SOFTWARE WINNERS TO BE ANNOUNCED

The grand prizes for the yearly software contest will be announced on Sunday, March 29, at the WACC Awards Banquet. A thousand dollars credit towards the purchase of ALTAIR equipment will be awarded to the author of the best "Major Program" submitted during the past year. Another prize of $250 credit towards the purchase of ALTAIR equipment will be awarded to the author of the best "Subroutine".

The first annual ALTAIR Software Contest began in April of 1975. The first entries were rather scanty, but as time has gone by, the number and sophistication of these entries has increased greatly. The ALTAIR Software Library is now a very valuable resource for ALTAIR users.

Each month during the past year, MITS has announced prizes for the best "Major Programs" and the best "Subroutines". The monthly prize for the best "Major Program" is $50 credit with a second prize of $25 credit and a third prize of $15 credit. The author of the best subroutine receives $25 credit with a second place prize of $15 credit. Winners of the yearly grand prize will be selected from these monthly contest winners, plus late submissions received at MITS before the convention.

The contest has proved to be an overwhelming success. The prizes have motivated ALTAIR users into building a very substantial software library. Needless to say, the contest will continue for another year.

MONITOR WINS SOFTWARE CONTEST AGAIN

This month another twenty-two programs were added to the software library. And, as usual, there were very small subroutines (13 bytes) to large programs (2,125 bytes).

First place program goes to another monitor program. This one includes the facility to set break points in a user program. This allows you to stop a program and print out register contents and examine memory locations to verify that the program is performing correctly or figure out why it isn't. While not as sophisticated as the break point facility in DBG-8800, it is still very useful.

Second place major program goes to a BIOPLOT program, which is perhaps the most unique entry for the software contest. This program produces a graphic plot of what are conjectured to be three cycles that affect a person's behavior. No matter what the validity of these cycles turns out to be, the program demonstrates good use of plotting techniques.

Third place major program goes to a LIFE program. In case you don't know already, LIFE is a game where an initial matrix of cells changes according to an algorithm which either deletes or inserts new cells. Certain patterns of cells repeat, others disappear, and others "move". This program displays the changes in the cell pattern in real time or a TVT-II.

FIRST PLACE MAJOR PROGRAM

#1-21-761
Authors: John Arnold and Dick Whipple
Length: Approximately 500 bytes
Title: ASCII Monitor/Editor

Following commands are included:

DOP-Dump Octal
LDO-Load Octal
EDT-Change memory
SBP-Set Break Point
CBP-Clear Break Point
XQT-Execute
RDC-Read Data from Cassette
WDC-Write Data to Cassette
RUN-Start user program
CPY-Block memory move
MSG-send characters to output device

— Continued On Page 7 —

Enthusiasm Builds for Altair Convention

As time draws near, enthusiasm for the first World Altair Computer Convention grows. Reservations are pouring in, and it looks like many participants will have to stay at a hotel other than the Airport Marina because the Marina will probably be filled. Arrangements for a second hotel are in progress.

The prize list for the winning demonstrations has been announced. Grand Prize will be an assembled Altair Floppy Disk Drive and Controller. Second Prize will be an assembled Altair 8800B with 4K of Altair static memory. Third Prize will be an assembled Altair 16K Static Memory Card. In addition to these prizes, a number of door prizes will be given away at the Sunday Awards Banquet. Included are:

1. Vectored Interrupt with Real Time Clock card (assembled).

2. PROM memory card (assembled).

3. 88-4PIO parallel interface card with 4 ports (assembled).

4. 88-2SIO serial interface card with 2 ports (assembled).

5. 25 copies of the Microcomputer Dictionary by Charles Sippl.

6. Several assembled Altair 680's.

7. Direct Memory Access card (assembled).

You must attend the banquet to win these prizes. Banquet tickets sold at the door ($10 each).

For further information, see the ad on the back page of this issue of Computer Notes, or contact David Bunnell at MITS, (505) 243-7821.

COMPUTER NOTES ©mits
FEBRUARY 1976
Vol. 1 Issue 9

Across the Editor's Desk

by David Bunnell

Now That We Are in the New Building

If you've ever had the opportunity to move a corporation, you know that the logistics can be staggering. And with a business such as MITS, you can't simply shut down for a few weeks. You have to continue in operation.

Considering this, the move to 2450 Alamo went remarkably well. As reported in this column in the last issue of C. N.; production, repair, shipping, and the stockroom were all moved and in operation before the rest of the company was moved. The rest of the company, which consists of marketing, accounting, administration, advertising, engineering, and software was moved and in semi-full operation within a two-day period. The movers had promised that this could be done in one day, but two days ain't bad.

Now that we have the facilities to greatly expand production and to work more efficiently, the question is this: Can we meet the ever-expanding demands of our customers?

Time will tell, of course, but I think the answer is a "qualified" yes. We get a lot of criticism for the things we haven't shipped, but you never hear about the things we have shipped. The number of Altair mainframes out in the field, up and running, is staggering. And the number of new Altair options is very impressive. My answer is "qualified" because virtually everyone in the micro-computer business has consistently under-estimated the market. No one can say with much accuracy how much this market will grow during the next year. The end is not in sight.

One thing that might blow the lid off is an article in Time Magazine, Readers Digest, Playboy, or a report by NBC or CBS news. These things have been rumored for some time, and I know for a fact that an article for Time has been written and submitted to their editors. But you know how editors are. Don't you?

Software in the Hobby Market

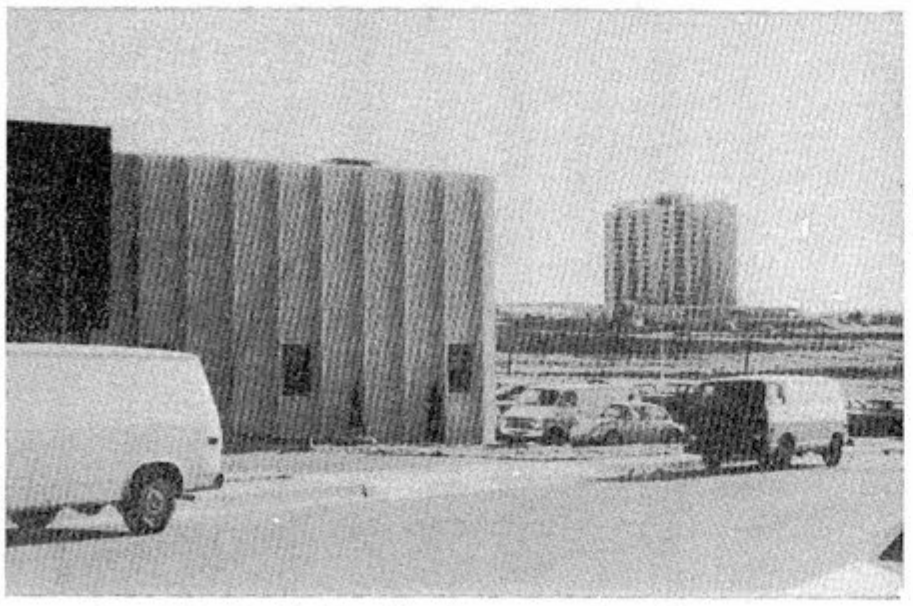
By now you may have seen Bill Gate's "Open Letter to Hobbyists" in one of the several hobby publications where it has appeared. (See opposite page.) Bill raises a number of good points, the most crucial of which is: Will there be good software available to hobbyists if they continue to steal it?

Bill and his crew now have BASIC up and running for the 6800. Their 8080 BASIC and their Altair Disk BASIC is phenomenal and who can believe that companies such as IMSAI will come up with anything nearly as good? And for "free", no less.

It's something to think about.

This Month's Issue

This issue of C. N. is limited by our usual standards due to the move and to the amount of energy required to organize the WACC. Missing is the much-read column by Ed Roberts, normally positioned on page 3. But, we'll be back on track in March.



(New MITS building in foreground. Airport Marina Hotel in Background. These buildings are the sites of the Altair Computer Convention.)

USERS GROUP NEWS

Convention time is approaching and by now, I hope, all of you have received our mailing of the schedule and reservation forms. As we noted on the prize list, the deadline for returning the forms was extended to March 10. If, for some reason, you are an 8800 owner or user, and you did not receive the mailing about WACC, drop me a postcard and I will send it to you immediately. The only persons we may have missed are those who just recently changed addresses or those who purchased through a school or company name and have not sent us the user's name.

In the October issue of Computer Notes we accepted a "Roulette" program, #912751, into the software library. This program was sent in by Gerhald Hansel, and I mistakenly put Gerhald down as the author. The program was actually written by Gerhald's son, Steven Hansel. "Roulette" has been tested on an IBM 360.

Our Accounting Department has asked me to mention refunds in this article. Customers who have cancelled an order, or for some reason are requesting a refund, should receive their refund within 2 to 3 weeks. The refund cannot be sent out immediately due to our computer invoicing and cancellation system.

Many customers have been ordering additional copies of BASIC. If you order a second copy of the same version software, you are charged a copying fee only. If you order an updated version, you are charged a copying fee plus the price difference between versions. Extra options ordered with software have additional charges. Please note on software orders what software you have previously purchased from MITS, if any. A few customers have been accidently overcharged for 2nd copies because we do not check each file completely with new orders.

I hope to see all of you at the World's ALTAIR COMPUTER CONVENTION.

by Barbara Sims

Letters to the Editor

Dear Sir:

While looking through all the various newsletters, Byte articles, Radio-Electronics, and Popular Electronics magazines in an attempt to interface my ALTAIR 8800 with Don Lancaster's TVT-1, and that darn Southwest Tech Products K/E/Y/-B/O/A/R/D/ that I should never have bought, but did, I suddenly realized that your product, the ALTAIR 8800 has come in for quite a bit of criticism.

Since I own one, purchased in kit form during the $995 "BASIC" special, and since it is up and running, I just wanted to tell you that I feel most of that complaining is unjustified. I, for one, am a satisfied owner of the ALTAIR 8800.

