders must be accompanied by a 25% deposit. Your credit card order must include the serial # of the card, expiration date, and your order must be signed. New Jersey residents add 5% state sales tax. For more information, send for our free catalog.

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CIRCLE NO. 25 ON INQUIRY CARD

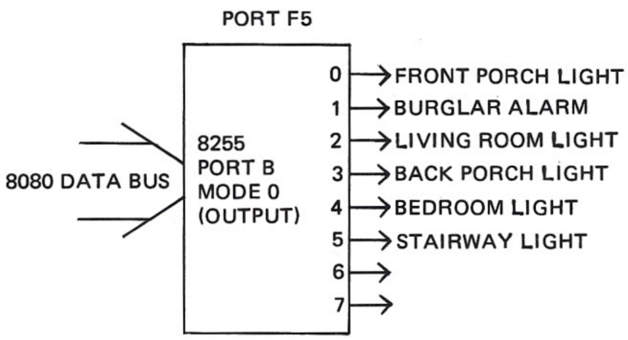

Figure 3

and is shown in Figure 3. The output bits when on (a "one") will generate the described function. The output lines will be connected to appropriate drivers and solid state relays to turn the device on or off. Other functions may be added as desired.

Some of the functions to be performed are as follows: (1) Turn burglar alarm on if the master alarm switch is on and any one of the intruder switches is on. The equation for this is: $E \bullet (B + C + H)$. (2) Turn front porch light on and living room light on if the light switch in the living room (D) is on and the photo cell detector (G) is on (dark). (This way your lights go on when it's dark and off when it's light, even if you're not home.) (3) Turn back porch light on as soon as it gets dark (photo cell goes on) and off as soon as it gets light regardless of switch positions but turn it off whenever the bedroom light switch is turned off (that is, on the transition from on-to-off). Also, allow the back porch light to be triggered on or off by the switch at the back door. (This example not only incorporates AND/OR functions but also flip-flop functions.)

The program to control these three simple functions is shown in Figure 4. These program steps could easily become a part of a microcomputer system that controls many functions within your home. An additional advantage of a system like this is that all switches could be connected to a master control panel using small gauge wire such as might be used for wiring an intercom system. (Maybe you could even incorporate voice recognition into a "super" system.)

How could you handle a "three-way" switch network that allows you to control the stairway light from two switches? Basically what is required is a system that inverts the light "on/off" function whenever either switch position is changed. This requires the microcomputer system to "remember" the last switch values and check them to see if they have changed. The following steps can be incorporated into the program for that purpose.

```
        IN 0F6H          ;GET ALL 8 VALUES
        ANI 3            ;SAVE ONLY 2 LSB
        LXI H, LASTV     ;POINT TO LAST VALUE
        CMP M            ;COMPARE OLD TO
                         ;NEW VALUE
        MOV M,A          ;SAVE NEW VALUE
                         ;(DOESN'T CHANGE
                         ;FLAGS)
        JZ NOCHG         ;IF SAME, NO CHANGE
        IN 0F5H          ;READ OUTPUT PORT
        XRI 00100000B    ;INVERT BIT 5
        OUT 0F5H         ;OUTPUT NEW BIT 5
                         ;(OTHER BITS
                         ;UNCHANGED)
NOCHG:  . . .            ;(NEXT FUNCTION)
```

This application, of course, can be expanded to as many switches as desired to control a single output.

Other Practical Uses

Hopefully, you have seen that the microcomputer system can be used to reduce hardware—logic elements, wires, cheaper switches, etc. In fact, the microcomputer can become an important ecological control unit when incorporated into a home environmental control system. By monitoring inside and outside temperatures, calculating the temperature gradient, setting optimum temperature gradient, setting optimum temperatures for different times of the day and so on, the microcomputer system can help to decrease the fuel consumption within your home.

There are many *control* applications where a microcomputer can be cost-effective in reducing hardware and increasing desirable features. The applications of microcomputers for these functions are unlimited and perhaps some of the ideas discussed here will encourage you to develop additional control applications for your microcomputer system.

REFERENCE

1. *8080 Assembly Language Programming Manual.* $5.00. Intel, 3065 Bowers Avenue, Santa Clara, Ca. 95051.

Figure 4

```
ISIS 8080 MACRO ASSEMBLER, V1.0                    PAGE 1
HOME CONTROLLER PROGRAM


                         TITLE    'HOME CONTROLLER PROGRAM'
               ;
               ;THIS PROGRAM DEMONSTRATES THE USE OF THE INTEL 8080
               ;IN AN APPLICATION THAT MIGHT BE FOUND IN THE HOME.
               ;
  1310         ORG      1310H
               ;
               ;SAVE SPACE FOR CONSTANTS
               ;
```

```
1310            BPSW:   DS 1               ;RAM SPACE FOR BACKPORCH SWITCH
1311            BDRM:   DS 1               ;RAM SPACE FOR BEDROOM SWITCH
1312            PHOTO:  DS 1               ;RAM SPACE FOR PHOTOCELL
                ;
                ;
                ;INITIALIZE THE RAM LOCATIONS
                ;
1313 3E01       START:  MVI A,1
1315 321013             STA BPSW           ;0 IF ON
1318 3E20               MVI A,20H
131A 321113             STA BDRM           ;0 IF ON
131D 3E40               MVI A,40H
131F 321213             STA PHOTO          ;0 IF DARK
1322 3E59               MVI A, 1011001B ;8255 CONTROL WORD
1324 D3F7               OUT 0F7H           ;SET 8255 MODE
                ;
                ;NOTE: IN THIS PROGRAM, THE OUTPUT PORTS MAY BE
                ;READ SINCE THEY ARE IMPLEMENTED WITH AN INTEL 8255
                ;
1326 DBF4       MAIN:   IN 0F4H            ;GET ALL 8 SWITCH VALUES
1328 47                 MOV B,A            ;SAVE IN REG. B
                ;
                ;PROCESS BURGLAR ALARM
                ;
1329 E610               ANI 10H            ;SWITCH E
132B C23613             JNZ NALRM          ;IF NOT ON, NO ALARM
132E 78                 MOV A,B            ;GET ALL 8 VALUES AGAIN
132F E686               ANI 86H            ;SAVE B, C & H
1331 EE86               XRI 86H            ;INVERT B, C & H
1333 C23D13             JNZ ALARM          ;IF ONE ON, SET ALARM
1336 DBF5       NALRM:  IN 0F5H            ;READ OUTPUT.PORT
1338 E6FD               ANI 11111101B      ;TURN ALARM OFF
133A C34113             JMP ALR1
133D DBF5       ALARM:  IN 0F5H            ;READ OUTPUT PORT
133F F602               ORI 00000010B      ;TURN ALARM ON
1341 D3F5       ALR1:   OUT 0F5H           ;OUTPUT NEW INFO
                ;
                ;PROCESS PORCH LIGHT & LIVING ROOM LIGHT
                ;
1343 78                 MOV A,B            ;GET ALL 8 VALUES AGAIN
1344 E648               ANI 48H            ;CHECK ONLY D & G
1346 EE48               XRI 48H            ;INVERT D & G
1348 DBF5               IN 0F5H            ;GET OUTPUT PORT (NO FLAG AFFECT)
134A CA5213             JZ LAMPS           ;IF D & G BOTH ON
134D E6FA               ANI 11111010B      ;TURN OFF ONLY BITS 0 & 2
134F C35413             JMP LMP1
1352 F605       LAMPS:  ORI 00000101B      ;TURN ON BITS 0 & 2
1354 D3F5       LMP1:   OUT 0F5H
                ;
                ;PROCESS OTHER FUNCTIONS
                ;
1356 78                 MOV A,B            ;GET ALL 8 SWITCHES AGAIN
1357 E640               ANI 01000000B      ;CHECK PHOTO-CELL
1359 211213             LXI H, PHOTO
135C BE                 CMP M              ;0 IF DARK, 40H IF LIGHT
135D 77                 MOV M,A            ;SAVE NEW VALUE
135E CA6513             JZ BRCHK           ;SAME AS LAST TIME
1361 A7                 ANA A              ;SET FLAG TO CHECK PRESENT VALUE
1362 CD9213             CALL BPRCH         ;IF BIT 6 = 0, TURN LIGHTS ON
```

```
                ;
                ;CHECK BEDROOM LIGHT SWITCH
                ;
1365 78         BRCHK:  MOV A,B             ;GET 8 SWITCHES AGAIN
1366 E620               ANI 00100000B       ;CHECK BEDROOM SWITCH
1368 CA7A13             JZ BRLON            ;IF ZERO, SWITCH IN ON
136B 211113             LXI H,BDRM          ;SWITCH OFF
136E BE                 CMP M               ;DID IT JUST GO OFF?
136F 77                 MOV M,A             ;SAVE NEW VALUE (NO FLAG AFFECT)
1370 C49513             CNZ TRNOF           ;TURN BACKPORCH LIGHT OFF IF
                                            ;BEDROOM SWITCH JUST WENT OFF
1373 DBF5               IN 0F5H             ;GET OUTPUT PORT DATA
1375 E6EF               ANI 11101111B       ;TURN BEDROOM LIGHT OFF
1377 C37E13             JMP BRLIT
137A DBF5       BRLON:  IN 0F5H             ;GET OUTPUT PORT DATA
137C F610               ORI 00010000B       ;TURN BEDROOM LIGHT ON
137E D3F5       BRLIT:  OUT 0F5H            ;OUTPUT NEW BEDROOM LIGHT STATE
                ;
                ;NORMAL BACKPORCH CONTROL
                ;
1380 78                 MOV A,B
1381 E601               ANI 1               ;MASK ALL BUT BP SWITCH
1383 211013             LXI H, BPSW         ;GET LAST VALUE
1386 BE                 CMP M
1387 CA2613             JZ MAIN             ;START OVER AGAIN
138A 77                 MOV M,A             ;SAVE NEW VALUE
138B A7                 ANA A               ;CHECK NEW VALUE
138C CD9213             CALL BPRCH          ;TURN ON OR OFF
138F C32613             JMP MAIN
                ;
                ;THIS SUBROUTINE CHECKS TO SEE IF BACKPORCH
                ;LIGHT MUST BE TURNED ON OR OFF
1392 CA9C13     BPRCH:  JZ TRNON
1395 DBF5       TRNOF:  IN 0F5H
1397 E6F7               ANI 0F7H            ;TURN BACKPORCH LIGHT OFF
1399 C3A013             JMP TRN
139C DBF5       TRNON:  IN 0F5H
139E F608               ORI 8H              ;TURN BACKPORCH LIGHT ON
13A0 D3F5       TRN:    OUT 0F5H
13A2 C9                 RET
0000                    END
```


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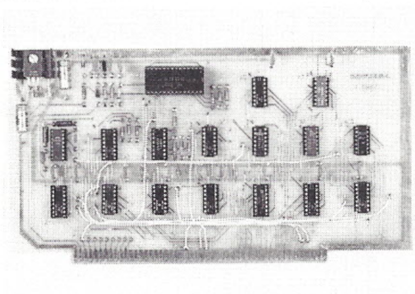
CIRCLE NO. 26 ON INQUIRY CARD

New Products

COMPTEK ANNOUNCES NEW CL2400 REAL TIME CLOCK

COMPTEK has recently introduced a unique real-time clock kit that is ALTAIR and IMSAI compatible. Designed specifically for ease of use, the new CL2400 real-time clock, is a



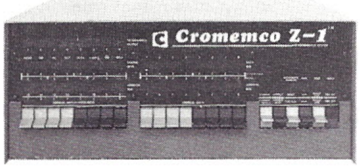
self-contained, hardware-implemented clock. In its normal mode of operation it keeps time in 24-hour format from 00:00:00 to 23:59:59 with one second resolution. The microcomputer system treats the device as a peripheral, allowing the six digits of the present time to be read by any high level language, such as BASIC, that has peripheral I/O capabilities (i.e., an OUT statement and an IN statement).

For more information contact: COMPTEK, P.O. Box 516, La Canada, CA 91011.

CIRCLE NO. 90 ON INQUIRY CARD

A MAJOR NEW MICROPROCESSOR DEVELOPMENT SYSTEM BASED ON THE HOT NEW Z-80 CPU

The industry's most advanced microcomputer with a 4 MHz clock rate and supported by a variety of practical peripherals is now available to hardware and systems engineers for use in their work with the Z-80.



Cromemco's new microprocessor development system, the Z-1, consists of what is certainly the industry's most powerful microcomputer supported by an array of well-known and often unique Cromemco peripherals. Specifically, the Z-1 is a ready-to-run system that includes this outstanding group of features: a Z-80/4 microprocessor chip; 8K of RAM memory; 8K of PROM capacity (for 2708 PROMs); a PROM programmer; a resident monitor in PROM; an RS232 serial I/O interface; a rugged, proved mainframe with a full 22 card-sockets and a heavy duty 28-amp power supply; a variety of peripheral support devices.

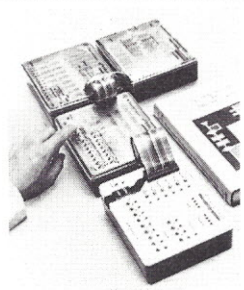
Despite this performance level, thei $2495 price of the Z-1 is markedly below minicomputer level—as is the price level of the support peripherals available for it.

For more information contact: Mr. Joe McCrate, Cromemco, 2432 Charleston Rd., Mountain View, CA 94040. (415) 964-7400.

CIRCLE NO. 91 ON INQUIRY CARD

TEXAS INSTRUMENTS ADDS NEW MODULES TO MICROPROCESSOR LEARNING SYSTEM

The self-contained units, controller, memory and input/output, complete the user-paced system for understanding microprocessors and provide a training ground for basic software and hardware development.



The basic Microprogrammer Module, which exemplifies the most fundamental level of microprocessor operation, was announced last January. The new modules allow users to progress in a logical sequence from micro to macro level programming to the operation of a fully automated digital system. Each module has its own instruction manual, battery, charger and interconnecting cables and connectors.

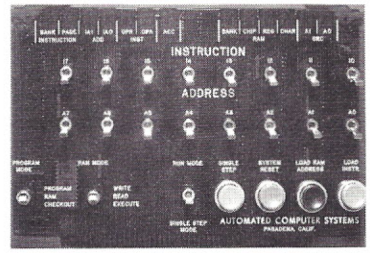
The system helps users learn microprocessor concepts and design techniques by providing an insight into the hardware requirements and limitations in designing microprocessor-based systems. Enough system hardware is provided for actual applications limited only by the 4-bit capabilities and the necessary interface circuitry to output devices.

For more information contact: Texas Instruments, Inc., Inquiry Answering Service, P.O. Box 5012, M/S 308 (Attn: M. P. Modules) Dallas, TX 75222.