I called MITS 3 times while I was constructing my computer, and each time all of your employees that I came in telephone contact with were very courteous to me and very helpful. Parts that needed to be replaced due to defects caused by your suppliers, not MITS, arrived within a week, and I am sure that even though they were sent by first class mail, most of the short delay was due to the postal department, not MITS. You see, they were shipped within 24 hours of my phone calls.

I never got around to sending my critique of Mike Hunter's MITS Caravan Presentation . . . It was excellent and he fielded some rather nasty questions from the session I attended when he was here in the Boston area, most of those from disgruntled 8800 owners who were having memory problems.

I guess most of the people who have constructed the 8800 and don't have it running may have valid complaints for your firm, and your product. And I will venture a guess that some of the people who get your newest baby, the ALTAIR 680, will feel the same way. I, for one, feel that I received full value for the money I paid.
I bought it on September 15, 1975, and as of this date I am satisfied with your product. It works for me. I can't ask anything more of it, or MITS . . . Nor should I expect anything more of it or your company.

Have a nice day.

M. Douglas Callihan

Dear Sirs:

I am a software engineer with EMC Controls and I have been involved in major software development projects for several years. Many people think that computer companies give software away as inducements to sell their hardware. This was true in the '60's when IBM sold systems for millions. But now that hardware is "cheap", most computer companies realize that software is the major cost in selling systems. I approve and agree with your statement about your right to place, what I consider a minimal charge, on the ALTAIR BASIC you have developed. More power to you.

W. T. Shaw

AN OPEN LETTER TO HOBBYISTS

To me, the most critical thing in the hobby market right now is the lack of good software courses, books and software itself. Without good software and an owner who understands programming, a hobby computer is wasted. Will quality software be written for the hobby market?

Almost a year ago, Paul Allen and myself, expecting the hobby market to expand, hired Monte Davidoff and developed Altair BASIC. Though the initial work took only two months, the three of us have spent most of the last year documenting, improving, and adding features to BASIC. Now we have 4K, 8K, EXTENDED, ROM and DISK BASIC. The value of the computer time we have used exceeds $40,000.

The feedback we have gotten from the hundreds of people who say they are using BASIC has all been positive. Two surprising things are apparent, however. 1) Most of these "users" never bought BASIC (less than 10% of all Altair owners have bought BASIC), and 2) The amount of royalties we have received from sales to hobbyists makes the time spent on Altair BASIC worth less than $2 an hour.

Why is this? As the majority of hobbyists must be aware, most of you steal your software. Hardware must be paid for, but software is something to share. Who cares if the people who worked on it get paid?

Is this fair? One thing you don't do by stealing software is get back at MITS for some problem you may have had. MITS doesn't make money selling software. The royalty paid to us, the manual, the tape and the overhead make it a break-even operation. One thing you do do is prevent good software from being written. Who can afford to do professional work for nothing? What hobbyist can put 3 man-years into programming, finding all bugs, documenting his product and distribute for free? The fact is, no one besides us has invested a lot of money in hobby software. We have written 6800 BASIC, and are writing 8080 APL and 6800 APL, but there is very little incentive to make this software available to hobbyists. Most directly, the thing you do is theft.

What about the guys who re-sell Altair BASIC, aren't they making money on hobby software? Yes, but those who have been reported to us may lose in the end. They are the ones who give hobbyists a bad name, and should be kicked out of any club meeting they show up at.

I would appreciate letters from anyone who wants to pay up, or has a suggestion or comment. Just write me at 1180 Alvarado SE, #114, Albuquerque, New Mexico, 87108. Nothing would please me more than being able to hire ten programmers and deluge the hobby market with good software.

Bill Gates
General Partner,
Micro-Soft

The Computer Store

The Computer Store opened in mid-March in Burlington, Mass., conveniently located near Route 128, the circumvential highway which embraces most of the New England electronics industry. This pilot location is at 120 Cambridge Street, Burlington, Mass., 10803, which is less than a mile north of Route 128, reached from Exit 41N. The phone number is (617) 272-8770. Hours are 9-5 on Mon. - Wed.; 9-9 on Thurs. - Fri.; and 10-5 on Saturday.

The Computer Store carries an extensive inventory of all Altair products and has a professional staff with a full complement of sophisticated equipment to assist in nearly any hardware or software system problem. This facility is intended to provide a full capability for both the hobbyist and the industrial and commercial Altair computer user.

In addition to full support of the MITS product line, the Computer Store carries tools and instruments, books and manuals, selected chips and support hardware, and is being expanded to include other supplies and support equipment to service the entire market who purchase the Altair computer systems, including distribution of such items as magnetic media (discs, cartridges) and paper products.

The founders of the "Northeastern" Computer Stores are Dick Brown and Sid Halligan, both of whom have had long and extensive careers in the mini and micro-computer industries. Dick, the President, has been Development Manager for Digital Equipment Corporation as well as formerly being a Vice President/Director of Control Logic as well as the founder/President of Computer Guild. Sid, Vice President, was a founder and Vice President (Sales) of Prime Computer, Inc., as well as having a long, successful career in marketing with Computer Controls Corp. (later Computer Controls Division of HIS) both in the United States and Europe. Other staff members bring heavy technical backgrounds to support the sales and marketing expertise.

The "Northeastern" Computer Store is not corporately related to Dick Heiser's Computer Store, also known as Arrowhead Computing, although both organizations are MITS dealers.

The Computer Store
120 Cambridge Street
Burlington, MA 10803
(617) 272-8770

Microsystems

If you'd like to LOAD up on some good INPUT, you should JUMP over to MICROSYSTEMS and see just how the Altair computers STACK up. Far from being a DUMP, it's the place to pick up a POINTER or two.

What you READ may not always REGISTER, so you should INTERFACE with the MICROSYSTEMS people to CLEAR the air about the WRITE system for you. It will ADD up to a smart MOVE so POP on over and PUSH your way in or give them a CALL and you'll be sure to COMPLEMENT their OUTPUT and RETURN again and again.

It won't hurt a BIT! (They don't BYTE!)

MICROSYSTEMS
6605A BACKLICK ROAD
SPRINGFIELD, VA 22150
(703) 569=1110

off the shelf

CPU

CPU (Computer Products Unlimited) is located at 4216 West 12th St., Little Rock, Arkansas, 72204, (501) 666-2839. The owner-manager is Harry W. Mohrmann, 31, who has a background in math and physics as well as six years experience as manager of a data processing center.

With a full-time staff of five, CPU offers for the hobbyist a complete line of MITS products as well as technical books and magazines, electronic tools, simulation board games, electronic parts and a work area for helping hobbyists build their kits.

For the businessman CPU installs, maintains, and programs complete computer systems for any application.

CPU also sells time, by the hour, on any of their three Altair 8K BASIC systems that they have available for playing games or for program development.

Store hours are 10 to 6, Monday through Saturday, and after hours by special appointment.

CPU is a division of Kay Enterprises, Inc., which for the past 13 years has provided customized services for sales analysis, payroll, accounts receivable, accounts payable, general ledger bookkeeping and software development.

Computer Products Unlimited
4216 West 12th St.
Little Rock, Arkansas 72204
(501) 666-2839

Marsh Data Systems

It's up and running. 8K BASIC is on display at Marsh Data Systems on the ALTAIR 8800, and it's a fantastic language we would like everyone to see. Our address is 5405-B Southern Comfort Blvd., Tampa, FL, 33614. Our telephone number is (813) 886-9890. We are located near the north west corner of the Tampa Airport at the intersection of Hillsborough Avenue and Eisenhower Boulevard. Our store hours are: Noon to 5 p.m. Tuesday through Thursday and Noon to 8 p.m. Friday and Saturday.

Marsh Data Systems, owned and operated by Don Marsh, features the complete line of ALTAIR products with both assembled units and kits available off the shelf. Naturally advice is available to the kit builders on assembly of their computer and interface to other devices. Software information is available as well as suggestions on standard programming techniques. This has become a meeting place for computer hobbyists, where we all can meet and talk computer. People like to play with BASIC (it's better than an electric train) and once you catch the fever, it's hard to quit. When BASIC is in the ALTAIR computer, it comes alive; and it has a very nice personality.

Marsh Data is also marketing computer books and literature. The literature includes two logic courses (Digital Logic Without Electronics and Intermediate Logic Diagrams) plus interface instructors for interfacing the ALTAIR 8800 with the SWTP CT-1024 Video Terminal. Under development is a Baudot to ASCII translator circuit for those of you who have Baudot machines. Our desire is to interface the ALTAIR 8800 with everything so the computer can be used with anything that might be available.

Marsh Data Systems
5405-B Southern Comfort Blvd.
Tampa, FL 33614
(813) 886-9890

Authoritative, up-to-the minute source of microcomputer terminology

MICROCOMPUTER DICTIONARY

The **Microcomputer Dictionary & Guide** by Charles J. Sippl fills the urgent need for all computer people, engineers, scientists, industrialists, communications people—as professionals, amateurs, teachers, or students—to become quickly acquainted with the terminology and nomenclature of microcomputing.

This book contains over 5000 definitions and explanations of terms and concepts relating to microprocessors, microcomputers, and microcontrollers. Its 704 pages also contain appendices on: programmable calculators; math and statistics definitions; flowchart symbols and techniques; binary number systems and switching theory; symbol charts and tables; summaries of BASIC, FORTRAN and APL. In addition there is a comprehensive electronics/computer abbreviations and acronyms section.

Order now and save! Just $15

The **Microcomputer Dictionary and Guide** normally sells for $17.95. As a special to the readers of Computer Notes, it is now being offered for $15 (plus $1 for postage and handling). This offer expires April 15, 1976.