CIRCLE NO. 92 ON INQUIRY CARD

MICROCOMPUTER SYSTEM ANALYZER MODEL NO. ACS-4040MCSA HAS TWO FACES

The ACS-4040MCSA is a low-cost multifunctional 4040 Microcomputer System Analyzer for varied microcomputer applications. The system analyzer can be used as a microcomputer control-display panel, as a hardware-software development tool, as a production check-out tool or as a field service maintenance tool. Used as a program development tool, the system analyzer offers a cost-effective alternative to software operating system techniques for developing,



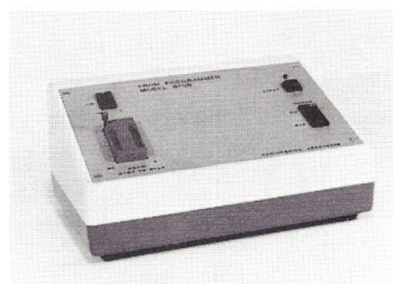
trouble-shooting and debugging 4040 microcomputer programs in real-time by providing up to a 3 to 1 reduction in program development time without requiring memory hardware to store the software operating system nor requiring a TTY for program development interface. The purchase price of the analyzer is approximately 1/3 of the cost of a TTY and software operation system memory. For more information contact: R. A. Stevens, 2361 E. Foothill Blvd., Pasadena, CA 91107, (213) 449-0616.

CIRCLE NO. 93 ON INQUIRY CARD

2704/2708 PROGRAMMER KIT

The Model 8700 PROM programmer kit is designed to build a completely self-contained programmer for programming the 2708 and 2704 type PROM's.

The programmer is housed in an attractively styled, high impact polystyrene case and has integral power supplies. It features internal timing circuitry to handle the PROM timing



requirements, allowing asynchronous operation and easy interfacing with virtually any microcomputer system, requiring only simple programs for its control. Flow charts on the data sheet describe the control programs, which must be supplied by the user.

The kit includes all the necessary hardware and design documentation to build this PROM programmer. it is easy to build. It has two circuit boards, containing all the hardware and only a few wires interconnecting the circuit boards.

The price for this kit is $149. Delivery, stock to 4 weeks.

For more information contact: Engineering Resources, 1903 Alameda Padre Serra, Santa Barbara, CA 93103. Phone (805) 963-3801.

CIRCLE NO. 94 ON INQUIRY CARD

POCKET DATA TERMINAL

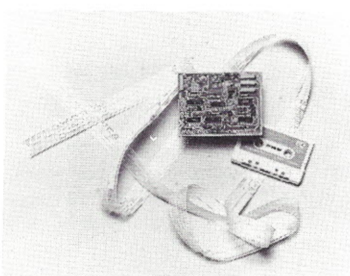
Internal, rear-mounted acoustic transducer provides instant, fumble-free, no-wires-required data input to any telephone mouthpiece, or two-way radio or tape recorder microphone . . . simply hold the Pocket Data Terminal up to the microphone and press the Auto-Dial button and within seconds the computer has answered and you can start entering data via the keyboard.

The Pocket Data Terminal Model PDT-1000 offers a significant security advantage to prevent unauthorized persons entering or gaining access to any system since all 7 (or less) Touch-Tone* digits can be outputed from memory as fast as 1/2 of a second total elapsed time.

CIRCLE NO. 95 ON INQUIRY CARD

LOW COST AUDIO CASSETTE/ TTY/CRT ADAPTER FOR MICRO PROCESSORS

Electronic Product Associates, Inc. recently announced the availability of a new, low-cost audio Cassette/TTY/CRT Adapter which allows any serial TTL or MOS output to simultaneously interface a low cost audio cassette player via frequency shift keying (Byte Standard) up to 300 Baud and to a standard RS232 CRT and a 20 mA current



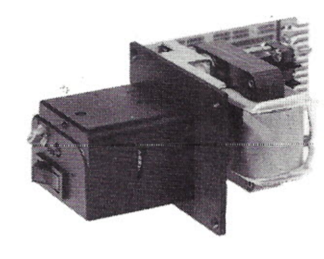
loop TTY. The adapter also simultaneously decodes Byte Standard FSK data from low-cost audio cassette players and from 20 mA current loop TTY and RS232 CRT. Audio cassette information is decoded by a proprietary phase locked loop system developed by EPA which is said to be the most reliable method available for transferring digital data to and from low-cost audio cassette players. The model TCC3 is 4½" × 3¼" (11½ cm × 8 cm) and mounts piggy back on the EPA Micro-68 development computer. The TCC3 price is $129.00 in singles, completely assembled and tested. Delivery is from stock.

For more information contact EPA, 1157 Vega Street, San Diego, California 92110 (714) 276-8911.

CIRCLE NO. 96 ON INQUIRY CARD

LOW COST PAPER TAPE READER READS 350 CHARACTERS PER SECOND

A series of paper tape readers that read all standard 5, 6, 7 or 8-level tapes with no adjustments at 350 characters per second is announced by Addmaster Corporation. Known as the Model 640 "Data Loader" Series, it employs LED light sources and hermeticaly sealed phototransistors. Power required 115VAC, 10 watts.



Outputs available are: Model 640-1, Schmidt triggered CMOS amplifiers and TTL-compatible drivers. Model 640-2, Schmidt triggered CMOS data amplifiers. Model 640-3, phototransistors only (includes selected emitter resistors.

Price: Single unit to 49 pieces: $151 (Model 640-3). Delivery: 2 weeks. For more information contact: Addmaster Corp., 416 Junipero Serra drive, San Gabriel, California 91776 (213) 285-1121.

CIRCLE NO. 100 ON INQUIRY CARD

DIRECT-ETCH AND POSITIVE PHOTO-RESIST KITS SIMPLIFY ETCHED CIRCUIT BOARD FABRICATION

Two new etched circuit board kits, from Vector Electronic Company, facilitate rapid production of quality circuit boards without expensive and time-consuming processing with cameras and darkrooms. The kits, Model No. 32X-1 and 32XA-1, contain positive resist coated circuit boards, bare cop-

per clad boards, and all materials necessary for fabricating circuit boards by the direct-art-then-etch process, and also by the positive photo-resist process.

Vector etched circuit kits are useful for both engineering and experimental circuit board fabrication. Existing full-scale artwork may be copied directly from hobby magazines with the supplied tracing and artwork materials.

For more information contact: Vector Electronic Company, Inc., 12460 Gladstone Ave., Sylmar, CA 91342; (213) 365-9661.

CIRCLE NO. 97 ON INQUIRY CARD

IMSAI announces a unique 4K RAM board for just $139.

Nobody has a 4K RAM board that gives you so much for your money. It's fully compatible with the Altair 8800.

Through the front panel or under software control, you can write protect or unprotect any 1K group of RAM's. Also under software control you can check the status of any 4K RAM board in 1K blocks to determine whether it's protected or not. The board has LED's that clearly show you the memory protect status of each 1K block and which block is active. And there's a circuit provided that will let you prevent the loss of data in the memory if there's a power failure. This low power board has a guaranteed 450 ns cycle time– no wait cycle required. There's nothing like the IMSAI 4K RAM board around.

Dealer inquiries invited.

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SYSTEM SPECIAL #1

IMSAI 8080 with full **22 slot** mother board, **8 additional 100 pin** edge connectors, **2-IMSAI Super 4K RAM** boards, **Polymorphics video** board 16 line x 64 characters (the **ONLY** one with graphics and built in keyboard interface). New **ASCII encoded Keyboard** in attractive case, **TARBELL cassette** interface for fast loading or storage of data. System comes complete with **books, documentation,** and **8K Basic.** All you need is a monitor or modified T.V. ($135) and a cassette recorder to make your system complete.

Reg. Price: Assembled-$2221. Kit-$1475.
Pkg. Price: Assembled-$2099. Kit-$1387

SYSTEM SPECIAL #2

Poly 88 micro computer with 64 character **Video Interface,** (filled with 100 pin-connectors), 8K RAM, operating system on ROM, choice of **Tarbell or Byte cassette** interface, one SIO port, new **ASCII encoded Keyboard** in attractive case, **12" T.V./monitor.** Turn it on & it's ready to use.

Reg. Price: Assembled-$1715. Kit-$1341.
Pkg. Price: Assembled-$1597. Kit-$1257.

ZILOG Z-80

System Z —
(A) IMSAI basic machine built around the **NEW CROMEMCO SUPER ZPU BOARD**⁂. Comes complete with **22 slot mother board,** 12-100 pin edge connectors, 8K of Super fast RAM, Byte Saver 8K PROM programmer board with 1K operating system on 2708 EPROM, IMSAI MIO board with 1-SIO & 2-PIO ports & a Byte/Tarbell cassette interface, Poly VTI-64 video interface, 12" T.V./Monitor, encased ASCII Keyboard. Total Price including cables & connectors, books & documentation:
Assembled-$3185.00 Kit-$2365.00

System Z —
(B) Same as above but with AMD-3 (24X80 CRT) replacing VTI-64, T.V./Monitor & Keyboard.
Assembled-$3810.00 Kit-$2760.00

⁂ZPU board features #1) 2 & 4 Mega Hertz clock using Z-80/4, #2) power on jump, to bring your System alive with 1K Byte operating kernel, #3) on board wait states to allow use of any memory board, #4) 40 TTL support chips to assure dependability and future compatability with other boards.

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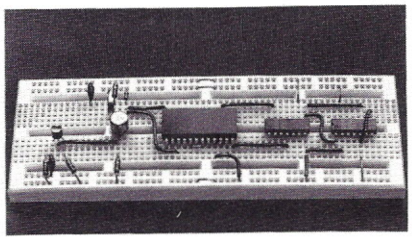
CIRCLE NO. 27 ON INQUIRY CARD

A P PRODUCTS, INC. LINE OF SOLDERLESS BREADBOARDS

A P Strips provide a low-cost alternative for the circuit builder who enjoys the speed,



ease and versatility of solderless breadboarding but doesn't need the larger-scale capabilities of an ACE solderless breadboard. A P Strips also make a convenient add-on to any ACE to increase its capabilities.

ACE, Super Strips, Terminal Strips, and Distribution Strips are available from leading electronics distributors or direct from the factory.

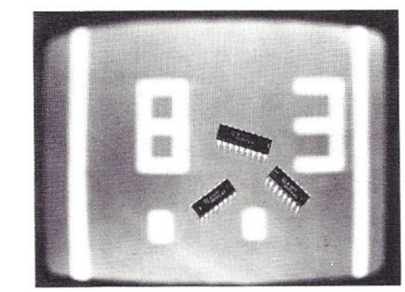
For more information contact Ken Braund, Product Marketing Manager, A P Products Inc., Box 110P, Painesville, OH 44077. Phone (216) 354-2101.

CIRCLE NO. 98 ON INQUIRY CARD

FAMILY OF UNIVERSAL GAME IC's ANNOUNCED BY TEXAS INSTRUMENTS

A family of universal game circuits for video game applications was recently announced by Texas Instruments Inc. These circuits offer users a wide range of games with easily changeable features and game rules.

Combinations of these circuits allow games with multiple balls, multiple walls, multiple



players, and obstacles. As a result, they can be used in simple tennis and hockey games or in more complex games such as race, battle, complex soccer, pool, and pin ball. Since horizontal player movement is available, the universal game circuits are compatible with joystick operation.

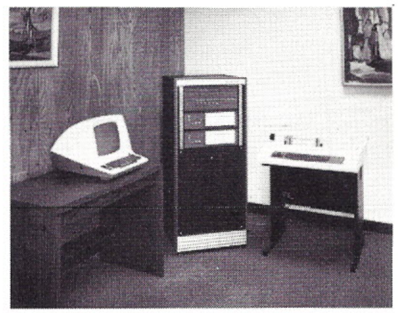
The first six circuits announced today are: SN76423—Game logic with automatic random English; SN76425—Horizontal and vertical sync generator; SN76426—Character generator; SN76427—Wall and ball generator; SN76428—Game logic with manual English; SN76460—0 to W (Win) at 20 Digital Scoring.

For further information contact: Texas Instruments Inc., Inquiry Answering Service, John Stich (806) 747-3737 Ext. 246. P.O. Box 5012, M/S 308 (attn: Video Game IC's) Dallas, TX 75222.

CIRCLE NO. 99 ON INQUIRY CARD

MICROCOMPUTER-BASED SMALL BUSINESS ACCOUNTING SYSTEM

Administrative Systems, Inc. recently announced a breakthrough in the price/performance ratio of small business computer systems. The Phase/One microprocessor-based system consists of a MITS 8800A computer with 16K bytes of RAM, two or more floppy



disks, an ADM-3 CRT terminal, and an LA-36 printer terminal, plus individually tailored applications programs to perform accounts payable, accounts receivable, payroll, general ledger, inventory control and job-cost analysis. The basic system handles 2,000 accounts receivable, 2,000 accounts payable, 2,000 employees on payroll or 650 general ledger accounts. The total price for the hardware is $9,980 and each software package is $2,000. For more information contact: Mal R. Lockwood, ASI, 222 Milwaukee, Suite 102, Denver, Colorado 80206. (303) 321-2473.

CIRCLE NO. 101 ON INQUIRY CARD

LOW-COST ACCESSORY BOARD INCREASES MEMORY AND INTERFACE CAPABILITIES OF MMD-1 MICROCOMPUTER

A new accessory board model MMD-1/MI with extra RAM memory, Teletype interface, and audio cassette interface is now available from E&L Instruments and from all E&L Instruments stocking representatives.

The MMD-1/MI simply plugs into the built in card edge connector on the MMD-1 and mounts on top of the unit.

An MMD-1/MI accessory board completely assembled and tested, sells for $200.00. In kit form with all parts for assembly, the price is $150.00. The MMD-1/MI has the following features: 2K RAM memory capability (1K supplied); Teletype interface (20 MA current

loop); Paper tape reader control for ASR33 Teletypewriters; Audio Cassette interface; and, Sockets to accept up to 1K PROM or ROM.

The addition of the MMD-1/MI board to the basic MMD-1 Microcomputer increases the on board memory capacity to 2.5K RAM and

1.5 K PROM or ROM.

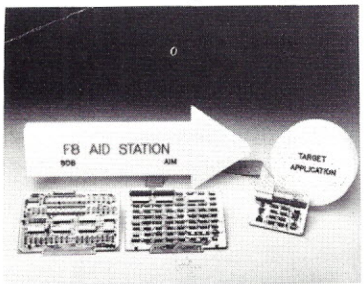
The Teletype interface and audio cassette interfaces allow easy and inexpensive data storage and retrieval.

For more information contact: E&L Instruments Incorporated, 61 First St., Derby, Connecticut 06418. Telephone (203) 735-8774.

CIRCLE NO. 102 ON INQUIRY CARD

MOSTEK INTRODUCES F8 DEVELOPMENT STATIONS

Two low-cost, Aid-in-Development (AID) Stations from MOSTEK allow debugging of F8 applications in the hardware and software configuration of the final system (target). The Application Interface Module (AIM) provides for emulation of the target ROM, or PROM



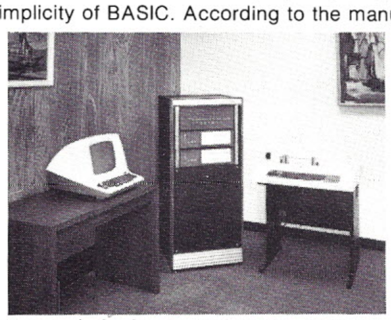
with RAM. The RAM, which appears as ROM to the application, can be loaded, debugged and modified using peripherals independent of the target. The Software Development Board (SDB) allows execution and debugging of software, plus, the capability to create and edit "source" listings and assemble them into corresponding "object" code. Together, SDB/AIM provide a cost-effective approach to target application development.

For more information contact: Don Ward, MOSTEK Corporation, 1215 W. Crosby Road, Carrollton, TX 75006, Phone (214) 242-0444.

CIRCLE NO. 103 ON INQUIRY CARD

OPUS/ONE, HIGH-LEVEL LANGUAGE COMPILER INTRODUCED BY ASI

ASI has announced OPUS/ONE, a high-level language compiler that incorporates the strong points of several large-system languages such as ALGOL and FORTRAN, yet maintains the commands, statements and simplicity of BASIC. According to the manu-



facturer, it is faster and more efficient in memory utilization, yet simpler to learn than BASIC. ASI states that the non-professional will find programming easy and straightforward; the professional will discover that many unique and creative combinations of code are possible, enhancing the program efficiency and power.

Some highlights of the language are: arithmetic precision up to 126 digits; strings automatically converted to numbers during numerical operations, with any length up to 128 characters; GOTO, GOSUB parameters can be variables or strings; variables, virtually unrestricted in character length, can represent a number, string or matrix; matrices up to 255 dimensions with either number or string elements; I/O print format statement has right and left justification, carriage return/line feed control within the parameter list; block structure similar to ALGOL's BEGIN-END features (brackets delimit blocks of program code). I/O handlers are available for most RS-232 and current loop devices. OPUS/ONE comes in floppy disk and audio cassette tape configurations, and requires a minimum of 8K bytes of memory. Custom configurations are also available.

The Disk version is available at $300; Cassette at $250. A detailed user's guide is available for $5.

For information, contact: Mal R. Lockwood, Administrative Systems, Inc., 222 Milwaukee, Suite 102, Denver, Colorado 80206. Phone: (303) 321-2473.

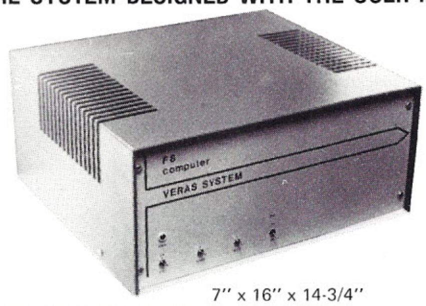
CIRCLE NO. 104 ON INQUIRY CARD

INTRODUCING THE **VERAS F8 COMPUTER**

THE SYSTEM DESIGNED WITH THE USER IN MIND

A COMPLETE 1K RAM SYSTEM

With CPU card, buffered mother card, power supply and cabinet. The VERAS System is developed around the popular F-8 Series of chips which in our estimation is the finest and most versatile Micro processor now available. The VERAS System can be made into a 17K processor by merely adding four of our optional memory boards.



7" x 16" x 14-3/4"

THE CPU BOARD FEATURES:

- Two I/O ports on the CPU and ROM chip make 32 bidirectional TTL lines.
- The Fairbug* programmed storage unit provides the programmer with all I/O subroutines, allows the programmer to alter or display memory, and register its contents via teletype.
- Programmable internal timer is built into the ROM chip.
- Built in clock generator and power on reset are built into the CPU chip.
- There is a local interrupt with automatic address vector.
- It is expandable to 65K bytes of memory.
- 20 mil loop and/or RS232 interface included.
- 1K of on board 2102 RAM.
- Serial interface built into PSU chip.

OUR 4K STATIC RAM BOARD FEATURES: (OPTIONAL)

- Outputs buffered.
- On board decoding for any four of 64 pages.
- Address and data lines are fully buffered.
- 32 2102-1 static RAM's, 500 ns. or less, requiring no refreshing.
- No onboard regulators to cause heat problems. (Chassis mounted)
- 4K memory boards with connector, buffers and static RAM's are available in kit form for **$149.00**

The fully buffered mother board will accept (4) 4K RAM boards for a total of 16K bytes of memory. Individual power terminals for each 4K RAM board are provided. Memory expansion beyond 16K bytes can be accomplished by the addition of more mother boards. Extra buffered mother boards with connector are available in kit form for **$45.00**

Our modular power supply is designed around a high frequency torroid transformer which affords a large saving in size and weight, and keeps filtering to a minimum. It is rated at +5V at 10 amps and -5V and ±12V at 1 amp. This power supply will drive our CPU, four memory boards and some peripherals.

POWER SUPPLY KIT **$124.00**

All boards are high quality G-10, double sided, solder plated with gold plated edge connector.

PACKAGING FEATURES ARE:

- A) Complete modular plug-in construction.
- B) Specifically designed rugged aluminum card rack with provisions for voltage regulators (TO-220 supplied) to keep heat off the boards.
- C) Designed for convection or optional forced cooling.
- D) All I/O ports brought out to the rear panel connectors for easy accessibility.
- E) Auxilary DC power available at the rear panel to power peripherals.

Veras Systems is currently developing the following:
UV PROM board, DMI and DMA board, Cassette, modem, video board and more. All these boards will have innovative design, something you will come to expect from VERAS SYSTEMS.

SPECIAL INTRODUCTORY PRICE FOR THE VERAS F8

Computer kit is **$429.00** or **$679.00** assembled. The price will be **$459.00** after Sept. 15, 1976. The kit includes everything you need to build the VERAS F-8 Computer as described. All boards, connectors, switches, discrete components, power supply and cabinet are supplied. Programming manual, data book and simplified support documentation supplied. 8K Assembler and Editor (paper tape) available on request with minimum order of 8K RAM.

Computer dealers and hobbyist club inquiries are invited.

Expected delivery time 30 days or less.

The More Flexible and Expandible Computer at a Comparative Price.

VERAS SYSTEMS

Warranty: 90 days on parts and labor for assembled units. 90 days on parts for kits. Prices, specifications and delivery subject to change without notice.

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A Div. of Solid State Sales, Inc.
Box 74E, Somerville, MA 02143
(617) 547-1461

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☐ Power Supply Kit

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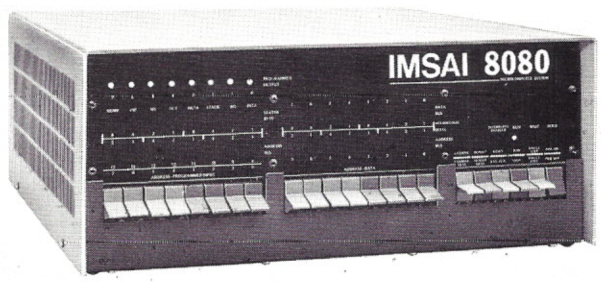

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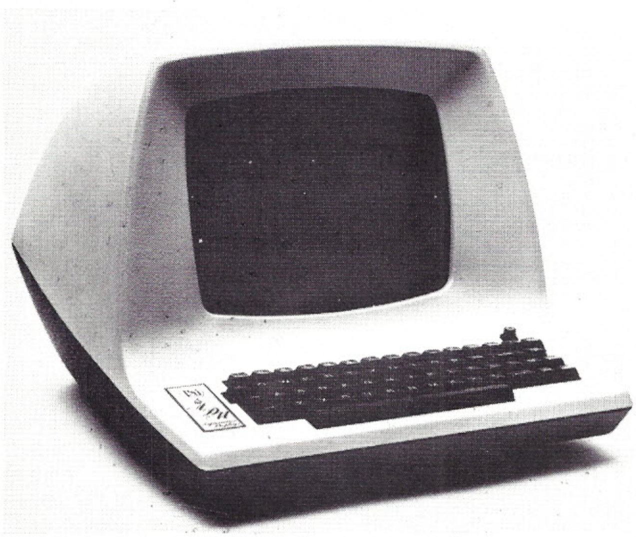


LEAR-SIEGLER MODEL ADM-3

CHARACTER GENERATION
5 × 7 dot matrix.

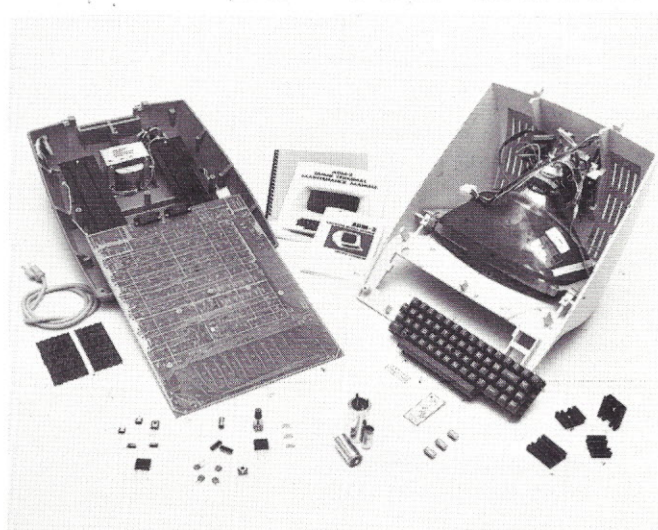
DISPLAY FORMAT
Standard: 1920 characters, displayed in 24 lines of 80 characters per line.

CHARACTER SET
Standard: 64 ASCII characters, displayed as upper case, plus punctuation and control.

COMMUNICATION RATES
75, 110, 150, 300, 600, 1200, 1800, 2400, 4800, 9600, 19,200 baud (switch selectable).

COMPUTER INTERFACES
EIA standard RS232C and 20 mA current-loop (switch selectable).

DATA ENTRY
New data enters on bottom line of screen; line feed causes upward scrolling of entire display with top-of-page overflow. Automatic new line switch selectable, end-of-line audible tone.



ADM-3K (24 × 80)	**$849.95**
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LOWER CASE OPTION	**$95.00**

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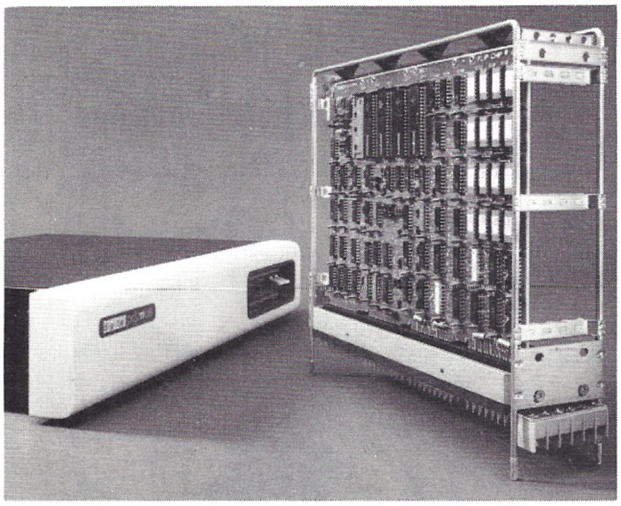
. . . FALL SPECIALS

LSI-11
MICROPROCESSOR MODULE



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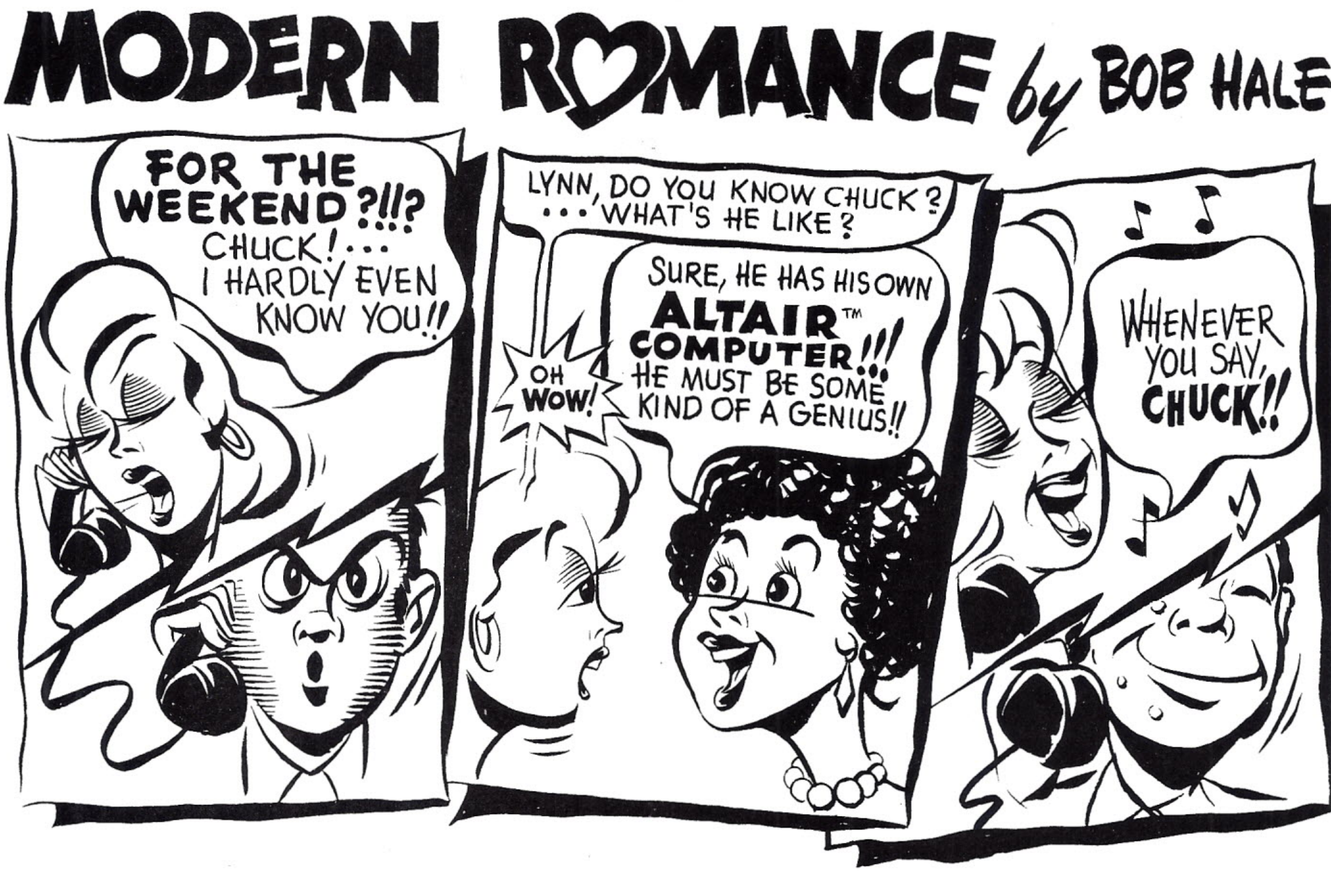

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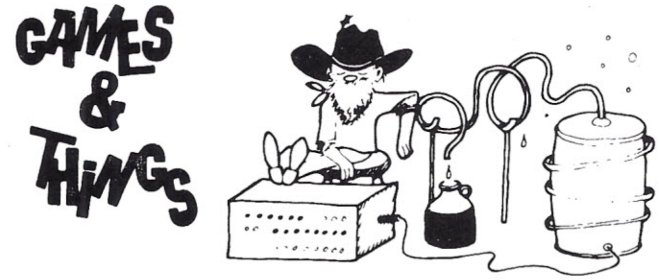


to bluff or not to bluff...

by Phil Feldman and Tom Rugg

Do you think you can bluff a computer? Could a computer bluff you? Now you (and the world) get a chance to find out the awful truth as we present the game of BLUFF this month.