Below are some example entries from the **Microcomputer Dictionary:**

bit — 1. Bit is an abbreviation for binary digit. Most commonly a unit of information equalling one binary decision, or the designation of one of two possible and equally likely values or states, usually conveyed as 1 or 0 of anything used to store or convey information. (such as 1 or 0, which may also mean "yes" or "no".) 2. A single character in a binary number. 3. A single pulse in a group of pulses. 4. A unit of information capacity of a storage device. The capacity in bits is the logarithm to the base two of the number of possible states of the device.

concatenate — To link together in a series.

cross assembler — 1. Refers to a program run on one computer for the purpose of translating instructions for a different computer. 2. Programs are usually assembled by the same assembler or assembly program contained within or used by the processor on which they will be run. Many microprocessor programs, however, are asembled by other computer processors whether they be standard, time-shared, mini or other microcomputers. This process is referred to as cross-assembly, and the programs are not designed for specific microprocessors but are to be used on other computers. They are known as cross-assemblers.

microcomputer — A general term referring to a complete tiny computing system, consisting of hardware and software, that usually sells for less than $500 and whose main processing blocks are made of semiconductor integrated circuits. In function and structure it is somewhat similar to a minicomputer, with the main difference being price, size, speed of execution, and computing power. The hardware of a microcomputer consists of the microprocessing unit (MPU) which is usually assembled on a PC board with memory and auxiliary circuits. Power supplies, control console, and cabinet are separate.

paging — Refers to a procedure for transmitting pages of information between main storage and auxiliary storage, especially when done for the purpose of assisting the allocation of a limited amount of main storage among a number of concurrently executing programs.

parallel input/output card — A typical full parallel input/output card has the necessary handshake flags for conventional parallel interface and contains all required addressing circuitry to allow each card to be addressed anywhere from location to location. In some systems both input and output data have their own 8-bit latch for buffering, including necessary logic to allow an adjacent channel to be a control channel. Thus, adjacent channels can be used to set up flags and also clear flags and interrupts.

subroutine — 1. In computer technology, the portion of a routine that causes a computer to carry out a well-defined mathematical or logical operation. 2. Usually called a closed subroutine. One to which control may be transferred from a master routine, and returned to the master routine at the conclusion of the subroutine. 3. Refers to either part of a master program or routine that may be 'jumped' or 'branched' to or to an independent program in itself but usually of smaller size or importance. 4. A subroutine is a series of computer instructions to perform a specific task for many other routines. It is distinguishable from a main routine in that it requires as one of its parameters, a location specifying where to return to the main program after its function has been accomplished.

transistor-transistor logic (TTL') — This is the most common form of IC logic. As a result, the relatively simple process used to produce TTL logic is a natural candidate for memory, especially since most memories are used with TTL logic. However, the TTL approach—even though the simplest bipolar process—is considerably more complicated and expensive than MOS. Since n-channel MOS can now be made as fast in performance as TTL bipolar, the importance of the TTL process to the memory market is limited. It will vie with CMOS for those applications represented by small memories of around 256 bits per chip, commonly intermixed with computer logic (distributed memory). The only advantage of both CMOS and TTL in these applications is their 100 percent compatibility with the logic (i.e., power supplies and signal levels). Of course, n-channel memories can also be made logic compatible at lower speed (2 to 3 MHz) operation. Slightly larger memories can bear the cost of having less than 100 percent compatibility, so the lower cost of n-channel will displace TTL and CMOS in all but the smallest memories.

testing, microprocessor — Testing microprocessors presents problems associated with system testing that are relatively foreign to device manufacturers and users. As in LSI memory testing, the functional test pattern cannot be of infinite proportions in length, but must correlate well with system usage. To do this, a systems approach is required. For example, it is not sufficient to use a test pattern derived from logic simulation. One must test the function of the microprocessor. For example, if one wishes to test the arithmetic unit, a simulation of NAND gate equivalents is no guarantee that the device will multiply properly. A realistic test would be to force the device to multiply! The tester is arranged to do this. The microprocessor instructions are loaded in the data buffer memory which is interfaced to the microprocessor under test.

A tester, controlling the DBM, presents varied sequences of instruction sets to the unit under test. In this way, the worst case sequence of instructions is presented to the test device. A microprogrammable multiprocessor is being used to test a microprocessor.

text editor — A text editor provides the system user with a convenient and flexible source text generation system. Source statements are entered via any source input device/file. The entered source text may be output, statements added, deleted or modified. The text editor permits the order of statements or groups of statements to be altered at any time. The final text is output to a source device/file for use as input to an Assembler.

wire-wrap advantages — Wire-wrapping offers the advantage of ease of design, freedom of layout, easy maintainability and parts replacement, ease of design change, good performance and good density. But unless users can justify wire-wrapped interconnection for applications on the basis of economics, there is no point in using it. Wire-wrapping would not enjoy its current popularity if it did not offer economic advantages over other techniques. But it is also far easier to lay out a wire-wrapped system than a printed circuit board, and there is also an increase in flexibility of component location. Design changes can be implemented by documentation changes. This is considerably easier than modifying printed circuit artwork and modifying an etched board when a design change is necessary. Replacing a component is also generally easier in a wire-wrapped system because of the plug-in feature inherent in wire-wrapping hardware. PCB components can be made pluggable, of course, by the addition of sockets, but sockets on a printed circuit board represent additional space, assembly labor and parts cost.

MAIL THIS SPECIAL COUPON TODAY!

☐ Enclosed is check for $_____

☐ BankAmericard #_____

☐ or Master Charge #_____

☐ Please send me _____copies of the **Microcomputer Dictionary & Guide** at $15 each, plus $1 postage and handling for each copy.

NAME_____

ADDRESS_____

CITY_____STATE & ZIP_____

MITS/2450 Alamo SE/Albuquerque, NM 87106

MITS/2450 Alamo SE/Albuquerque, NM 87106/505-243-7821

GENERAL SOFTWARE NOTES

Package I has been upgraded in many ways. And now the machine language debugger, DBG-8800, is included as an integral part of Package I. As a result of this change, DBG-8800 will no longer be priced separately from Package I. Instead, Package I version 3.0 will cost $75 effective immediately. Users who still have Package I or DBG-8800 on order will receive Package I/DBG version 3.0 at no extra charge. All new orders should be placed at the $75 rate (cassette or paper tape). Sale of the source of DBG-8800 on cassette or paper tape has been discontinued.

There has been a number of inquiries as to whether DBG-8800 is useful with BASIC. The answer is no. ALTAIR BASIC has its own debugging facilities designed specifically for debugging BASIC programs.

For those who are interested in more information on DBG, here is a quick example:

(underlined typed by user)

```
DEBUG

1.  $SΔ1Ø/  NOP MVI B,100 <LF>

2.      12/  NOP LXI H, #6000 <LF>

3.      15/  NOP MVI M, 0 <LF>

4.      17/  NOP INX H <LF>

5.      20/  NOP DCR.B <LF>

6.      21/  NOP JNZ 15 <LF>

7.      24/  NOP .X

8.      10G

9.        Ø  BREAK @24

10. $0ΔL/ 100 <CR>

11.     B/  Ø  <CR>

12.     F/ 106! ZP
```

In the example above, <CR> stands for carriage return and <LF> for line feed. What the program does is zero out the 100 octal locations starting at location 6000 decimal (# means decimal - line 2). After the program is entered (symbolically!) a break point is set after the last instruction (line 7). Next execution is begun with a G(GO) command. When the memory clear program is done, the break point is hit and DBG types the break point number and the address of the break point (line 9). The user then examines some registers in octal mode (lines 10 & 11). The user then examines the flag (condition code) register and uses the special exclamation point command to see symbolically which flags are set.

This is a good example of how short programs may be "improvised" using DBG. The monitor program save facility could be used to save such improvised programs on paper tape or cassette.

BASIC NEWS

Disk BASIC is running! Thanks to many long hours of coding, typing, and debugging by that microcomputer programmer par excellance, Bill Gates, ALTAIR Disk BASIC has struck a new high in micro software. As mentioned before, Disk BASIC has:

Random files
Sequential files
Program saves and load from disk
Program chaining
etc.

We recommend that you have 20K bytes of memory if you wish to use disk Extended BASIC. BASIC takes about 15K minimum (can be more depending on the number of simultaneous random and sequential files the user wants to have open).

Disk BASIC will always have the cassette and line printer features built in. (No special versions should be ordered.) Disk BASIC is version 3.3 of BASIC. This means it also has:

Octal constants
Console command
Improved random number generator
Cassette numeric array save/load features

and more. These features will not be available in the 4K, 8K, and Extended versions (which will stay at version 3.2), but they will be available in ROM Extended BASIC.

ROM BASIC?

Yes indeed. No prices or delivery dates are available, but we will have BASIC on 12K of ROM. If you like to power your machine down, but don't like to reload BASIC (and can't yet afford a disk), ROM BASIC is the answer! We will have more information in coming newsletters.

For those of you who have left your fantastic compiler or whatever waiting in a drawer, now's the time to get it out! The yearly grand software prize ($1,000 in credit for ALTAIR products) will be announced at the WACC. So dig out that software and send it in! Today!

Now that Disk BASIC is done, work on finishing the DOS is underway. Files are compatible between the DOS and Extended Disk BASIC--in fact much of the same code is used. We now project a delivery date of the DOS version 1.0 of about April 15.

6800 BASIC

Is finished . . . due to the extraordinary efforts of Richard Weiland III, the 6800 now has a BASIC comparable to the 8080's. Size: About 6300 decimal bytes. It is so similar to ALTAIR 8K BASIC, the differences may be summarized on one page.

As those of you who have used 8K BASIC are aware, it is only 5900 bytes, so the 6800 version is slightly bigger (7%). 8080 addicts that we were, we expected the 6800 version to be much bigger. But Ric's efforts proved convincing. It is the concensus of most people that have programmed both CPU's that while the 8080 can be programmed in slightly tighter (and tricky) code, the 6800 is the easier of the two machines for a beginner to learn, and requires only slightly larger memory than the 8080 when programmed by an expert.

No price for 6800 BASIC has yet been set.

Please direct any questions you have about 6800 software to Mark Chamberlin, our resident 6800 systems programmer, who is presently working on the assembler, editor and monitor.

Direct any 8800 Package I questions to Paul Wasmund, who rules the realms of Package I.

SOFTWARE

SOFTWARE CONTEST WINNERS
Continued from Page 1

SECOND PLACE MAJOR PROGRAM

#2-3-761
Author: L. M. Eastburn
Length: 2048 + 77 = 2125 bytes
Title: BIOPLOT
Huge machine language program which plots graphically on a teletype or other terminal a person's 23 day physical & 28 day sensitivity and 33 day cognitive biorhythm cycles.