The Rules of BLUFF

The game involves two players and a set of eleven cards. Instead of regular playing cards, each of these cards contains a different number from one to eleven.

To begin the game the cards are shuffled. Five are dealt to each player and one is placed face down between the players. The object of the game is to guess the identity of this secret card, or to cause your opponent to guess it incorrectly.

The players alternate turns. On each turn a player must do one of two things:

1) Announce he is going to guess the identity of the secret card. He then states his guess and the secret card is revealed. The player wins the game if he is right or loses the game if he is wrong.

2) Ask his opponent if he has any particular card in his hand.

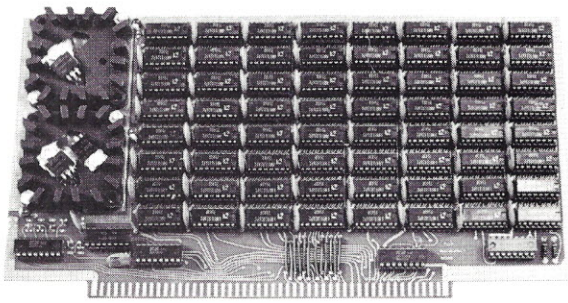
The questioned player must then answer truthfully yes or no. Although the questioned player must answer honestly, no such restriction is placed on the questioner. Thus the element of bluffing arises. You see, you can ask your opponent for a card that you know is right in your own hand.

This places your opponent in an immediate dilemma. If you weren't bluffing, then the asked for card is in fact the secret card and you know it. Thus your opponent must guess that card as the secret card immediately, for you will certainly do so on your next turn if you get the chance. But if you were bluffing and he guesses that as the secret card, he will of course be wrong. He will then lose, but even worse he has to put up with the sickly grin on your face for having successfully tricked him. Humiliation takes strange forms!

When a player does have a card asked of him, he removes it from his hand and exposes it face up on the table. Also, if he has bluffed on his previous trun, he exposes that card on the table before taking his normal turn. Thus the players do not have to remember cards they both know are not the secret card.

Play proceeds until one player decides to guess at the secret card. The outcome of the game rests on that guess.

The Original 8K Low Power Static Memory Kit Still at the Low Price of $285.



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16K STATIC RAM MEMORY

The 16K static RAM memory by **MIKRA-D** is a single board ALTAIR/IMSAI compatible memory configurable from 4K to 16K bytes in steps of 4K bytes. Our 16K memory is unique in the hobbyist/education field because it allows expansion to full 8080 address capability in only 4 slots.

All ALTAIR/IMSAI features are implemented, including:
—On board voltage regulator
—Buffered inputs and outputs
—Memory protect features activated by front panel switch
—Plugs right into ALTAIR/IMSAI bus
—500ns access time allows maximum 8080 speed

IN ADDITION, the **MIKRA-D** 16K static RAM provides the following features:
—Fully compatible with DMA devices
—Incredible 16K density on one board
—Increased reliability due to more bits per IC
—Low power per bit (.04ms/bit average)
—Module fully socketed

SIZE: 5" high × 10" wide (ALTAIR size)
POWER: -16v + 5% at 0.1A + 16v at 0.3A + 8v at :3A
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MD-2046-4K Implemented (kit): $205.00
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CIRCLE NO. 34 ON INQUIRY CARD

The BLUFF Program

The program implements the game with the computer being one of the players. It assumes a referee is present who makes sures the players abide by the rules. (We know you don't need a referee, but all your friends do.) The referee's duties are to expose the guessed cards and confirmed bluffs, and to establish whether or not asked cards are in the players' hands.

When it is your turn to play, the following information is printed out: (1) the cards left in your hand; (2) the number of cards left in the computer's hand, and (3) the cards already exposed.

Now the program asks for your play. If you input a number from one to eleven, this is interpreted as asking the computer for that card. If you input a 0 (zero), this means you wish to guess the secret card. The program then asks for your choice.

Since one game doesn't mean too much, the program records the number of games won by each player during a session. Usually a series of games is played to determine a winner. A minimum of five games should be played for a fair contest.

The program plays an honest game (we wouldn't bluff about that.) It is written in MITS Basic. It fits easily on a 12K Altair machine running with 8K Basic.

Strategy

The game is more subtle than might appear at first glance. It is important to mix your bluffs and honest-asks, since consistent bluffing or non-bluffing will only lead to predictable patterns. Some experience will be required, of course, but we'll let you find that out for yourselves. Generally, the player with the most cards left in his hand has the advantage. If you have no cards left you might as well guess at the secret card because your opponent knows what it is.

One final word of advice: Try to keep a poker face while playing. Don't make it easy for the computer by smiling or trembling when you BLUFF.

```
YOUR PLAY? (0=GUESS , 1-11 ARE ASKS)? 3

REFEREE SAYS I DON'T HAVE THE 3

DO YOU HAVE THE 8 ?

REFEREE SAYS YOU DO HAVE THE 8

REFEREE SAYS YOU BLUFFED LAST TIME ABOUT THE 3

YOUR HAND IS:  7  11  10
 5 CARDS ARE IN MY HAND
CARDS EXPOSED ARE:   8  3

YOUR PLAY? (0=GUESS , 1-11 ARE ASKS)? 6

REFEREE SAYS I DO HAVE THE 6

DO YOU HAVE THE 10 ?

REFEREE SAYS YOU DO HAVE THE 10

YOUR HAND IS:  7  11
 4 CARDS ARE IN MY HAND
CARDS EXPOSED ARE:   8  3  6  10

YOUR PLAY? (0=GUESS , 1-11 ARE ASKS)? 5

REFEREE SAYS I DO HAVE THE 5

DO YOU HAVE THE 2 ?

REFEREE SAYS YOU DO NOT HAVE THE 2
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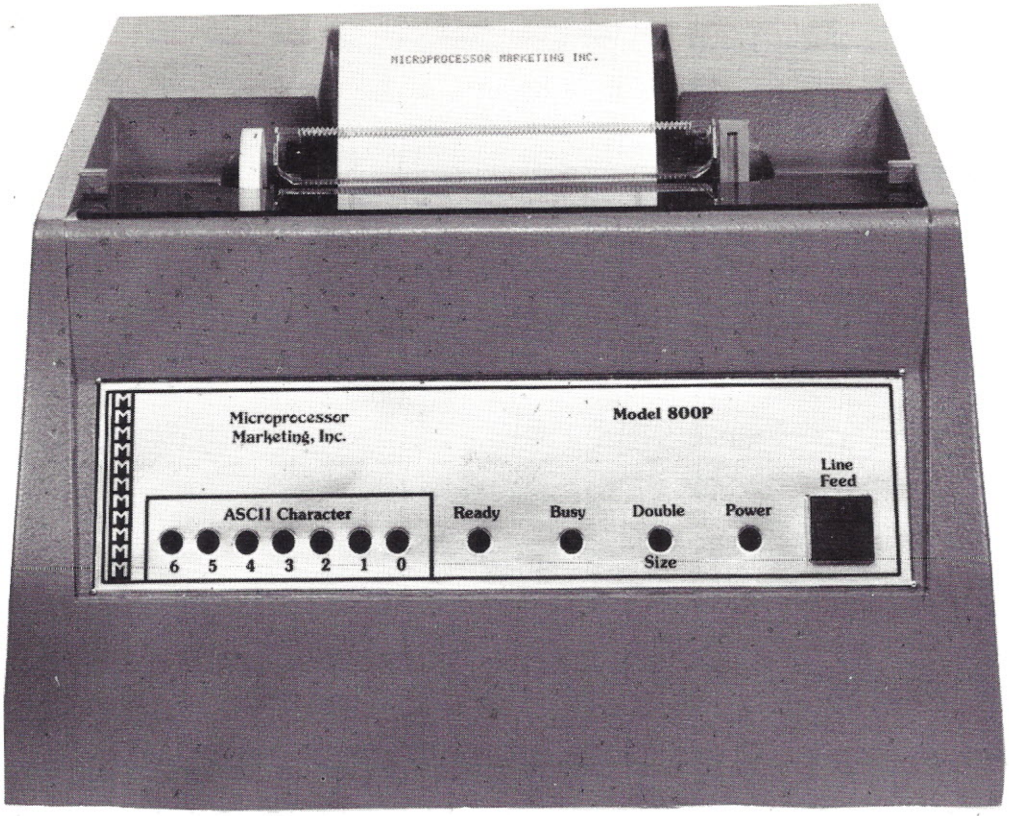

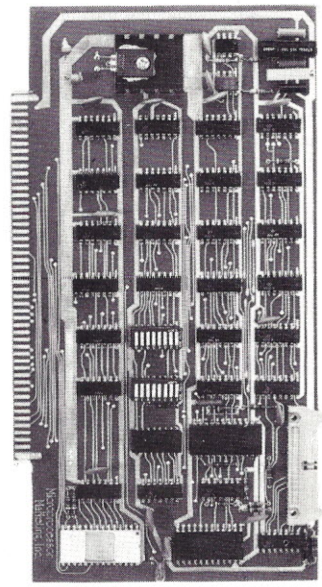

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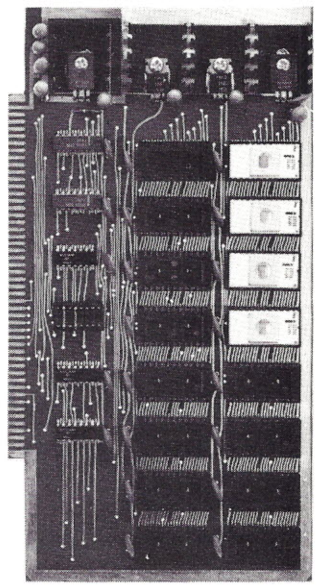
Assembled and tested with
Cabinet, cables and connectors $519.95

16K EPROM BOARD—

Uses new INTEL 2708's, 1K X 8 per chip—Try 12K BASIC on one board with 4K to go!—Purchase assembled board with 1K to start, add 2708's at any time—NEC, AMD and others will second source 2708's soon—Used in our commercial systems

Assembled and tested,1K $229.95
2708's $70.00



IMSAI Products

8080 Kit $540 | 8080 Assembled $829 | 4K RAM Kit $125

We recieve numerous inquiries about commercial applications hobbyists have in mind, but we have about 5 years of work to do now. We feel the hobbyists need to help themselves and exchange ideas, form partnerships and use their collective knowledge to make themselves money.

Microprocessor Marketing Newsletter will allow you to find help among yourselves, by exchanging names, possible applications, ideas, etc. We will assist with articles on applications, starting a company, acquiring financing, manufacturing, and actually taking the product to the commercial market.

Microprocessor Marketing Newsletter will be mailed first class each month starting November 1976. Subscription rate is $20.00 per year.

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7450	.14	74180	.80
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HIGH SPEED

74H00	.20	74H51	.20
74H01	.20	74H52	.20
74H04	.20	74H74	.40
74H10	.20	74H103	.50
74H11	.20	74H106	.50
74H40	.20		

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4011	.16	4043	.75
4012	.16	4044	.70
4013	.35	4049	.38
4015	.80	4050	.38
4016	.35	4066	.65
4019	.70	4068	.35
4020	.90	4069	.16
4021	.95	4071	.16
4023	.16	4073	.16
4024	.75	4075	.16
4025	.20	4516	.85
		4585	.85

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CIRCLE NO. 37 ON INQUIRY CARD


```
YOUR HAND IS:  7  11
 3 CARDS ARE IN MY HAND
CARDS EXPOSED ARE:   8  3  6  10  5

YOUR PLAY? (0=GUESS , 1-11 ARE ASKS)? 9

REFEREE SAYS I DO HAVE THE 9


I'M GOING TO GUESS AT THE SECRET CARD
I THINK ITS THE 2

THE SECRET CARD IS THE.................. 2

I WIN

WE'VE PLAYED 2 GAMES THIS SERIES
I'VE WON 1
YOU'VE WON 1

HOW ABOUT ANOTHER GAME? (0=NO, 1=YES)? 0


SO LONG, ITS BEEN FUN

OK



OK
RUN
PLEASE INPUT A RANDOM NUMBER? 3.14159
THE REFEREE DEALS THE CARDS -- HE TOSSES THE COIN AND
I'LL GO FIRST THIS GAME

YOUR HAND IS:  6  8  11  5  7
 5 CARDS ARE IN MY HAND
NO CARDS ARE EXPOSED YET
DO YOU HAVE THE 4 ?

REFEREE SAYS YOU DO NOT HAVE THE 4

YOUR HAND IS:  6  8  11  5  7
 5 CARDS ARE IN MY HAND
NO CARDS ARE EXPOSED YET

YOUR PLAY? (0=GUESS , 1-11 ARE ASKS)? 2

REFEREE SAYS I DO HAVE THE 2

I WAS BLUFFING LAST TIME ABOUT THE 4

DO YOU HAVE THE 5 ?

REFEREE SAYS YOU DO HAVE THE 5

YOUR HAND IS:  6  8  11  7
 3 CARDS ARE IN MY HAND
CARDS EXPOSED ARE:   2  4  5

YOUR PLAY? (0=GUESS , 1-11 ARE ASKS)? 10

REFEREE SAYS I DON'T HAVE THE 10

DO YOU HAVE THE 3 ?

REFEREE SAYS YOU DO NOT HAVE THE 3

YOUR HAND IS:  6  8  11  7
 3 CARDS ARE IN MY HAND
CARDS EXPOSED ARE:   2  4  5

YOUR PLAY? (0=GUESS , 1-11 ARE ASKS)? 0

WHAT DO YOU THINK THE SECRET CARD IS? 10

YOU GUESSED THE 10

THE SECRET CARD IS THE.................. 10

YOU WIN

WE'VE PLAYED 1 GAMES THIS SERIES
I'VE WON 0
YOU'VE WON 1

HOW ABOUT ANOTHER GAME? (0=NO, 1=YES)? 1

YOU GO FIRST THIS GAME

YOUR HAND IS:  7  3  8  11  10
 5 CARDS ARE IN MY HAND
NO CARDS ARE EXPOSED YET
```

```
OK
NULL3

OK
LIST

100 REM THE GAME OF BLUFF
110 REM WRITTEN BY PHIL FELDMAN AND TOM RUGG  JULY/1976
120 DIM C(11),H(5),H5(5),E(11)
130 INPUT"PLEASE INPUT A RANDOM NUMBER";X:X=-ABS(X):Z=RND(X):I0=0
140 I1=1:I2=2:I3=3:I4=4:I5=5:I8=11:I9=-1:F8=-1:IF RND(I1)>.5 THEN F8=I1
210 G=I0:G1=I0:G5=I0:FOR I=I1 TO I8:C(I)=I:NEXT I
250 PRINT"THE REFEREE DEALS THE CARDS -- HE TOSSES THE COIN AND"
260 GOSUB 1200:FOR I=I1 TO I5:Z=I+I5:H(I)=C(I):H5(I)=C(Z):NEXT I
320 M=C(I8):N1=I5:N5=I5:B1=I0:B5=I0:F=I0:N9=I0:X=I0:F8=F8*I9
410 IF F8<I0 THEN PRINT "YOU GO FIRST THIS GAME"
420 IF F8>I0 THEN PRINT "I'LL GO FIRST THIS GAME"
430 GOSUB 1000:IF F8<I0 THEN 500
450 IF F8>I0 THEN 800
500 PRINT:INPUT"YOUR PLAY? (0=GUESS , 1-11 ARE ASKS)";X:IF X<I0 THEN 500
540 IF X>I8 THEN 500
550 X=INT(X):IF X>I0 THEN 610
570 PRINT:INPUT"WHAT DO YOU THINK THE SECRET CARD IS";X:GOTO 2700
610 GOSUB 2200:PRINT:F=I0
640 IF B5<I0 THEN PRINT"REFEREE SAYS THE";-B5;"IS ALREADY EXPOSED"
650 IF B5<I0 THEN 720
660 GOSUB 2000:IF F<I0 THEN PRINT"REFEREE SAYS I DON'T HAVE THE";X
690 IF F>I0 THEN PRINT"REFEREE SAYS I DO HAVE THE";X:GOSUB1900:GOSUB1300
720 IF B1<=I0 THEN 780
730 PRINT:PRINT"I WAS BLUFFING LAST TIME ABOUT THE";B1:X=B1:GOSUB 1900
770 GOSUB 1300
780 PRINT
800 GOSUB 1400:IF X<I0 THEN 2700
810 GOSUB 1800:GOSUB 2100:IF F>I0 THEN GOSUB 2400:GOSUB 1300
840 IF F=I0 AND B1=I0 THEN B1=-X
860 IF B5<=I0 THEN 920
870 PRINT:PRINT"REFEREE SAYS YOU BLUFFED LAST TIME ABOUT THE";B5:X=B5
900 GOSUB 2400:GOSUB 1300
920 GOSUB 1000:GOTO 500
1000 PRINT:IF N5=I0 THEN PRINT"YOUR HAND HAS NO CARDS LEFT":GOTO 1080
1030 PRINT"YOUR HAND IS: ";:FOR I=I1 TO N5:PRINT H5(I);:NEXT I:PRINT
1080 PRINT N1;"CARDS ARE IN MY HAND"
1090 IF N9=I0 THEN PRINT"NO CARDS ARE EXPOSED YET":RETURN
1110 PRINT"CARDS EXPOSED ARE:  ";:FOR I=I1 TO N9:PRINT E(I);:NEXT I
1150 PRINT:RETURN
1200 FOR I=I8 TO I2 STEP I9:Z=INT(RND(I1)*I)+I1:J=C(Z):C(Z)=C(I)
1240 C(I)=J:NEXT I:RETURN
1300 IF N9=I0 THEN 1360
1310 Z=I0:FOR I=I1 TO N9:IF E(I)=X THEN Z=I1
1340 NEXT I:IF Z=I1 THEN RETURN
1360 N9=N9+I1:E(N9)=X:RETURN
1400 IF B1<I0 THEN X=B1:RETURN
1420 L=N1:L1=N1:IF N5>N1 THEN L=N5
1450 IF N5<N1 THEN L1=N5
1460 IF L1>I0 AND L>I1 THEN 1500
1470 GOSUB 1700:X=-X:RETURN
1500 Y=I1/L:IF F<I0 THEN 1550
1520 GOSUB 1700:IF RND(I1)<Y THEN X=H(I1)
```

```
1520 GOSUB 1700:IF RND(I1)<Y THEN X=H(I1)
1540 RETURN
1550 IF RND(I1)>Y THEN 1580
1560 X=F:RETURN
1580 GOSUB 1750:IF RND(I1)<Y THEN X=H(I1)
1600 RETURN
1700 Z=N5+I1:J=INT(RND(I1)*Z)+I1:IF J=Z THEN X=M
1730 IF J<Z THEN X=H5(J)
1740 RETURN
1750 Z=N5+I1:J=INT(RND(I1)*Z)+I1:IF J=Z THEN X=M
1760 IF J<Z THEN X=H5(J)
1770 IF X<>-F THEN RETURN
1780 IF J>I1 THEN X=H5(J-I1)
1790 IF J=I1 THEN X=M
1795 RETURN
1800 B1=I0:FOR I=I1 TO N1:IF H(I)=X THEN B1=X
1830 NEXT I:RETURN
1900 IF N1=I0 THEN RETURN
1910 Z=I0:FOR I=I1 TO N1;IF X=H(I) THEN Z=I
1940 NEXT I:IF Z=I0 THEN RETURN
1960 H(Z)=H(N1):N1=N1-I1:RETURN
2000 F=-X:IF N1=I0 THEN RETURN
2020 FOR I=I1 TO N1:IF H(I)=X THEN F=X
2040 NEXT I:RETURN
2100 PRINT"DO YOU HAVE THE";X;"?":GOSUB 2600:PRINT
2140 IF F=I0 THEN PRINT"REFEREE SAYS YOU DO NOT HAVE THE";X
2150 IF F>I0 THEN PRINT"REFEREE SAYS YOU DO HAVE THE";X
2160 RETURN
2200 B5=X;IF N9=I0 THEN 2260
2220 FOR I=I1 TO N9:IF E(I)=X THEN B5=-X
2240 NEXT I:IF B5<I0 THEN RETURN
2260 IF N5=I0 THEN RETURN
2270 B5=I0:FOR I=I1 TO N5:IF H5(I)=X THEN B5=X
2290 NEXT I:RETURN
2400 IF N5=I0 THEN RETURN
2410 Z=I0:FOR I=I1 TO N5:IF X=H5(I) THEN Z=I
2440 NEXT I:IF Z=I0 THEN RETURN
2460 IF Z=N5 THEN 2500
2470 FOR I=Z TO N5-I1:H5(I)=H5(I+I1):NEXT I
2500 N5=N5-I1:RETURN
2600 F=I0:IF N5=I0 THEN RETURN
2620 FOR I=I1 TO N5:IF H5(I)=X THEN F=I1
2640 NEXT I:RETURN
2700 PRINT:IF X>I0 THEN PRINT"YOU GUESSED THE";X
2720 IF X<I0 THEN PRINT"I'M GOING TO GUESS AT THE SECRET CARD"
2730 IF X<I0 THEN PRINT"I THINK ITS THE";-X
2740 PRINT:PRINT"THE SECRET CARD IS THE..................";M
2760 PRINT:G=G+I1:Z=I0:IF X>I0 AND X=M THEN Z=I1
2800 IF X<I0 AND -X<>M THEN Z=I1
2810 IF Z=I0 THEN G1=G1+I1:PRINT"I WIN"
2830 IF Z=I1 THEN PRINT"YOU WIN":G5=G5+I1
2850 PRINT:PRINT"WE'VE PLAYED";G;"GAMES THIS SERIES":PRINT"I'VE WON";G1
2880 PRINT"YOU'VE WON";G5:PRINT
2900 INPUT"HOW ABOUT ANOTHER GAME? (0=NO, 1=YES)";X:PRINT:IF X=I1THEN260
2940 PRINT:PRINT"SO LONG, ITS BEEN FUN"

OK
```

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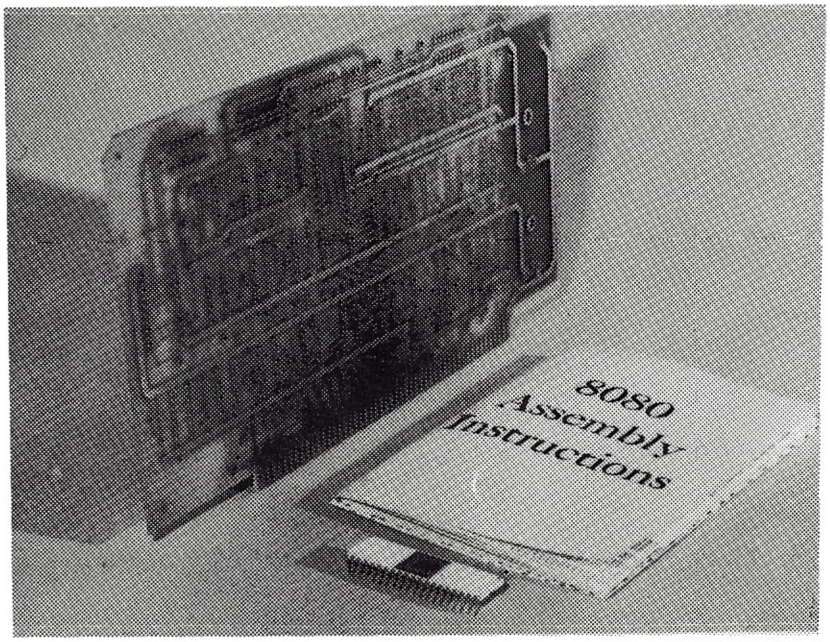

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BUT IT'S FUN . . . BUT IT'S EDUCATIONAL

by JOANNE KOLTNOW VERPLANK
Community Computer Center,
Menlo Park, California

Two "clients" who had never seen a computer or terminal ten minutes before this picture was taken.

Ms. Verplank is the director of Community Computer Center in Menlo Park, California. CCC is a non-profit educational organization exploring educational and recreational uses of computers. Using a PDP 8 and a PDP 11/15 to run games on six terminals, CCC has been playing computer games with students and introducing teachers to benefits of using computers in schools.

We all know that games are fun, and most of us have played enough computer games to find them fascinating too. The computer is the perfect patient partner, the impeccable scorekeeper, the lightning calculator, and perhaps the sufficient challenge. Kids also have discovered computers, and have played games on them whenever they have had the chance. These computer games can be more than pure entertainment, however. They can also be used for educational purposes. Over the past several years, we at the Community Computer Center have been playing computer games with kids and introducing their teachers to the benefits of using these games in school.

Although computers are an aspect of modern technology not usually found in schools, they are inherently enticing to kids, and computer games can fill some of the needs in the classroom. Children are motivated to read because they are anxious to find out what the computer is "saying" to them. Once they can read "too big" and "too small" the world of the computer game is open to them. As children progress through the games, they come upon more words they need to read. When new games are offered judiciously, not frustrating the player with too many unfamiliar words, they continue to motivate reading.

Skills can be taught using computer games. Some of the most simple games we play offer a wide range of skills for the player to learn and practice. In "Number," for example, the computer picks a number, asks for guesses, and responds with clues.

```
GAME NO.?1

**NUMBER
YOUR GUESS?67
TRY BIGGER
YOUR GUESS?78
TOO SMALL
YOUR GUESS?95
TOO SMALL
YOUR GUESS?97
TOO SMALL
YOUR GUESS?99
TRY SMALLER
YOUR GUESS?98
YOU GOT IT IN 6 TURNS!!!
```

The child practices reading words and numbers, following directions, making judgments, formulating guesses, and constructing and typing numbers. The child knows, or learns, to make successive guesses within the boundaries set in previous turns. If 31 was "too big," for instance, a guess of 49 would be inappropriate. Inappropriate guesses usually indicate that the child was playing with a range of numbers beyond his or her comprehension. When the teacher has successfully matched the range of numbers to the child's ability, the child will play with understanding. The time before winning will not be too long, and all the behaviors just completed will be reinforced. As much as possible, the game's level of difficulty should be matched to the player's ability. There is little point in playing a game that is so far beyond one's understanding that the computer's responses are ignored.

Concepts as well as skills can be introduced via the games. "Number" and its alphabetical counterpart "Letter" can be used at a higher level to approach the concept of guessing strategies. When players are able to guess within boundaries, though doing so without apparent design, they should be encouraged to consider creating guessing strategies. We describe strategies as "any kind of *plan* for your guessing." We tell players, "There are lots of different strategies you might use for this game. Look for one you think will work best." Many strategies emerge, and we discuss them all. At some point, players come upon the binary search method, and realize that it is the most efficient guessing strategy for this sort of game. Because they figure it out, and try it out, they understand it. They are more likely to remember the strategy this way,

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CIRCLE NO. 39 ON INQUIRY CARD

and know when to use it, than if we had simply taught it to them.

Binary search is a particular strategy that adults often see before kids do. One of the ideas that we try to impress on teachers is that people are ready for various levels of understanding at different times. A strategy that a child has put together is more likely to be remembered than one that has been fed to him.

"Animal" is another favorite game that is educational on many different levels. This time, the *player* thinks of an animal and the *computer* tries to guess it.

```
WOULD YOU LIKE TO PLAY 'GUESS THE ANIMAL'
WITH THE PDP-8?
*Y

PLEASE THINK OF AN ANIMAL.
HAVE YOU THOUGHT OF ONE YET?
*Y
HAS IT GOT A TAIL
*Y
HAS IT GOT JUST TWO LEGS
*N
IS IT A HORSE
*N
OH DEAR! I DIDN'T GET THAT ONE.
WOULD YOU PLEASE TYPE IN THE ANSWER.
*LION
PLEASE GIVE ME A QUESTION THAT WOULD
DISTINGUISH IT FROM A HORSE
*DOES IT ROAR
AND WHAT WOULD BE THE ANSWER IN THE CASE
OF A HORSE
*N
THANK YOU VERY MUCH—I WILL REMEMBER THAT.