THIRD PLACE MAJOR PROGRAM

#1-5-761
Author: Adolph P. Stumpf
Length: 247 bytes
Title: LIFE
Plays the game LIFE on a TVT-2, but can be modified to run on other terminals.

FIRST PLACE SUBROUTINE

#1-15-763
Author: Don Baechtel
Length: 157 bytes
Title: CDUMP
"Core" dump program which dumps memory in octal and in equivalent ASCII characters.

SECOND PLACE SUBROUTINE

#2-2-764
Author: M. A. Enkelis
Length: 20 bytes
Title: 16-bit Delay
This subroutine loops for a number of seconds, minutes and hours--up to 12 hours.

THIRD PLACE SUBROUTINE

#1-8-761
Author: J. W. Macarty
Length: 32 bytes
Title: String Table Search
Uses a search tree to match a string against a table of reserved words.

#1-14-761
Author: Mark Prinsen
Length: 324 lines (BASIC)
Title: Stock Market Simulation
Allows up to 10 players to play a simulated stock market. Slight changes are necessary to run in ALTAIR BASIC.

#2-2-761
Author: M. A. Enkelis
Length: 19 lines (BASIC)
Title: Julian Calendar

#2-13-761
Author: Roger Walker
Length: 238 bytes
Title: OCTAL MINI-MONITOR

#1-20-761
Author: Erik T. Mueller
Length: 206 bytes
Title: Number Guessing Game
User must try to guess a number between 0 and 255. Assumes a TVT-II is the terminal.

Slot Machine Game
For MITS BASIC by Jon Walden

This program is written using the combinations and percentages suggested by Donald D. Spencer on pages 219-223 of his book, "Game Playing with Computers".

SLOT MACHINE IS SET UP WITH 3 REELS, 20 SYMBOLS EACH REEL:

	REEL 1	REEL 2	REEL 3	SYMBOL	EQUIVALENT
CHERRIES	4	6	0	=	1
ORANGES	5	4	7	0	2
BELLS	4	6	5	1	3
LEMONS	3	2	4	#	4
WATERMELONS	3	1	3	+	5
BARS	1	1	1	$	6

PAYOFFS ARE AS FOLLOWS: (A = ANY SYMBOL)

COMBINATION			PAYOFF	NUMBER OF POSSIBLE WAYS
=	A	A	$ 3	400
=	=	A	5	240
0	0	$	6	20
1	1	0	8	168
#	#	#	10	24
+	+	$	15	3
0	0	0	18	140
+	+	+	20	9
$	$	$	200	1

PAYOFF AVERAGES $70.49 FOR EVERY $80 PUT IN; NET LOSS IS $9.51; THE HOUSE MAKES 11.89%. (CASINOS ARE THOUGHT TO MAKE BETWEEN 3% AND 50% WITH THE AVERAGE BETWEEN 11% and 12%).

EACH TIME THE REELS SPIN, YOU ARE BETTING A DOLLAR. THE PROGRAM ESTABLISHES THE REEL EQUIVALENTS WITH RANDOM NUMBERS, PRINTS OUT THE SYMBOLS, THE PAYOFF (IF ANY), AND SUMMARIZES YOUR FINANCIAL POSITION AT THAT POINT. (REMEMBER IF YOUR WINNINGS ARE $20 AND YOU WIN A $5 PAYOFF, YOUR NEW WINNINGS ARE $24--$25 MINUS THE DOLLAR YOU BET.)

THE PROGRAM IS WRITTEN IN "MITS" BASIC AND USES THE FOLLOWING VARIABLES:

K	PAYOFF COUNT
L	LOSSES (MONEY PUT IN)
N	NUMBER OF RANDOMS IGNORED
P	PAYOFF
Q	EQUIVALENT OF ALL THREE REELS
R(3)	EQUIVALENT OF INDIVIDUAL REELS
S(6)	SYMBOL EQUIVALENT TABLE
W	WINNINGS (TOTAL PAYOFFS)
X/Y	"FOR" LOOP CONTROLLED VARIABLES
Z	IGNORED RANDOMS
D$	DECISION
R$(3)	SYMBOL FOR INDIVIDUAL REELS
S$(6)	SYMBOL TABLE

I'd like to say something brief about MITS Basic: I think it's great! Comments have been made about it being slow and about certain clumsy features. But the agility to play with bits, to sense ports and to use single ASCII codes is long overdue! I hope the use of "INP" in this program will encourage other programmers to work on new data input methods (especially for games). Having to "hit return" after each entry is a drag!

— Continued On Page 8 —

#1-15-764
Author: Don Baechtel
Length: 13 bytes
Title: MULT
8 bit times 8 bit unsigned binary multiply.

#1-15-765
Author: Don Baechtel
Length: 57 bytes
Title: MBSHIFT
Shifts up to 64K bytes, up to 256 places left or right with zero fill into the empty positions.

#1-15-766
Author: Don Baechtel
Length: 33 bytes
Title: APTLOAD
Absolute boot loader.

#2-12-761
Subroutines
Author: Sidney Rosell
Length: 45 bytes
Title: Memory Test and Clear Routine
Simple memory test. Can also be used to clear memory.

- Continued on Page 8 -

Software contest winners
Continued From Page 7

#1-15-761
Author: Don Baechtel
Length: 84 bytes
Title: TAPELOAD
Loads an ASCII octal paper tape into memory.

#1-15-762
Author: Don Baechtel
Length: 28 bytes
Title: DIV
Divides an 8 bit unsigned binary number by an 8 bit unsigned binary number.

#1-22-761
Author: William A. Ruggirello
Length: 106 bytes
Title: 16 Bit Divide
Divides a 16 bit unsigned binary number and rounds up the 16 bit result.

#1-28-761
Author: Martin H. Eastburn
Length: 48 bytes
Title: Memory Test
Simple memory test by another member of that prolific group of programmers, the Eastburn family.

#2-2-763
Author: M. A. Enkelis
Length: 7 lines (BASIC)
Title: Pseudo Random Number Generator
Generates a 16 bit pseudo random integer.

#1-23-761
Author: Harold A. Corbin
Length: 310 bytes
Title: Paper tape Editor
This editor allows corrections to be made to a line as it is typed in, and automatically adjusts input fields on each line to satisfy the input field requirements for a multi pass 8080 assembler.

#2-2-762
Author: M. A. Enkelis
Length: 76 lines (BASIC)
Title: LUNAR LANDER
Game to simulate landing of lunar module on the moon.

#2-5-761
Author: George W. Rompot
Length: 49 bytes
Title: ASCII Keyboard Load
Loads OCTAL data through a keyboard into memory.

PACKAGE I REVISED

by Paul Wasmund

For all faithful users of Package I, we have some great news. The finishing touches are being put on Revision 3.0 of this package and it really looks great. Just to start with, the DEBUG package is now included with Package 1. The other big news is the Monitor. It now supports all MITS I/O boards, has a built in console command and has some minimal debugging features built into it. To give you an idea of the improvements, here is a list of the new commands:

NUL - Causes nulls to be written after a carriage return.
CNS - Console command.
EXM - Prints contents of memory locations in octal.
DEP - Deposits octal constants in memory.
DMP - Dumps absolute programs from the monitor
JMP - Jumps to any location in memory.

The Package I manual has also been improved, making it easier for beginners to read and understand.

This is hoped to be the last major revision of Package I. The only new releases will be to fix bugs that may be found. If you do find anything you think is a software bug, please send me an output demonstrating the problem if possible.

Slot Machine Game

Continued From Page 7

```
100 DATA ,0,1,#,+,$
110 FOR X=1 TO 6:READ S$(x):S(X)=X:NEXT
120 IF NOT (INP(0)<128) G010 120
130 OUT 1,12
140 PRINT 1AB(6);">>>>>> SLOT MACHINE<<<<<<":PRINT:PRINT
150 N=INT(500*RND(8))+1
160 FOR X=1 10 N:Z=RND(8): NEXT
170 PRINT "PRESS THE SPACE BAR TO GET REPEATED"
180 PRINT "REEL SPINS. (EACH SPIN COSTS YOU $1.)"
190 PRINT:PRINT "PRESS 'Q' WHEN YOU'RE READY TO QUIT."
200 PRINT:PRINT "PRESS ANY OTHER KEY TO GIVE YOURSELF"
210 PRINT "A BREAK. THE SPACE BAR WILL GET YOU"
220 PRING "GOING AGAIN . . . GOOD LUCK!!!"
230 IF NOT (INP(1)=32 OR INP(1)=81) GOTO 230
240 IF INP(1)=81 GOTO 750
250 L=L+1
260 FOR X=1 TO 3:R(X)=INT(20*RND(8))+1:NEXT
270 IF R(1)< 6 THEN R(1)=2:GOTO 330
280 IF R(1)<10 THEN R(1)=1:GOTO 330
290 IF R(1)<14 THEN R(1)=3:GOTO 330
300 IF R(1)<17 THEN R(1)=4:GOTO 330
310 IF R(1)<20 THEN R(1)=5:GOTO 330
320 R(1)=6
330 IF R(2)  7 THEN R(2)=3:GOTO 390
340 IF R(2)  13 THEN R(2)=1:GOTO 390
350 IF R(2)  17 THEN R(2)=2:GOTO 390
360 IF R(2)  19 THEN R(2)=4:GOTO 390
370 IF R(2)=19 THEN R(2)=5:GOTO 390
380 R(2)=6
390 IF R(3)< 8 THEN R(3)=2:GOTO 440
400 IF R(3)<13 THEN R(3)=3:GOTO 440
410 IF R(3)<17 THEN R(3)=4:GOTO 440
420 IF R(3)<19 THEN R(3)=5:GOTO 440
430 R(3)=6
440 Q=100*R(1)+10*R(2)+R(3)
450 IF Q=666 THEN P=200:GOTO 550
460 IF Q=555 THEN P=  20:GOTO 550
470 IF Q=222 THEN P=  18:GOTO 550
480 IF Q=556 THEN P=  15:GOTO 550
490 IF Q=444 THEN P=  10:GOTO 550
500 IF Q=332 THEN P=   8:GOTO 550
510 IF Q=226 THEN P=   6:GOTO 550
520 IF INT(Q/10)=11 THEN P=5:GOTO 550
530 IF INT(Q/100)=1 THEN P=3:GOTO 550
540 P=0
550 FOR X=1 TO 3:FOR Y=1 TO 6
560 IF R(X)=S(Y) GOTO 580
570 NEXT Y
580 R$(X)=S$(Y):NEXT X
590 W=W+P:IF P=0 GOTO 610
600 K=K+1
610 PRINT:PRINT "REELS:"TAB(9);R$(1);TAB(12);R$(2);TAB(15);R$(3)
620 IF P=0 GOTO 700
630 IF P=200 GOTO 660
640 IF NOT (INP(0)<128) GOTO 640
650 OUT 1,7:PRINT "PAYOFF: $";P:GOTO 700
660 FOR X=1 TO 75
670 IF NOT (INP(0)<128) GOTO 670
680 OUT 1,7:NEXT
690 PRINT "JACKPOT!!!!!! $";P
700 ON SGN(W-L)+2 GOTO 710,720,730
710 PRINT "SO FAR YOU'VE LOST $";L-W:GOTO 740
720 PRINT "SO FAR YOU'RE EVEN":GOTO 740
730 PRINT "SO FAR YOU'VE WON $";W-L
740 PRINT:GOTO 230
750 PRINT:PRINT "TIMES PLAYED: ";L:PRINT "NUMBER OF PAYOFFS: ";K
760 PRINT "AMOUNT PAID: $";W
770 ON SGN (W-L)+2 GOTO 780,790,810
780 PRINT "TOTAL LOST: $";L-W:PRINT "WANNA TRY AGAIN, SUCKER?":GOTO 9999
790 PTINY "YOU BROKE EVEN. TOO BAD,":PRINT "THE NEXT ONE MIGHT HAVE"
800 PRINT "BEEN THE BIG ONE!":GOTO 9999
810 PRINT "TOTAL WON: $";W-L:PRINT "YOU BUY THE DRINKS!"
9999 END
OK
```