PLEASE THINK OF AN ANIMAL.
HAVE YOU THOUGHT OF ONE YET?
```

The game motivates reading, learning about animals, and learning to use reference books. The players have to follow directions:

```
PLEASE THINK OF AN ANIMAL.
HAVE YOU THOUGHT OF ONE YET?
*SKUNK
PLEASE SAY YES OR NO.
*Y
```

They must also think about their animals in ways they perhaps had not expected to:

```
HAS IT GOT A TAIL
*N
DOES IT MAKE WAR
*'Y
IS IT A HUMAN BEING
```

They have to create questions according to a prescribed pattern:

```
WOULD YOU PLEASE TYPE IN THE ANSWER.
*SPARROW
PLEAE GIVE ME A QUESTION THAT WOULD DIS-
TINGUISH IT FROM A BIG-BIRD
*DOES IT TALK
```


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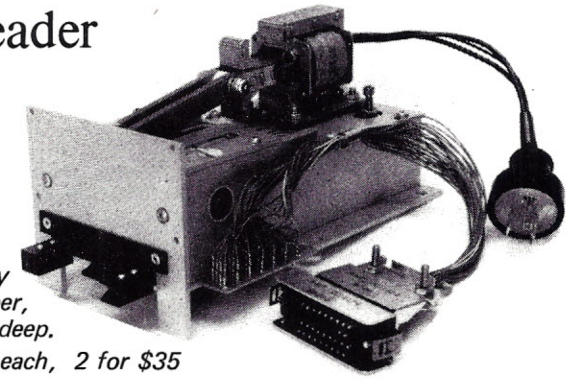

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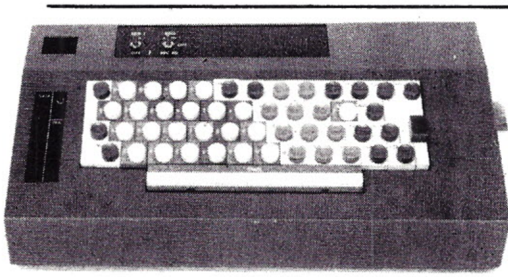

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CIRCLE NO. 40 ON INQUIRY CARD

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CIRCLE NO. 41 ON INQUIRY CARD

Because of their backgrounds, some children are considered "language deprived." They benefit from any occasion to verbalize. "Animal" offers them this opportunity and gives it a direction. Whenever a group of children play "Animal," they use books and discussion to determine what they will tell the computer. The players think and talk about animals. They also learn to consider similarities and differences in formulating their questions.

Computer games can be used with individuals, small groups, or in whole class instruction. A game may be presented to the class, then modified to meet the needs of individuals, or it may be taught directly to a small group. This depends both on the ability range within the class and the availability and convenience of the terminal. The amount of teacher preparation will vary, too. The ideal situation involves matching the game and the players so well that they can play completely on their own.

Some of the special qualities of the computer show to best advantage where there is a single player. The computer's infinite patience allows adequate thinking time. A player does not have to defer to a quicker classmate, an unfortunately frequent occurrence for some children. Learning to recognize and complete patterns is hard for some children, and the same patient computer allows a child to thoroughly learn the necessary response pattern. Someone who does not finish the "read the question/type the answer/press RETURN" pattern will find that the computer fails to respond. After some time, the player will review the action and figure out what was missing—without the slightest comment from the computer. Eventually the review process will become part of the response and the player will have learned the pattern without outside help.

Patience is also important when the player gives the same wrong answer several times. If the game and player are well matched, this will not happen often. However, if it does, a good program will not distinguish between the first and successive instances of a particular response. Eventually it will be the player who will catch the mistake.

Infinite patience is especially useful for the times when a child plays the same game repeatedly. Perhaps it's the pleasure of success in an otherwise unsuccessful school situation; maybe a child is reluctant to try new things. Whatever the reason, the computer will play a game as long as the player wants to. At some point, the child will have had enough, but not because the computer was tired.

People's feelings are important, and their confidence is sometimes fragile in strange situations. Realizing this, we make our game programs considerate. If a particular guess is inappropriate to the game, the computer politely tells the player:

```
YOUR GUESS?82
TOO BIG
YOUR GUESS?R
I'M CONFUSED—PLEASE TYPE A NUMBER
YOUR GUESS?75
```

The games are also easy to discontinue:

```
YOUR GUESS?STOP
THIS GAME AGAIN (YES OR NO)?
```

Except in a few special cases, our games do not limit the players' number of tries. People play until they get the answer, at which time the computer congratulates them:

```
YOU GOT IT IN 5 TURNS!!!
```

Or they stop the game themselves:

```
YOUR GUESS?44
TOO BIG
YOUR GUESS?STOP
THIS GAME AGAIN (YES OR NO)? NO
```

Guess limits and/or sarcastic comments do not belong in games, especially when the games are otherwise providing a positive experience for the player. Someone may wish to work out personal guess limits as challenges, or to set up a record-keeping progress report, but neither of these should be done automatically. Games differ in how much room there is for player improvement. Once a player knows the most efficient strategy, scores in most of the guessing games will show improvement only with luck.

This is not meant to imply that all games for school use should be without limits of any kind. "Wumpus" is a good game and the limits are part of the challenge. The player is lost in a series of connecting caverns. The object is to shoot the Wumpus before it eats you. There are also dangers to avoid and a limited

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number of arrows provided. The configuration of the caverns and the placement of the dangers is different in each game, so one doesn't win by remembering where the Wumpus is. Players read the output and make a map as they thread their way through the caves.

```
I SMELL A WUMPUS!

YOU ARE IN ROOM 18
TUNNELS LEAD TO 11  17  2

SHOOT OR MOVE?M
MOVE TO?17

I FEEL A DRAFT!

YOU ARE IN ROOM 17
TUNNELS LEAD TO 18  20  1

SHOOT OR MOVE?M
MOVE TO?18

I SMELL A WUMPUS!

YOU ARE IN ROOM 18
TUNNELS LEAD TO 11  17  2

SHOOT OR MOVE?M
MOVE TO?2

OOPS . . . BUMPED A WUMPUS!
```

Some players lose. They make careless or unlucky moves and end up in the pit or the Wumpus.

```
**WUMPUS**
I FEEL A DRAFT!
BAT NEARBY!

YOU ARE IN ROOM 11
TUNNELS LEAD TO 18  20  5

SHOOT OR MOVE?M
MOVE TO?18
```

Joanne Verplank, director of Community Computer Center in Menlo Park, CA., enjoys her student's pleasure in discovering the "magic" of a computer printout.

"Wumpus" is not a beginner's game. Players should be able to understand the complicated situation of the caves and to follow directions. While playing, they make maps from verbally presented information, make decisions, and take risks. They experience some of the laws of probability and have to decide on bold or conservative approaches to the choice they are faced with. "Wumpus" encourages risk-taking while providing a relatively safe environment, the make-believe world of the game. This game-time decision-making allows players to practice for other times in life when the outcome of their decisions may be more important.

Many of the computer games, including some as complex as "Wumpus," can and should be played without a computer. When a game is played off the computer, someone, or a group, acts as the computer. Besides the obvious logistical advantages of extending computer usage, there are also educational benefits in playing the games this way. The "kid-computer" has to perform all of the computer's tasks. In the case of "Number," this means generating the secret number, comparing it to the guessed number, giving the appropriate response, and keeping count of the guesses made. Though it sounds complicated, even very young children, when the number range is within their abilities, can learn and enjoy playing "Number" this way.

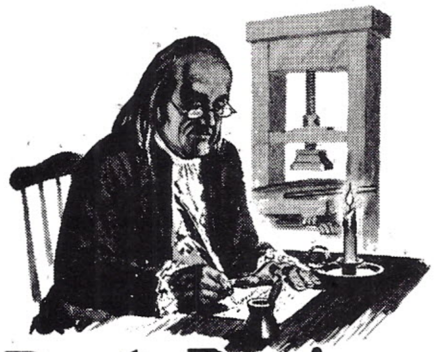
"Being the computer" gives practice in different skills than are exercised when one is the player. Since the real computer never gives incorrect responses, the kid-computers have to do as well. This is a challenge they can meet and enjoy doing.

When children discover that they can *be* the computer in one game, some of the mystery of the game process, and of the computer, is removed. This allows them to be open to understanding other games as well. Playing against the computer has a new dimension when the player also has "been the computer."

The option of playing many of these games without a computer also allows the teacher to introduce new games in the classroom in simplified forms, in depth, and at any time.

There is a wide selection of games suitable for use in elementary and high schools. Players can find themselves challenged to guess the computer's secret word or secret number, where the hints are given in code; they can try to unscramble a list of numbers, beat the Taxman, or hunt the Cricket, Hurkle, or Snark. There are simulation games where players try to land a spaceship without crashing, manage the resources of a kingdom, or direct the operations of a small business. Some simulations require large group participation, others can be played alone. Some of the complex games can be made available to less sophisticated players either by simplifying the rules or teaching them in stages. Many of the simpler games are suitable introductory material for older students who can be offered the challenge of finding good guessing strategies.

Computer games and simulations can help meet some of the obvious needs in the classroom. They also offer many more subtle educational advantages.



Book Review

BUILDING YOUR OWN WORKING ROBOT

by David Heiserman

Tab Books
Blue Ridge Summit, Pa. 17214

Price: $8.95 hardbound
$5.95 paperback

Review by Michael S. Westvig

At last! A book on how to build what is probably the highest class of machine today, and an introduction to the infant science of robotics.

The robot's name is Buster. Step-by-step instructions include plans, schematics, logic circuits and wiring diagrams for his construction. The publishers call Buster "the most lovable (and mischievous) mechanical pet in the world . . . in one of the most unusual and exciting project books ever published."

Buster shatters all existing beliefs of waht a robot should be. Stripped of the window dressing, Buster displays whirling motors and blinking lights. His intrigue lies in his animal-like reflex system.

The book divides the project into three phases and relies on TTL technology, transistor amplifiers and elementary control circuits. Through the first seven chapters, Buster I develops into a binary-controlled wheeled machine, capable of sixteen different actions, under human control. In the second phase, Buster II is cut from the umbilical cord and is given his autonomic reflex system and independence. With a set of touch sensors and logic levels of priority, he explores, cries when hungry (low batteries) or gets stuck between two objects. In phase three, Buster III is able to find his battery charger, follow a white line and tag along behind you, his master. The project is left open with the proposal that Buster IV be completed with a microprocessor brain added to the basic reflex system, giving him a goal-seeking mode of behavior.

The book's summary is an excellent outline of the project and the author suggests re-reading it as Buster progresses. He sums up his feeling of the system with, "The entire Buster program is worthless if you insist upon having total control over the machine at all times. If having complete control is your desire, you ought to turn to a much less sophisticated mechanism, such as a radio-controlled airplane."

BOOKS IN BRIEF

Two excellent books published by Prentice-Hall, Inc. look expensive but are packed with valuable information for the hobbyist involved in logic design and programming.

DIGITAL CIRCUITS AND LOGIC DESIGN by Samuel Lee ($24.00). Breadboards logic design applications for all the latest MSI ad LSI IC's—plus how to use PLA IC's in sequential logic design and a new combinational design for ROM arrays. Worked out samples bring you comprehensive techniques ready-to-apply straight from the guide right to your work. Also includes extensive fault detection and diagnostic methods for combinational and sequential IC's. Pub. 7/76, 608 pp., 264 illustrations.

A DISCIPLINE OF PROGRAMMING by Edsger W. Dijkstra ($14.95). Its

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MOS DIGITAL ICs

by George Flynn

Howard W. Sams & Co., Inc.
Indianapolis, Ind. 46268

Price: $5.95

Review by Stephen R. Tuenge

There are two basic approaches to the use of modern integrated circuits. One method is to acquire a thorough knowledge of the inner workings of all the various devices and know just how each and every gate or element responds. Equally as valid, for most logic design, is to consider each IC as a 'black box' that performs a particular function with certain limitations. In either case, a minimum of information is needed in order to do anything useful with ICs. Perhaps it is a bit unfair to expect a book entitled *MOS DIGITAL ICs* to provide the needed information, but why else buy such a book?

The author does an excellent job of explaining how MOS ICs work. Beginning in the first chapter with an explanation of how the various MOS families are fabricated, how they work, and the basic differences between the families, Mr. Flynn carries through to the operation of many complicated devices. All the basics are well covered, and anyone getting to chapter seven has already learned almost everything needed in the way of internal operation of even such exotic devices as dynamic Random Access Memories. Ending the book with circuits for interfacing the various logic families and listing some of the MOS ICs by package number and function, the author rounds out what appears to be a rather complete treatment of the subject.

However, since most of the people who are apt to read this magazine are builders and doers, this book leaves a lot to be desired. For the person who only wants to learn the subject for its own sake and does not intend to apply the knowledge to any useful end, it's all there. If, on the other hand, the reason for buying such a book is to be able to use the information for design purposes, then one of the many books on the subject (one for each family) by RCA would be a much better choice. RCA's books not only give the pinouts (missing in *MOS DIGITAL ICs*) and supply voltages needed for the 'black box' approach, but offer a wealth of information on each IC for the serious designer.

SHOCK . . . VECTORED from pg. 41

permit the student to progress to writing simple programs on his own and being able to understand the specifications and instructions that accompany various factory-assembled prototyping boards.

The course presentation usually assumes some knowledge of digital electronics, but it skips over many of the fundamental concepts and theories so that the student can attain overall comprehension in the shortest possible time. The student is left to "fill-in" fundamental knowledge, or study advanced texts, as befits his individual needs.

These "crash" courses are not substitues for more formal learning although they are pointing the eay

These "crash" courses are not substitutes for more formal learning although they are pointing the way toward revision and rearrangement of the order in which the subject matter is presented in formal technical courses.

Some educators see the validity of introducing microcomputer training into programming and data processing courses so that persons specializing in that field will have a better comprehension of the role of hardware, a subject now treated rather superficially in those specialized courses.

E & L was one of the first companies to offer unified texts (called Bugbooks) that could be used for effective primary training in digital electronics for persons lacking a formal background in electronics engineering, and have gone on to offer a series covering logic and memory experiments using TTL integrated circuits, the universal asynchronous receiver transmitter and microcomputer interfacing.

The latest series of Bugbooks integrates the subjects of digital electronics, microcomputer interfacing, and microcomputer programming into a single unified course.

They plan to offer additional instructional texts as the need arrises to meet student or instructor demand. Moreover, they anticipate revisions as a result of "feedback" from students and instructors. These revisions may take the form of additional experiments to clarify or emphasize key points or coverage of more advanced subjects.

Cancer's warning signals:

1.
Change in bowel or bladder habits.

2.
A sore that does not heal.

3.
Unusual bleeding or discharge.

4.
Thickening or lump in breast or elsewhere.

5.
Indigestion or difficulty in swallowing.

6.
Obvious change in wart or mole.

7.
Nagging cough or hoarseness.

If you have a warning sign, see your doctor!

AMERICAN CANCER SOCIETY

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FORTH: A STACK ORIENTED LANGUAGE

by WILLIAM S. SINCLAIR

Ever since the introduction of the first minicomputer in the mid 60's, there has been a persistent and growing need for software development tools which can reside within a small computer system.

Ideally, such a tool would offer the programmer a short debugging turnaround cycle, perhaps even interactive debugging, and take up a relatively small amount of memory. With the impressive advent and growth of the computer hobbyist movement, such program development aids are even more important.

Around 1970, some students at MIT invented an unusual language called FORTH™, which has great promise of meeting the hobbyist's needs for such a tool. FORTH,™ which is currently being used to develop application programs for radio astronomy work at MIT and Cal Tech, is a good compromise between the bulkiness of high-level languages such as FORTRAN or BASIC and the programming difficulties associated with assembly language coding. FORTH™ systems have been implemented on several different minicomputers, such as the DEC PDP-11, Data General's NOVA, Xerox's SIGMA 5; and some large computers such as the DEC PDP-10, and the IBM 360 lines and, as of this date, one microprocessor (RCA COSMAC). FORTH™ Incorporated, a company in Manhattan Beach, California, has announced that they are working on FORTH™ systems that will be implemented for the 8080 INTEL and the Motorola 6800 lines, and furthermore, claim that their price tags for the "bare-bones" systems will be within the hobbyist's budget.

This article will attempt to give you a feel for the philosophy of FORTH,™ as well as some programming examples. FORTH's™ advantages and disadvantages will be compared with those of other well-known languages.

The main features in FORTH™ are a push-down stack, the elements of which are manipulated by a set of operands using reverse Polish notation. (H-P calculator users, take note!) Unlike calculators, however, the operands and operators are usually alphanumeric. The operands fall into several different categories: literals, variables, constants, and arrays. These operands are normally floating point or integer, but other types of operands can easily be added.

The syntax of FORTH™ is quite simple. The FORTH™ "words" are strings of characters delineated by blanks or carriage returns. A FORTH™ statement might look like this:

```
X @ Y @ Z @ * * Q =
```

The words can be any length but are normally truncated internally after six characters.

When the name of a variable or array is encountered, its address is pushed onto the stack. When a literal or constant is encountered, its *value* is pushed on to the stack. When an operator is encountered, it performs some authentic or logical operation (or perhaps I/O) using the stack elements, and returns the result on the stack. For instance, suppose "A" and "B" are integer variables, and "+" is the usual integer arithmetic operator. If the FORTH™ text is A B + then right before the "+" word the stack will have the address of "B" on top, with the address of "A" under it. The "+" word will cause the two to be added together, and the stack will have "address of A" + "address of B" in it. The operands A and B are dropped from the stack before the result is pushed onto the stack. In fact, the operands are almost always dropped before the results are pushed on.

Before Operation	After Operation
ADDR (B)	ADDR(A)+ADDR(B)
ADDR (A)	XXX
XXX	YYY
YYY	ETC
ETC	

For purposes of illustration, let us introduce two more important FORTH™ operators. The "@" operator uses the top stack element as an address, then replaces that element with the contents of that address. The "=" operator uses the top stack element as a memory address and replaces that location in memory with the next-to-top stack element. So if you want to perform the equivalent of C = A + B in FORTH™ you would say:

```
A @ B @ + C =
```

After the second "@" operator, the stack would look like this:

Contents (B)
Contents (A)

Then after the "+" operator, it would look like this:

Contents (A) + Contents (B)

After the "=" the stack will be as it was previously, with the contents of "C" set equal to the contents of "A" plus the contents of "B".

After A Fetch @

(Before B Fetch @)	After B Fetch @	After +
Contents (A)	Contents (B)	Contents (A) + Contents (B)
XXX	Contents (A)	XXX
YYY	XXX	YYY
ETC	YYY	ETC
	ETC	

After =

XXX

YYY

ETC

Note: C now contains contents (A) plus contents (B)

ASSEMBLY LANGUAGE COMPATIBILITY

One of the most important features in FORTH™ is the ability to define FORTH™ words in terms of other words, or in terms of assembly language instructions. Typically, the fundamental operators such as +, −, *, /, @ are defined at the assembly language level. The user can build up a very powerful set of FORTH™ words by defining them in terms of assembly language level CPU operations, or in terms of other words he has previously defined.

COMPARABLE MERITS

Let us forego more details for now and discuss the qualitative merits of FORTH™ as compared with other languages available to small computer system users, such as BASIC and assembly language coding.

	BASIC	FORTH	ASSEMBLER
Programming ease	good	fair	poor
Programming flexibility	poor	very good	very good
Memory efficiency	very poor	good	very good
Self documentation	good	poor	very poor
Debugging ease	good	good	very poor
CPU efficiency	very poor	good	very good
Ease of language development for individual computers	poor	good	fair
Machine interchange-ability	good	good	very poor

Some explanation of the above table is in order. By "programming ease" we mean the amount of effort required to express the problem in that language, assuming that the language can be used at all. BASIC was designed for the novice programmer, thus facilitating problem expression. The demands of assembly language are just the opposite, whereas FORTH™ lies somewhere in between.

By "programming flexibility" we mean, the number of different types of problems the language can solve. Assembly language can be used to solve any problem, whereas BASIC has inherent restrictions that render certain problems impossible to solve efficiently.

"Self documentation" refers to the ease with which the language user can deduce the purpose of the program by merely looking at the code. A BASIC program listing is quite self-explanatory compared to assembly code, which demands the copious use of comments.

"CPU efficiency" refers to the amount of time the CPU requires to perform the actual operation expressed by the algorithm. BASIC fares poorly because it requires the evaluation of text syntax, parsing, etc., at run time, as well as performing the operations in the algorithm. In contrast, assembly language can be easily optimized for minimum use of CPU time.

"Memory efficiency" is analogous to "SPU efficiency" in that we ask what resources are wasted by using the language in comparison to what is needed for solving the problem. BASIC again compares poorly because it has to be resident in memory along with the program that is running. If you have 16K of memory and you are using 12K BASIC, you have a mere pittance remaining to hold your program.

"Debugging ease" is the measure of how easily you may detect and correct the inevitable bugs in your running program. Assembly language does not usually contain convenient debugging aids, whereas FORTH™ and BASIC provide relatively easy-to-insert PRINT or DUMP statements.

The seventh row of the table attempts to ascertain the ease of getting a system running on a given computer. The simplest system one can imagine is straight hex or octal. In contrast, BASIC requires many man-months of development effort, and represents a significant cost in any computer system manufacturing endeavor.

Machine interchangability is of primary interest to hobbyists. A library of programs written in BASIC is of little use unless the versions used on different machines are syntactically consistent. Fortunately, there is some consistency between the different BASICS. If you program around the little nuisances, you can usually get like results on different machines.

An examination of the table indicates that FORTH is a compromise between assembly language and BASIC (or other high-level languages), and its features make it an attractive tool for small computer systems.

Details of the various types of features available in FORTH™ will be presented in a succeeding article. For now, I will list the categories of operators commonly available in a FORTH™ system:

1) Arithmetic *and* logical operations on the 16-bit quantities.

BRANCH to . . . pg. 80

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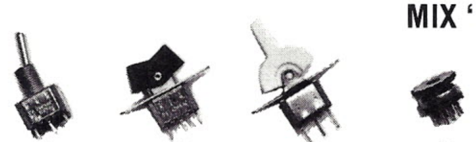

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JBT	MRI-121	B	SPDT	(ON-OFF-ON) SOLDER
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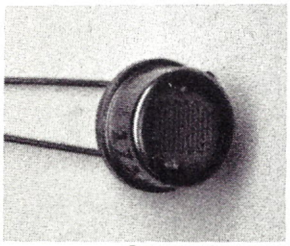

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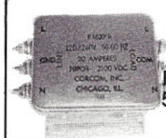

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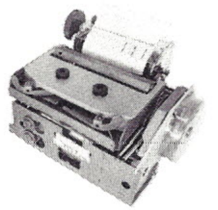

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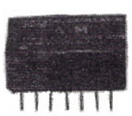

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HARDWARE REPORT

By Scott Wilcox

There comes a time in the life of almost every computer when the hardware gets sick. Sometimes it may be only a little sick; other times the patient may almost die. Hopefully your system will not blow up; however, there does not seem to be a single hobbyist who has not experienced some hardware failure or malfunction. (If there are readers out there who lead charmed lives and have no such problems, please let us know.)

What does one do when the hardware is suspected of being sick? Usually the scope and other test gear are dusted off and pressed into service. This is standard procedure. Troubleshooting will always be time-consuming and new techniques for reducing test time and increasing diagnostic confidence are continually sought.

We present here a simple bit of troubleshooting hardware that, used in conjunction with appropriate diagnostic programs, can be useful in fixing your system. The circuit shown in Figure 1 is a hardware address trap which can be built with three ICs and may prove useful, especially if you have memory problems that cause you to distrust the memory's ability to run programs properly. The address of the trap may be set to the address location of a program instruction to determine if the processor attempted to execute that instruction. On the ALTAIR/IMSAI, pressing the front panel "clear" will allow the program to continue. Also, there is no limit to the number of traps that may be installed to set a number of breakpoints.

If you need a terminal for your system that is fast, quiet and very functional, the Lear-Siegler ADM-3 Dumb Terminal kit is practical and economical. We built one of the first kits and found that the wait for delivery was well worth it. (Building the terminal from a kit can save you almost $300.)

The kit version gives you the 80 character × 24 line option and the assembly goes almost like clockwork. The assembly instructions are clear, and there is a 70-page maintenance manual. The unit is of such professional quality that each component of the kit is packaged in its own bag. After having completed the assembly in about 12 hours, the unit came up running and checked 100% functional the first time power was applied!

Interfacing to an ALTAIR through a Processor Technology 3P+S set for RS232 went by the book as well. Now, with over 200 operating hours on the terminal, there has yet to be a failure of any sort. For the price, this terminal is a real value for the small system user.

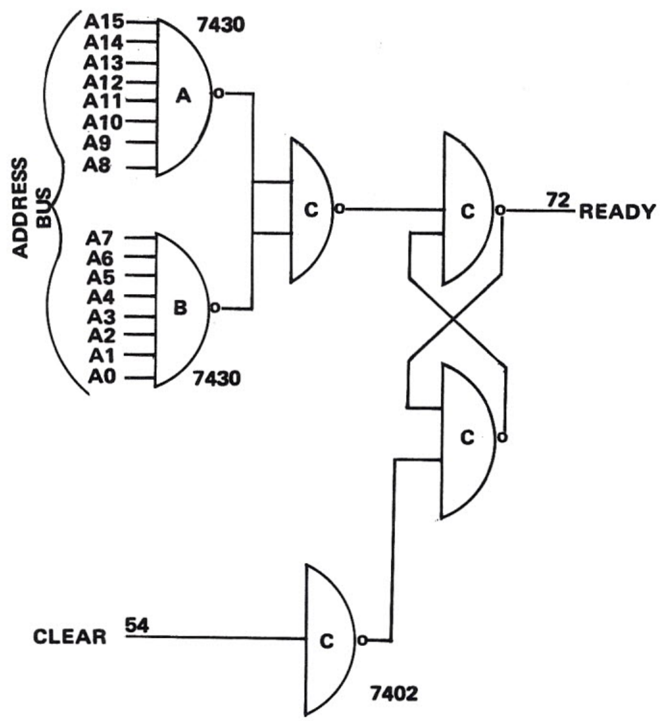

Figure 1
ALTAIR/IMSAI ADDRESS TRAP

MICRO-BUSINESS . . . VECTORED from pg. 32

In summary, the microcomputer should be thought of as a labor-saving, cost-reducing accounting system that will give the small businessman an inexpensive tool to enhance management of his enterprise. It is a welcome alternative to the large-scale systems being marketed to big business.

All printouts curtesy of Administrative Systems, Incorporated from their ASI PHASE/ONE system. The author appreciates the extensive contributions of Kithie Gateley, Software Director of ASI, and the ASI staff.

FORTH . . . VECTORED from pg. 78

2) Floating point operations on 32- or 48-bit quantities.
3) IF . . . THEN . . . ELSE structures.
4) Do loops (like FORTRAN)
5) Block or sequential I/O.
6) Arithmetic comparisons (floating and integer).
7) Masked search, replace and compare.
8) Subscripting to any desired degree of complexity.

The next article in this series will describe the use of these operators in detail, with programming examples. If space permits, I will give a complete program (such as LIFE), showing how it would be written and debugged interactively on a TTY or CRT console.

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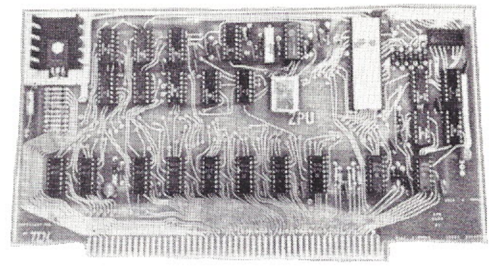

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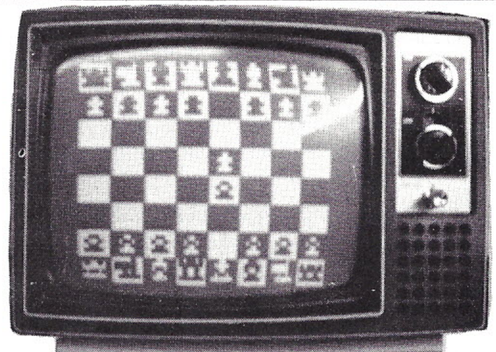

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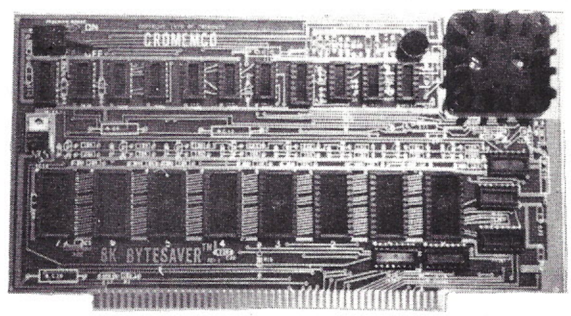

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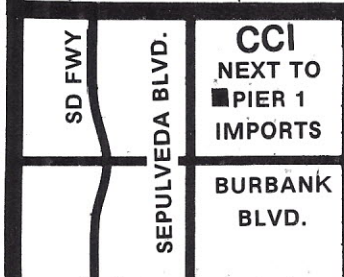

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COMPUTERS IN THE CLASSROOM

by LARRY PRESS

Larry Press originally wrote this article for David Ahl and it was printed in Creative Computing, *Jan./Feb. 1975. It was reprinted in the Jan. 75 issue of the* AEDS MONITOR. *We have been granted permission by the author to reprint the article here.*

This article discusses and presents some examples of what I will loosely call the exploration and play mode for computer-assisted learning. The examples will all be drawn from the area of English, since the humanities are generally neglected; however, I have had positive results using a similar approach in classes on operations research, and Papert advocates exploration and play in mathematics.

Another reason for choosing English is that I hope to stimulate others with substantive backgrounds in English to build upon my ideas. I am not an English teacher and elaboration of my examples should improve them considerably.

Exploration and Play

Let me illustrate exploration and play by contrasting it with a more typical drill and tutorial approach to learning parts of speech. A hypothetical drill and tutorial program might present questions such as:

Given the sentence: The boy ran to his home, which word(s) are nouns? which word(s) are verbs?

The student's response would be matched with "boy," "home," "ran," and judged either *right* or *wrong.* If right, he would be congratulated and presented with a new "frame." If wrong, he could be shown some tutorial explanation of nouns and verbs and retested. The system would record his progress through this sifting, branch network.

A pure drill and practice version might just list words and ask for a judgment—noun or verb. The mistaks would be marked and a total score tabulated. This could even be done on a timed basis (e.g., five seconds per word, or try to get as many correct as you can in one minute).

Compare these hypothetical programs to the INSULT dialogue in Figure 1. (In reading this, as well as all other printouts in the paper, keep in mind that it was generated sequentially in a conversational manner.) The key difference is that there is no "right" answer in Figure 1. The student explores—he types in words and gets sentences. The computer never says "right" or "wrong," the student's ear is the judge of his work. He plays as well. The "insults" are funny and he soon learns to amuse himself with sense and nonsense responses.

The emphasis in the former programs, as well as in much of our noncomputer based education, is on getting the right answer. Failure to do so results in a slight rebuff; success a small reward. As Holt has shown at length, concentration upon getting the right answer is counterproductive. Holt has observed it to be a source of anxiety to students and sees it resulting in a low tolerance for ambiguity. Holt reports much failure correlated with fear; and a machine that says "wrong" is, indeed, rather frightening.

The student is also in a passive role in the drill and tutorial mode, responding to the demands and judgments of the machine. In the INSULT example, the student soon learns that he is in control and actively directs the course of his exploration.

Figure 1

```
RUN
INSULT
HEY STUPID! WHAT'S YOUR NAME ANYHOW??