Reprinted from the February, 1976, issue of Interface Magazine.

Vector Interrupt and Real Time Clock

by Annette Milford

Two new MITS products, the 88-Vector Interrupt (88-VI) and the optional 88-Real Time Clock (88-RTC) are now being shipped to customers. Although both of these peripherals have been designed on the same printed circuit board, the Vector Interrupt may be purchased without the Real Time Clock. The 8800 can be hardwire connected for a maximum of one interrupt system. This means, of course, that it is not possible to wire an I/0 board for single level interrupt and connect the 88-VI for multi-level interrupt.

VECTOR INTERRUPT

As an independent board, the 88-VI has been designed to increase the efficiency of your system. It is useful in real time applications, when it is necessary to service I/0 devices on a priority basis. Specifically, the VI provides the 8800 with the capability to interrupt activity, via the Restart (RST) instruction and to allow only the highest active priority of eight levels to interrupt the 8800. A system which includes the Floppy Disk, a teletype, a line printer and an 88-VI, for example, should service the Floppy Disk before any other device. Placing the Floppy Disk at the highest priority on the 88-VI then, insures that the software necessary to process data is available to the ALTAIR 8800 as soon as possible.

The ENABLE INTERRUPT instruction of the 8800 permits the 88-VI to interrupt. After each interrupt from the 88-VI is completed, ENABLE INTERRUPT is activated again, thereby reactivating the 8800's internal interrupt. The RST instruction translates in octal code to 3A7; and "A" translates into a 3 bit code which represents one of the eight priority locations: 0, 10, 20, 30, 40, 50, 60, or 70 (octal). Restart instructions, then, are RST 0 = 307, RST 10 = 317, RST 20 = 327, etc., (octal).

The interrupt service routine for level 2 would appear as follows:

OCTAL LOCATION	INSTRUCTION
20	PUSH B
21	PUSH D
22	PUSH H
23	PUSH PSW
24	JMP LEV2

NOTE: As soon as the interrupt RST instruction is executed, interrupts are automatically disabled.

```
LEV2    LDA     CURLEV      ;GET LEVEL INTERRUPTED
        PUSH    PSW         ;SAVE OLD LEVEL ON STACK
        MVI     A,15Q       ;SET CURRENT LEVEL
        STA     CURLEV
        ORI     300Q        ;OR IN BITS REQUIRED BY VI BOARD
                            ;ORI 330Q SHOULD BE SUBSTITUTED
                            ;IF THE RTC IS HOOKED TO THIS LEVEL
        OUT     376Q
        EI
        .
        .
        .                   ;DEVICE SERVICE ROUTINE
        .                   ;GOES HERE
        .
        DI
        POP     PSW         ;POP OLD INTERRUPT LEVEL
        STA     CURLEV      ;RESTORE CURLEV
OFF:    ORI     300Q        ;"OR" IN BITS FOR VI
BOTH:   OUT     376Q        ;TELL VI BOARD WHAT LEVELS TO ACCEPT
        POP     PSW         ;RESTORE ALL REGISTERS
        POP     H
        POP     D
        POP     B
        EI                  ;ENABLE THE INTERRUPTS
        RET                 ;RETURN FROM INTERRUPT
```

A software device called the interrupt service handler, supervises eight interrupt service routines, thereby enabling the interruption of a lower interrupt routine by a higher one and also insuring that each lower routine is returned to and fully executed.

The RST instruction saves the current program counter in the stack, then branches to the appropriate location (0, RST 0; 10, RST 1; 20, RST 2; 30, RST 3; 40, RST 4; 50, RST 5; 60, RST 6; 70, RST 7). The correct interrupt service routine saves all CPU registers on the stack, then, if required, jumps out of the RST location to complete the rest of the program.

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HARDWARE

Using the VLCT with 4PIO

by Bill Kuhn

In answer to questions about use of the VLCT with the 4-PIØ, we have made the following hookup and tested it.

GENERAL PROCEDURE:

First: Decide what section of the 4-PIØ port you will use for the various signals necessary.

Second: Make an interface cable (25 pin male to 25 pin female) to connect the 4-PIØ to the proper lines on the VLCT (or if you haven't wired your VLCT you can wire its connector and eliminate the extra cable.)

Third: Initialize the port so it is ready to send and receive on the proper sections.

Fourth: Design and run a test program to check steps 2 and 3.

HERE'S WHAT WE DID

1. We chose section A of the 4-PIØ for input data lines, and CA1 as our flag for data ready at the input lines.

We chose section B for output data lines and CB1 as our signal from the VLCT requesting new data. CB2 was chosen as the signal to the VLCT that new data was ready at its inputs.

2. We made an interface cable as shown in the following chart:

NOTE: If you haven't wired your VLCT, you may wire its connector the same as the 88-4PIØ connector and eliminate the interface cable.

88-4PIØ Signal Name	Connector Pin #	Connector Pin #	VLCT Signal Name
PA 0	4	5	DØ 0
PA 1	5	6	DØ 1
PA 2	14	7	DØ 2
PA 3	15	8	DØ 3
PA 4	16	1	DØ 4
PA 5	17	2	DØ 5
PA 6	18	3	DØ 6
PA 7	19	4	DØ 7
CA 1	2	10	READY OUT
CA 2	3	not used	
PB 0	20	14	DI 0
PB 1	21	15	DI 1
PB 2	22	16	DI 2
PB 3	23	17	DI 3
PB 4	25	21	DI 4
PB 5	25	20	DI 5
PB 6	10	19	DI 6
PB 7	11	18	DI 7
CB 1	12	23	READY KEY
CB 2	13	22	DATA READY IN
Ground	6	13	Ground
		9	RESET IN
		25	BUSY OUT

NOTE 2: We also tied Pin 9 to Pin 25 on the VLCT end of our cable to accomplish the following:

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Computer Clubs

Amateur Computer Group of New Jersey
Sol Libes
(201) 889-2000 (day)
277-2063 (eve)
George Fischer
(212) 351-1751

Amateur Computer Society
260 Noroton Ave.
Darien, CT 06820

Atlanta Area Microcomputer Hobbyist Club
Jim Dunion
421 Ridgecrest Rd.
Atlanta, GA 30307
(404) 373-8990

Bit User's Association
5010 4th Ave. S.
Minneapolis, MN 55408

CACHE
PO Box 36
Vernon Hills, IL 60061

Canadian Computer Club
G. Pearen
861 11th St.
Brandon, MB, Canada
(204) 725-1079

Chicago Area Microcomputer Users Group
Bill Precht
1102 S. Edson
Lombard, IL 60148

Computer Hobbyist Group of North Texas
℞ 2377 Dalworth 157
Grand Prairie, TX 75050
Bill Fuller
(214) 641-2909
Neil Ferguson
(817) 461-2867
Lannie Walker
(817) 244-1013

Computer Hobbyists of Santa Barbara
131 Santa Ana Place
Santa Barbara, CA 93111

Denver Amateur Computer Society
PO Box 6338
Denver, CO 80206

HP-65 Users Club
Richard J. Nelson
2541 W. Camden Pl.
Santa Ana, CA 92704

Homebrew Computer Club
Robert Reilling,
193 Thompson Square
Mountain View, CA 94043

Miami Area Computer Club
Terry Williamson
PO Box 430852, S.
Miami, FL 33143

Micro-8 Computer User Group
Cabrillo Computer Center
4350 Constellation Rd.
Lompoc, CA 93436

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New Audio Modulation Method for ACR

As evidence that we at MITS listen to our customers, we are improving the 88-ACR read and write performance. The changes described below will allow the 88-ACR to accept 2.75 times wider speed variation when demodulating tapes written with the new method. Also, demodulation (reading) of tapes written by the old method will be the same as before.

I Purpose: Make reading and writing of data on audio tapes less susceptible to errors due to speed variations, and to make adjustment of R29 (phase locked loop center frequency adjust) less critical.