?LARRY
ALLRIGHT LARRY, WHAT IS YOUR FAVORITE NOUN?
?COW

IT FIGURES! WELL, WHAT'S YOUR FAVORITE VERB?

?PAINT

HEY LARRY, HOW WOULD YOU LIKE TO PAINT A COW????

DONE

RUN INSULT
INSULT

HEY STUPID! WHAT'S YOUR NAME ANYHOW??

?LARRY
ALLRIGHT LARRY, WHAT IS YOUR FAVORITE NOUN?
?HORSE

IT FIGURES! WELL, WHAT'S YOUR FAVORITE VERB?

?TICKLE

HEY LARRY, HOW WOULD YOU LIKE TO TICKLE A
HORSE????

DONE
```

More Examples

I will present three more examples of exploration and play programs in English. The first and simplest is for small children and is adapted from the TV show Sesame Street. It is illustrated in Figure 2 and the dialogue is self-explanatory. It could obviously be generalized by programming other "families" of words.

Figure 2

```
GET-SESAME
RUN SESAME

LET'S MAKE THE UN-FAMILY WORDS! I NEED YOUR
HELP.
YOU GIVE THE START AND I WILL PUT IN THE 'UN'.

GIVE ME ONE OR MORE LETTERS?R
R PLUS UN GIVES RUN!!

GIVE ME ONE OR MORE LETTERS?F
F PLUS UN GIVES FUN!!

GIVE ME ONE OR MORE LETTERS?GREG
GREG PLUS UN GIVES GREGUN!!

GIVE ME ONE OR MORE LETTERS?
DONE
```

Next is the program WISHES, which is illustrated by the conversation of Figure 3. This program is adapted from Koch, a fascinating book on teaching poetry writing to grammar school children. (It also presents much grammar school poetry.) Koch recommends that each session begin with a warmup such as that on color words in the first half of Figure 3. After the warmup, the student constructs a "wish poem."

Figure 3

```
WISHES

LET'S WRITE A WISH POEM
TO WARM UP, TRY PLAYING WITH COLOR WORDS.
FOR EXAMPLE:
WHAT COLOR DO YOU THINK OF WHEN I SAY APPLE?
GREEN
HOW ABOUT SKY?BLUE
YOU KNOW, YOU DON'T ALWAYS HAVE TO USE THE
REAL COLOR OF SOMETHING IN A POEM. YOU CAN
USE ANY COLOR YOU FEEL LIKE EVEN IF IT SEEMS
FREAKY OR SILLY. IF YOU DON'T COUNT RED OR
GREEN, WHAT COLOR SEEMS LIKE APPLES? SILVER
CLOSE YOUR EYES AND SEE IF YOU CAN IMAGINE A BIG,
SILVER APPLE. SEE IF YOU CAN MAKE IT GROW OR
DANCE OR DO SOMETHING SILLY. JUST TYPE OK WHEN
YOU ARE FINISHED.
?OK
THINGS LIKE APPLES ARE NOT THE ONLY THINGS
THAT MAKE PEOPLE THINK OF COLORS. FOR EXAMPLE
A THIRD GRADER NAMED JOHN THOUGHT THAT THE
SOUND OF A CAR ENGINE WAS SCRATCHY RED?
WHAT COLOR IS THE SOUND OF A WHISTLE?
BRIGHT BLUE
THE WHISTLE SOUNDS BRIGHT BLUE!
TRY MAKING THE SOUND OF A BALLOON POPPING.
WHAT COLOR IS THAT? ORANGE
WHAT COLOR WAS THE BALLOON? RED
WHAT COLOR DO YOU SEE WHEN YOU IMAGINE THE
FEELING OF A BIG ICE CUBE ON YOUR TUMMY?
DEEP BLUE
YOU ARE REALLY GETTING INTO COLOR WORDS!
NOW LET'S TRY WORKING ON A WISH POEM.
EACH LINE SHOULD HAVE A WISH IN IT AND IF
YOU WANT TO YOU CAN PUT IN COLORS TOO.
JOHN AND HIS SISTER WHO IS IN KINDERGARTEN MADE
UP THESE EXAMPLES TO SHOW YOU:

   I WISH FOR A BIG GREEN 1000 DOLLAR BILL
   I WISH THAT EVERY DAY WAS MY RED AND WHITE
BIRTHDAY PARTY
   I WISH ALL THE STORES WERE FREE RED BLUE

GET IT? NOW YOU TYPE IN A WISH. MAKE IT LESS THAN
ONE LINE LONG, OK, WHAT DO YOU WISH?
?I WISH I WAS A BIG GREEN BASEBALL
FAR OUT! TRY ANOTHER ONE. REMEMBER, IT CAN BE
CRAZY OR FREAKY IF YOU WANT IT TO.
?I WISH IT WAS SUPER YELLOW SUNNY
ALLRIGHT! WOULD YOU LIKE TO MAKE UP MORE? YES
OK GIVE ME AS MANY WISHES AS YOU WANT TO. JUST
TYPE
STOP WHEN YOU RUN OUT OF WISHES. GIVE ME
YOUR NEXT WISH.
?I WISH TO WISH
NEXT
?I WISH FOR MORE AND MORE AND MORE
NEXT
?AND EVEN MORE
NEXT WISH
?STOP

NOW I'LL SHOW YOU A NEW WISH POEM

I WISH I WAS A BIG GREEN BASEBALL
I WISH IT WAS SUPER YELLOW SUNNY
I WISH TO WISH
I WISH FOR MORE AND MORE AND MORE AND EVEN
MORE

THAT'S A PRETTY SLICK WISH POEM YOU WROTE!
CATCH YOU LATER.
```

Koch suggests dozens of such warmups and many types of poems are illustrated in his book. There are lie poems, dream poems, being-an-animal poems, comparison poems, I-used-to-but-now poems, and many more. Mine is only a simple example, and many more such programs could be written.

Finally, Figure 4 shows a conversation with the program BARTH. This is inspired by John Barth, who periodically tells the reader to insert words of his own choice at various points in his stories. For instance, in the story Title we find this sentence: "A person who can't (verb adverb) ought at least to speak correctly, or more esoterically: Why do you suppose it is, she asked (long participle phrase of the breathless variety characteristics of the dialogue attributions in nineteenth-century fiction) that literate people such as we talk like characters in a story?"

Figure 4

```
GET BARTH
RUN
BARTH

LET'S WRITE A STORY. YOU WILL HAVE TO GIVE ME
SOME WORDS:

FIRST, WHAT IS YOUR FAVORITE ARTICLE OF
CLOTHING?SHOES
OKAY, WHAT IS YOUR FAVORITE NOUN?PICKLE
NOW GIVE ME A DARK, SINISTER ADJECTIVE?HOARY
AND WHAT IS THE MOST EVIL COLOR YOU CAN THINK
OF?FLECKY GREEN
BY THE WAY, WHAT IS YOUR FIRST NAME?
LARRY
ALLRIGHT LARRY, WHAT IS THE SWEETEST, MOST
DELICATE FLOWER? ROSE
NOW I NEED AN ADJECTIVE. IT SHOULD BEGIN WITH
AN 'S' SOUND
AND SHOULD BE REFINED AND GENTLE. IT COULD EVEN
```

```
BE A NONSENSE WORD IF IT SOUNDED NICE? SWEET
NEXT I WILL NEED A COLOR WHICH YOU FEEL
SYMBOLIZES INNOCENCE? BABY BLUE
NOW GIVE ME A SWEET, GENTLE NOUN?COTTON
OKAY, WHAT IS ANOTHER ARTICLE OF CLOTHING?
SHIRT
NOW, GIVE ME A PLURAL BODY PART?TOES

FINALLY, I NEED TO KNOW WHICH ANIMAL SEEMS
MOST COMICAL TO YOU?MOOSE

ALLRIGHT, THAT SHOULD DO IT. HERE IS OUR STORY.

THE LEGEND OF LITTLE RED RIDING SHOES

   THERE ONCE WAS A GIRL CALLED LITTLE RED
RIDING SHOES. ONE DAY HER MOTHER GAVE HER A
BASKET OF PICKLES TO GIVE TO HER GRANDMOTHER.
ON THE WAY, A HOARY, FLECKY GREEN FROG NAMED
LARRY SAW HER. THE FROG DECIDED TO GET TO
GRANDMOTHER'S FIRST!
   WHEN THE FROG GOT THERE, GRANDMA WAS
TENDING HER ROSE GARDEN, DRESSED IN SWEET, BABY
BLUE SNEAKERS. SHE WAS SWEET AND GENTLE AS
COTTON SO THE FROG ATE HER UP, PUT ON HER SHIRT
AND JUMPED INTO HER BED.
   YOU PROBABLY KNOW THE REST OF THE STORY,
RIGHT? THEY GO THROUGH THE 'MY WHAT BIG TOES
YOU HAVE' THING FOR A WHILE, THEN LARRY KISSES
RED, THEY BOTH TURN INTO MOOSES, THEY ARE
MARRIED AND LIVE HAPPILY EVER AFTER.

SIGH . . . A HAPPY ENDING

DONE
```

It was my original intent to build the example in Figure 4 around an existing poem, with various words left open to the user, but I was unable to do so. Instead, I invented the "story" which is shown.

This sort of program could easily lead into explicit discussion of formal aspects of poetry. Even in Figure 4, we see examples of allusion, metaphor, alliteration, tone and euphonia. The following list illustrates the manner in which a similar program might be extended:

(a) Onomatopoeia: Give me a verb which sounds like wood breaking.

(b) Rhyme: Give me a noun which rhymes with cow or give me a two-syllable adjective which rhymes with turtle.

(c) Alliteration: Give me an adjective that begins with an "sh" sound.

(d) Assonance: Give me an adjective with an "a" sound in the middle.

(e) Consonance: Give me a noun which ends with "ts".

(f) Euphonia: Give me a smooth, pleasant sounding adverb.

(g) Cacaphonia: Give me a rough, harsh adverb.

(h) Meter: Give me a three syllable adjective with the accent on the second syllable.

(i) Imagery: Give me a bright red object (to be used in a visual metaphor). Obviously, nonvisual images may be used as well.

(j) Metaphor: Give me a soft noun (to be used in a metaphor).

(k) Synecdoche: What do you consider the essential part of a tree to be?

(l) Or even Barth's long participle phrases a la nineteenth century fiction!

This list was culled from an introductory poetry text by Perrine. Note that all of the formal concepts illustrated by a story such as that of Figure 4 do not have to be supplied explicitly by the student; e.g., the allusion to Red Riding Hood. The above list could easily be expanded by suggesting that examples of paradox, irony, symbols, metonymy, etc. could be built into the "body" of the story.

Conclusion

I've presented four examples of exploration and play programs for English. In each case, there was no such thing as a wrong answer; the user was active, and I attempted to create an air of carefree play. It is my hope that others will develop, use, evaluate and distribute similar programs.

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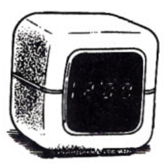

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List the articles you have enjoyed reading most. ______________________________

Describe new topics you would like to see discussed. ______________________________

Check the box which best applies to your level of expertise:

HARDWARE: None ☐ I want to learn ☐ Some (I know a resistor from a flip-flop) ☐
Mechanic (you design it, I'll build it) ☐ Old Hand (I designed it and it works) ☐
Expert (If Intel had me they'd be famous) ☐

SOFTWARE: None ☐ I want to learn ☐ Some (I wrote an RPG program once) ☐
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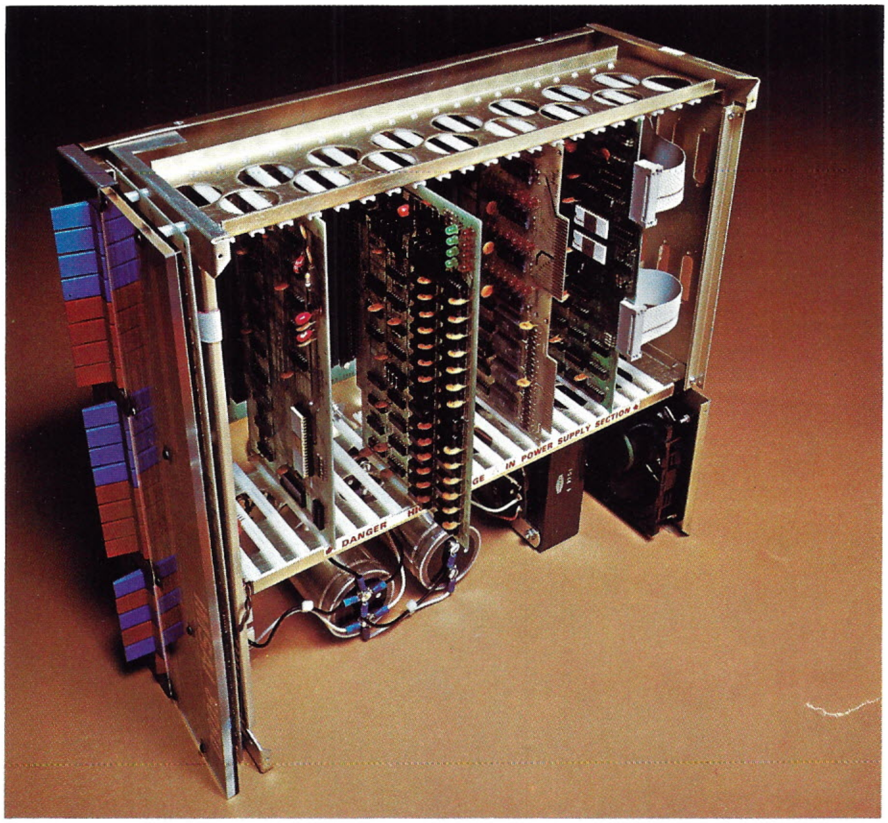

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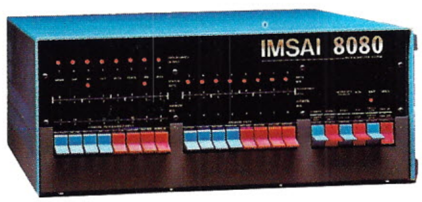

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