II Method: Change modulator frequencies from 2225Hz/2025Hz-(200 Hz difference) to 2400Hz/1850Hz-(550 Hz difference). This change keeps the center frequency at 2125Hz, allowing the 88-ACR to demodulate (read) either type of modulation.

III Modifications to 88-ACR Modem Boards in the field:

A) Modulator - Change jumpers as follows:

1. Remove jumpers #1 & 2.
2. Connect pins 3, 4, and 5 of IC "J" together.
3. Change jumper #3 from 3B to 2A.
4. Change jumper #4 from 4B to 4A.
5. Disconnect pins 5 and 6 of IC "K" from ground (unsolder and bend out of board).
6. Connect pins 4 and 5 of IC "K" together.
7. Change jumper #5 from 5B to 2A.
8. Connect pin 6 of IC "K" to point 5A.
9. Change jumper #7 from 7B to 7A.

NOTE: The "B" row of jumper points is closest to edge of Modem Board, the "A" row of jumper points is closest to the row of numbered jumper wires (see schematic diagram in manual).

This changes the modulation frequencies to:

LOGIC 1 = 2404 Hz ± 1 Hz
LOGIC Ø = 1852 Hz ± 1 Hz

(measured at IC "H"-8)

B) Demodulator: Change R28 to 3.3K ohms, or parallel a 5.6K ohm resistor with the existing 8.2K ohm resistor.

This change increases the lock range of the phase locked loop (IC "C") for the wider frequency spread of the new modulation method. It does not affect demodulation of tapes previously recorded with the old frequencies (2225/2025 Hz).

This change allows tape speed variations between writing and reading of over 3% without readjustment of R29 (if demodulating tapes written with the new method).

IV Other Circuitry Changes Recommended for the 88-ACR.

A) Change C18 (was 5 µf electrolytic) to a 1 µf mylar or non-polarity sensitive capacitor. This prevents breakdown of C18 when reverse biased (no carrier).

— Continued On Page 13 —

VLCT — Continued From Page 10 —

BUSY is low active and goes low after DATA READY IN goes high only for the time constant determined by the One slot in the VLCT Receiver. As long as RESET -(BUSY) is high, the sequence generator of the VLCT send section will not count. The result is that after entering three key strokes, the READY OUT goes low signaling the 4-PIØ that DATA is ready. Your software should send the received data back to the VLCT for verification. No new data will be transmitted till the VLCT receives data back. (See "Using the VLCT", Computer Notes, Vol. 1, Issue 5.)

3. We used the same initialization program contained in the 4-PIØ manual with the following changes.

Loc. 15 005 Disables CA2, sets CA1 low active, and enables it (bit 7 becomes our DATA READY flag).

Loc. 21 055 Same as in manual except CB2 set when next "E" pulse goes high instead of when CB1 is active.

4. Our test program is as follows:

Loc.	Octal	Mneumonic	
0	333	INPUT	Read A Control Register
1	020	address	
2	346	ANI	Mask for bit 7 (data ready flag)
3	200	data	
4	312	JZ	Test and loop if (Loc. 0) not present
5	xxx	‹b2›	
6	xxx	‹b3›	
7	333	INPUT	Input data
10	021	address	
11	323	OUTPUT	Output data
12	023	address	
13	303	JMP	
14	xxx	‹b2›	(Loc. 0)
15	xxx	‹b3›	

When this program is run, the following should happen: after you enter 3 keystrokes, the octal number should appear at the DATA IN display on the VLCT and should remain until you enter another 3 keystrokes.

If that works, you are all set. Talk to your computer!

VI & RTC

— Continued From Page 9 —

During this program, the following occurs: The previous interrupt level (in CURLEV) is saved on the stack. The current interrupt level is output to the VI board in order to prohibit interrupts at level 2 or levels of any lesser priority (in this case, 3, 4, 5, 6, or 7) from interrupting. The current interrupt level is saved in CURLEV. Interrupts are then re-enabled to allow execution of higher priority interrupts. At this point, the appropriate device service routine should be executed. After the service routine is completed, interrupts are disabled. The previous interrupt level, saved in CURLEV is re-stored in CURLEV and output to the VI controller. The registers are then popped off of the stack, interrupts are reenabled, and the interrupt service routine returns.

The interrupt routine is the same for all interrupt levels, except for instruction 3(MVI). The following chart indicates the correct MVI instruction for each of the eight interrupt levels. Level 0 is the highest priority interrupt level, and level 7 is the lowest. Note also that instruction 5 requires that 330 be substituted for 300 if the RTC is hooked to this level, thereby allowing the RTC to interrupt when serviced.

Interrupt Level	RST Address	Instruction
0	0	MVI A,17Q
1	10	MVI A,16Q
2	20	MVI A,15Q
3	30	MVI A,14Q
4	40	MVI A,13Q
5	50	MVI A,12Q
6	60	MVI A,11Q
7	70	MVI A,10Q

REAL TIME CLOCK

The Real Time Clock is designed for the computer system in which timing of events is critical. An interrupt is generated by the 88-RTC after a precise interval of time, thereby enabling software to time certain routines and even to generate the correct time, day, and year upon request.

The 88-RTC provides the option of one of two sources, a derivative of the 2 megahertz clock or the line frequency. Both sources offer respective advantages. The 2 megahertz clock should be used in systems that demand a fast RTC; it is selectable for time intervals down to every 100 microseconds. The line frequency (60 Hertz) on the other hand, is efficient in systems that depend upon accuracy over a long period of time. Power companies constantly adjust frequency, thus insuring a consistent source.

The table below shows the frequency and associated time interval for both sources at each of the four selectable divide rates:

SOURCE	DIVIDE RATE	DIVIDE FREQUENCY (HZ)	TIME INTERVAL
Line Frequency (60 Hertz)	1	60	16.67 milliseconds
	10	6	166.7 milliseconds
	100	.6	1.67 seconds
	1000	.06	16.67 seconds
10,000 Hz (a derivative of the 2 MHz system clock)	1	10,000	100 microseconds
	10	1,000	1 millisecond
	100	100	10 milliseconds
	1000	10	100 milliseconds

Note that this time interval represents the frequency at which the 88-RTC will cause an interrupt. For example, if 1000 Hz is selected, the RTC will generate an interrupt every 1000th of a second or 1000 interrupts/second.

MITS has developed a machine language program for the 88-RTC, which keeps track of hours, minutes, seconds, and 60ths of seconds in four consecutive memory locations. This program uses 8K BASIC, a USR assembly language subroutine, and an interrupt response subroutine. To execute the program, strap the RTC for line frequency in ÷ 1, and load the following program using Package I (assembler, editor, monitor). Note that Q represents octal.

After the program is loaded, BASIC must be loaded into the CPU. The "memory size" question in BASIC's initialization's dialog should be answered with 8122. All other initialization questions in BASIC should be answered as usual.

After initialization, certain modifications to BASIC must be made.

1. A JMP instruction must be put at location 70, so that the interrupt will cause a JMP to the machine language interrupt response routine. Correct branching is implemented by the following three BASIC commands:

```
POKE  56,195
POKE  57,187
POKE  58,31
```

2. The following commands allow the USR function to turn on the clock and to enable interrupts. This changes the JMP FCERR in location 72 to a JMP INIT (see symbol table).

```
POKE  73,250
POKE  74,31
```

3. In order to set the time, make these commands. (Note: Set the time a few minutes ahead to allow for the time necessary to type the commands):

```
POKE 8180, TIM (60ths of a second)
POKE 8181, TIM (seconds)
POKE 8182, TIM (minutes)
POKE 8183, TIM (hours)
```

The above commands could also be part of a BASIC program which asked for the initial tie as HHMMSSJJ (hours, minutes, seconds and jiffies -- 1 jiffy = 1/60 second).

— See program on Page 13 —

ACR

— Continued From Page 11 —

B) Use the old C18 (5 µf electrolytic) to add a 5 µf capacitor: + end to IC "C" pin 9 end of R30, -- end to -12 volts. This helps stabilize adjustment of R29.

C) Change R32 to 8.2K (use old R38) and change Z1 (12 volt zener) to a 3.3K resistor. This allows the P. L. L. output (IC "C", pin 8) to pull down point "RS" to a valid logic Ø even if the system negative voltage supply is low.

D) Remove diode D4. This allows reading and writing of tapes simultaneously.

E) Optional - For indication of the carrier (2K Hz tones) a L. E. D. may be wired to points "A" and "K" on the Modem Board. Remove the jumper wire from "A" to "K", and connect the LED anode to "A", the cathode to "K". When the carrier is being received, the LED forward current is about 10MA. Use a red LED only--1.7 volts forward drop.

V Effective Date of Change

A) All COMTER II units, all assembled 88-ACR's and all repaired 88-ACR's shipped from MITS after March 1, 1976, contain the modification described above.

B) All 88-ACR kits shipped after March 15, 1976, contain the modification described above.

C) All ALTAIR BASIC and Package I cassette tapes will be made with the new modulation technique starting April 5, 1976.

VI Converting Old Tapes to the New Modulation Method:

Although it is not necessary, you may wish to convert existing tapes to the new form. To do this, you need two tape recorders and:

A) Modify your 88-ACR board as indicated, including Step IV-D.

B) Identify the slower of the two tape recorders, and use it for playback of your existing tape during transfer. The play machine should be slightly slow to prevent the inputting of data faster than it can be outputted. Connect the slower machine to the "PLAY IN" circuit, and adjust R29 for the proper pattern.

— Continued On Page 15 —

Program for RTC

— Continued From Page 12 —

```
        ORG     17673Q      ;PROGRAM STARTS AT THIS MEMORY LOCATION
START:  PUSH    PSW         ;STACK ALL REGISTERS TO BE USED
        PUSH    B
        PUSH    H
        LDA     CURLEV      ;PICK UP OLD LEVEL NUMBER
        PUSH    PSW         ;SAVE IT ON THE STACK
        MVI     A,10Q       ;NEW LEVEL IS 10Q
        STA     CURLEV      ;STORE THIS AS THE NEW CURRENT LEVEL
        ORI     330Q        ;OR IN BITS NEEDED TO RESET RTC AND VI BOARD
        OUT     254         ;OUTPUT LEVEL INFO TO VI BOARD
        EI
        MVI     B,3
        LXI     H,NMB       ;GET ADDRESS OF 60TH'S OF SECONDS COUNTER
LOOP:   MOV     A,M         ;PICK UP COUNTER
        INR     M           ;INCREMENT COUNTER
        SBI     59          ;CHECK IF COUNTER IS NOW = TO 60
        JNZ     OUTLP       ;IF < 60 WE ARE DONE
        MOV     M,A         ;IF = 60 ZERO OUT COUNTER
        INX     H           ;POINT AT NEXT COUNTER
        DCR     B           ;DECREMENT NUMBERS OF COUNTERS LEFT TO CHECK
        JNZ     LOOP        ;LOOP TILL 60TH'S, SECONDS, AND MINUTES ARE DONE
        MOV     A,M         ;NOW CHECK HOURS COUNTER
        INR     M
        SBI     23          ;MAKE SURE NOT MORE THAN 24 HOURS
        JNZ     OUTLP
        MOV     M,A
OUTLP:  DI
        POP     PSW         ;POP OLD INTERRUPT LEVEL OFF STACK
        STA     CURLEV      ;STORE AGAIN AS CURRENT LEVEL
        ORI     300Q        ;OR IN CONTROL BITS FOR VI
        OUT     254         ;OUTPUT CURRENT LEVEL TO VI BOARD
        POP     H           ;RESTORE ALL REGISTERS USED
        POP     B
        POP     PSW
        EI
        RET                 ;RETURN TO INTERRUPTED PROGRAM
NMB:    DS      5
CURLEV: DB      0
INIT:   MVI     A,360Q      ;INITIALIZE THE VI BOARD
        OUT     254
        EI
LAST:   RET
        END     TIM

UNDEFINED SYMBOLS

SYMBOL TABLE

$0200000
START 017673
CURLEV 017771
NMB 017764
LOOP 017721
OUTLP 017746
INIT 017746
INIT 017772
LAST 017777
```

EXAMPLE: If the RTC were to be set for 9:30 a.m., the commands would appear as follows:

```
POKE 8180,0
POKE 8181,0
POKE 8182,30
POKE 8183,9
```

4. In order to start the clock, type:

```
A = USR (1)
```

A printout of the correct time will be received when the following BASIC program is typed in.

```
10  DIM Z(3)
20  FOR X=1 TO 3
30  Z(X)=PEEK(8180+X)
40  NEXT X
50  PRINTZ(3);":";Z(2);":";Z(1)
RUN
Δ9Δ:Δ3Ø : 0


Δ9Δ:Δ30Δ:Δ0
```

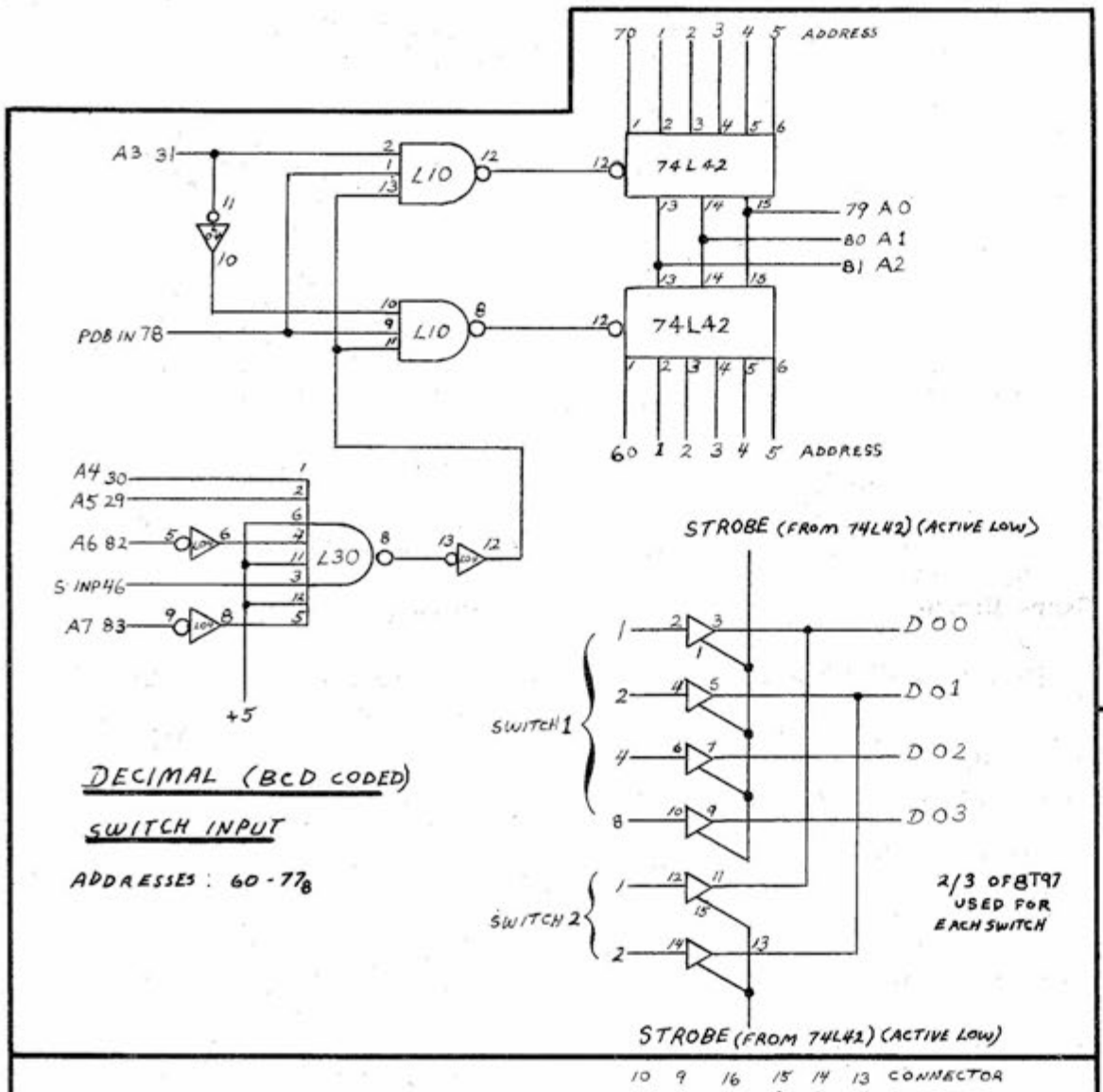
Altair 8800 Interfaces

ALTAIR 8800 INTERFACE--THANKS TO PROFESSOR KENNETH B. WIBERG OF YALE UNIVERSITY

Altair 8800 Interfaces

One of a kind interfaces are most conveniently made by wire wrapping, and wire wrapping tools are available at a reasonable price. Most wire-wrap boards are made by inserting wire-wrap IC sockets into a suitable board and making connections on the reverse side. This is inconvenient for two reasons. First, each module will then take two locations on the Altair mother board. Second, it is much easier to wire wrap on the front side of the board (where the IC's can be seen) than on the reverse.

The MITS prototype board can be converted into a wire-wrap board by soldering IC sockets into the places provided, and inserting Vector T-44 mini-wrap terminals from the back side into the holes connecting with the socket pins. The terminals should be soldered from the reverse side. These terminals just fit into the holes provided. Up to 16 sixteen-pin plus 4 fourteen-pin sockets may be placed on the board.



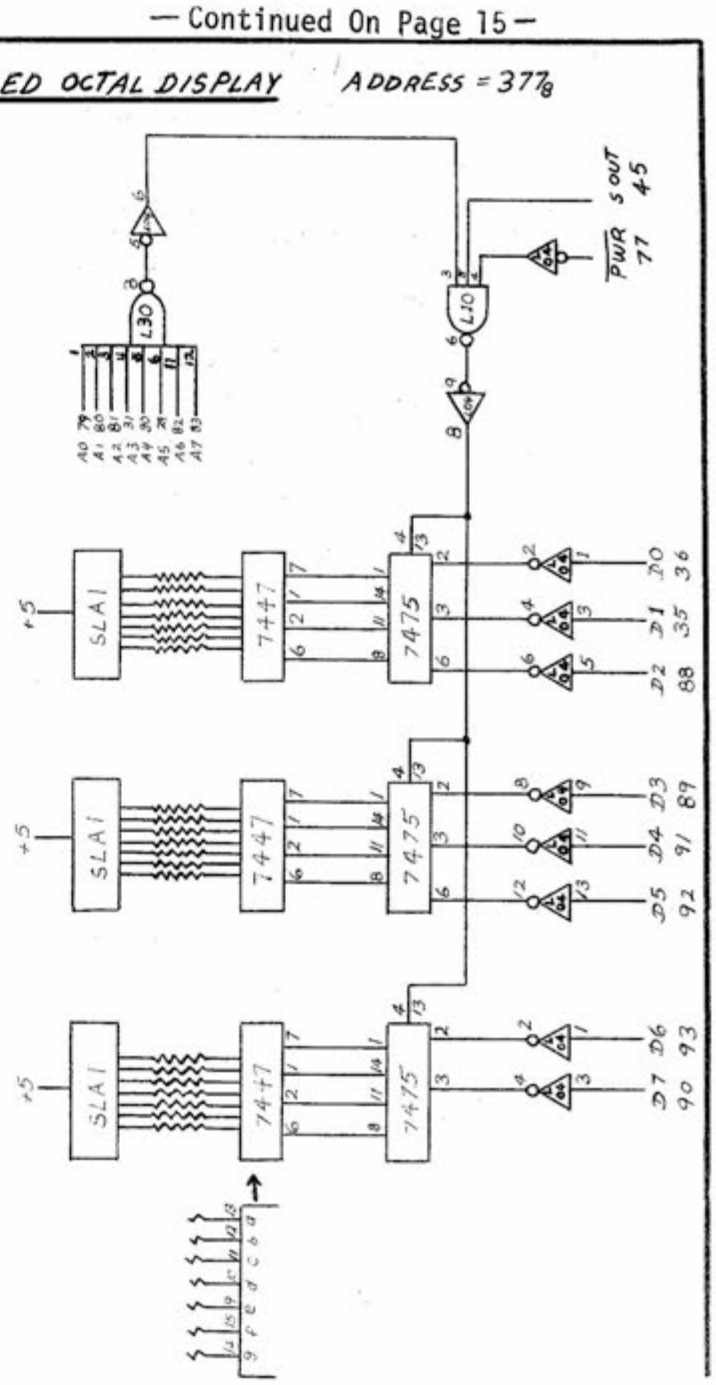
For those who construct I/O boards, an interface which will display the contents of the accumulator is convenient. Such an interface is shown in Fig. 1. The address 377 is decoded by the 74L30, and the output is ANDed with SOUT and PWR by the 74L10. The strobe signal is inverted by a 7404 (which will drive the 7474's) and is used to latch the data on the bus in the 7475 latches. Their output are decoded by the 7447's and displayed using 7 segment LED units. The contents of the accumulator are displayed by including

OUT 377

in a program.

In some of our applications, we wish to read data from BCD coded switches. Since the 8080 allows a large number of I/O addresses, it is convenient to read the contents of each switch using a unique address. As shown in Fig. 2, this can easily be done using a 74L30 to decode the four more significant address bits along with SINP, and two 74L10 gates to AND A3 (or $\overline{A3}$) with the output of the 74L30 and PDBIN and select one of two 74L42. The 74L42's decode the three least significant address bits when enabled, giving eight possible strobe pulses from each. A given strobe pulse (negative going) is used to enable

— Continued On Page 15 —



ACR

— Continued From Page 13 —

C) Connect the other tape recorder to the "RECORD OUT" circuit and use it for recording the new tape.

D) Use the following program to transfer data:

Address	Octal Code	Mnemonic
000,000	333	IN
1	006	
2	017	RRC
3	332	JC
4	000	
5	000	
6	333	IN
7	007	
10	323	OUT
11	007	
12	303	JMP
13	000	
14	000	

E) Start the record machine first, then start play machine; then play program to transfer data.

F) After your tape has been transferred, check it for correct data. If your playback tape recorder was too fast, then there will be bytes dropped.

G) Once your tapes have been transferred, R29 will probably not require readjustment. This is one of the advantages of spreading the modulation frequencies.

If you have only one tape recorder, or if the above procedure does not work for you, read the old tape into memory, then write it out to tape.

Use the 88-ACR read/write programs listed in the Nov/Dec COMPUTER NOTES, pages 22 & 23. If you are rerecording an ALTAIR BASIC cassette, the test byte must be changed to 175 for version 3.1 and 256 for version 3.2.

If you need to order parts for the modification, order:

2 ea. 102085 3.3K resistor
1 ea. 100363 1.0mf mylar capacitor

The cost of parts + postage & handling is $5.00.

OOPS!

Additions/Corrections

88-4PIØ

1. Pin 6 on the 25-pin female connectors is GROUND (this is not shown on the schematic).

2. Error on page 6 of the Theory of Operation Manual. In the table at the bottom of the page (setting up C2 to act as an input), right-most column labled "$\overline{IRQ}$". Change Bit 7 to Bit 6 in both the second line and the fourth line.

88-2SIO

a) If the $\overline{\text{Data Carrier Detect}}$ and $\overline{\text{Clear to Send}}$ inputs are not being used, they must be jumpered to Ground.

b) When using the 2SIO board to connect a device that is to be used for loading MITS software, start the bootstrap loader before starting the loading device (paper tape reader, etc.).

ALTAIR 8800 INTERFACE

— Continued From Page 14 —

four 8T97 gates which are connected to the corresponding switch. Up to 16 BCD switch (16 integers) can be read in using this one interface.

Similarly, BCD data may be displayed using 7 segment units via the interface shown in Fig. 3. Here, the three 74L20 gates perform the high order address decoding function, enabling one of the 74L42 decoders. The strobe signals may be used to latch data into one of several TIL 308 display units (or the corresponding combinations of latches, decoders and 7 segment displays). The data are buffered by 74L04 and 7406 inverters in order to have sufficient drive to handle up to 16 TIL 308's.

COMPUTER CLUBS

— Continued From Page 10 —

San Diego Club
Garry Mitchell
Box 35
Chula Vista, CA 92012

Southern California Computer Society
PO Box 987
South Pasadena, CA 91030

29 Palms California Area Group
Sgt. Wesley Isgrigg
74055 Casita Dr.
29 Palms, CA 92277
(714) 367-6996

UCLA Computer Club
3514 Boelter Hall
UCLA
Los Angeles, CA 90024

Universe Unlimited
User's Group
John E. Kabat
11918 Forrest Ave.
Cleveland, OH 44120
216-781-9400 Ext. 55
216-795-2565

Nashua NH Computer Club
Dwayne Jeffries
181 Cypress Ln.
Nashua, NH 03060

New England Computer Club
c/o BYTE Magazine
Peterborough, NH 03458

New York City Micro
Hobbyist Group
375 Riverside Dr., 1E
New York, NY 10025

Pacesetter User's Group
1457 Broadway, Rm. 305
New York, NY 10036

People's Computer Company
PO Box 310
Menlo Park, CA 94025

Pittsburgh Area Computer Club
Eric Liber
400 Smithfield St.
Pittsburgh, PA 15222
412-391-3800
412-276-6546

Sacramento Minicomputer Users Group
PO Box 741
Citrus Heights, CA 95610

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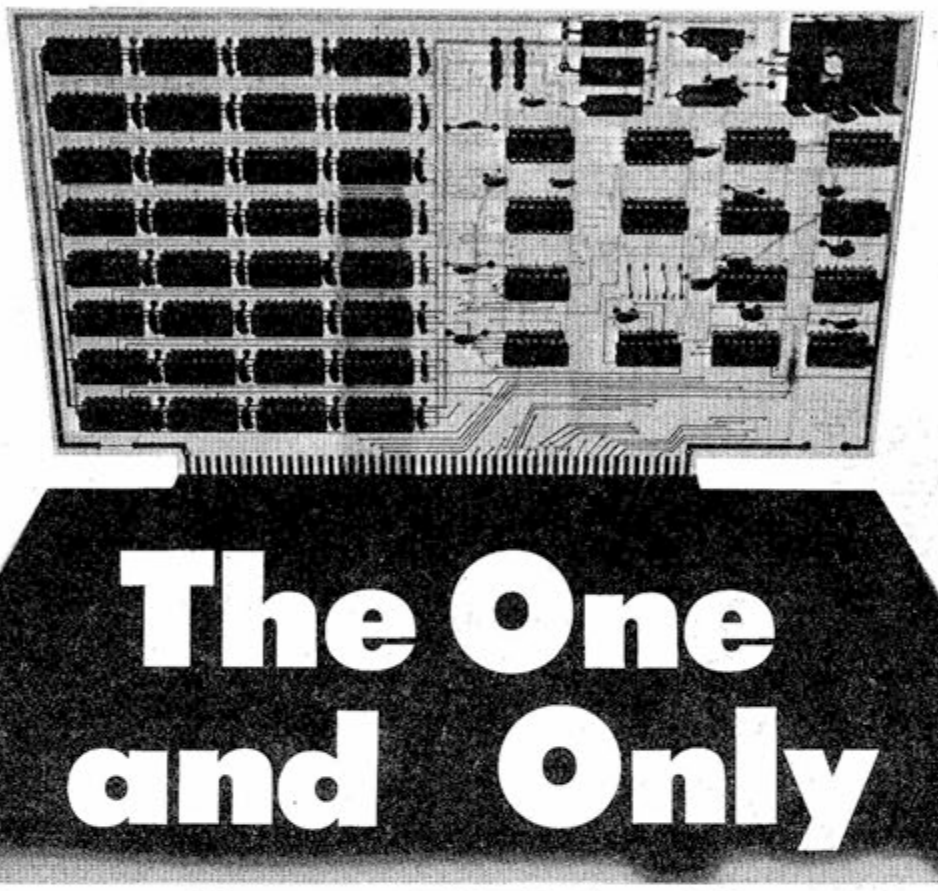

The One and Only

Altair® 4K Static.

Altair 4K Static from MITS is unquestionably the finest 4K static memory available anywhere. It is also the fastest.

Altair 4K Static uses Intel 2102 A-4 memory chips which have a worst case access of 450 nanoseconds at 70 °C. At normal system temperatures the access times are typically less than 300 nanoseconds.

Altair 4K Static is fully isolated from the system bus by Schmitt ™ Triggers. Thus, the excessive capacitive loading caused by other 4K static memories is eliminated. Use of these triggers on all Altair 4K static inputs greatly reduces noise. Internal data collection nodes also use Schmitt Triggers, which prevents internal data bus noise from being transmitted to the system data bus.

Altair 4K Static is the only 4K static supported by MITS. Owners of Altair 4K Static are eligible to qualify for discounts on AltairBASIC and other MITS products.

Altair 4K Static is the only 4K static that comes with all the required Altair hardware including edge connectors and card guides.

Altair 4K Static is the answer for Altair owners who need static memory for special applications such as the TV Dazzler from Cromemco.

PRICES:

Altair 4K Static Kit	**$159**
Altair 4K Static Kit with 2K Memory	**$134**
Chip set to convert 2K to 4K	**$ 45**

SPECIAL—Altair Documentation Notebook. Contains catalog, price sheet, Computer Notes newspaper, Software Information Package, technical data on Altair hardware, list of authorized Altair dealers, list of computer clubs, survey of home computing market, and much more. All in top quality three ring binder. Only $5 plus $1 for postage and handling. Offer expires April 30, 1976.

MAIL THIS COUPON TODAY

Enclosed is check for $ _____
BankAmericard # _____ or Master Charge # _____
☐ Altair 4K Static ☐ Altair 2K Static
Include $3 for postage and handling
☐ Please send me the Altair Documentation Notebook. Enclosed is $5 plus $1 for postage and handling.
☐ Please send free catalog and price sheet.

NAME _____
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Prices, delivery and specifications subject to change.

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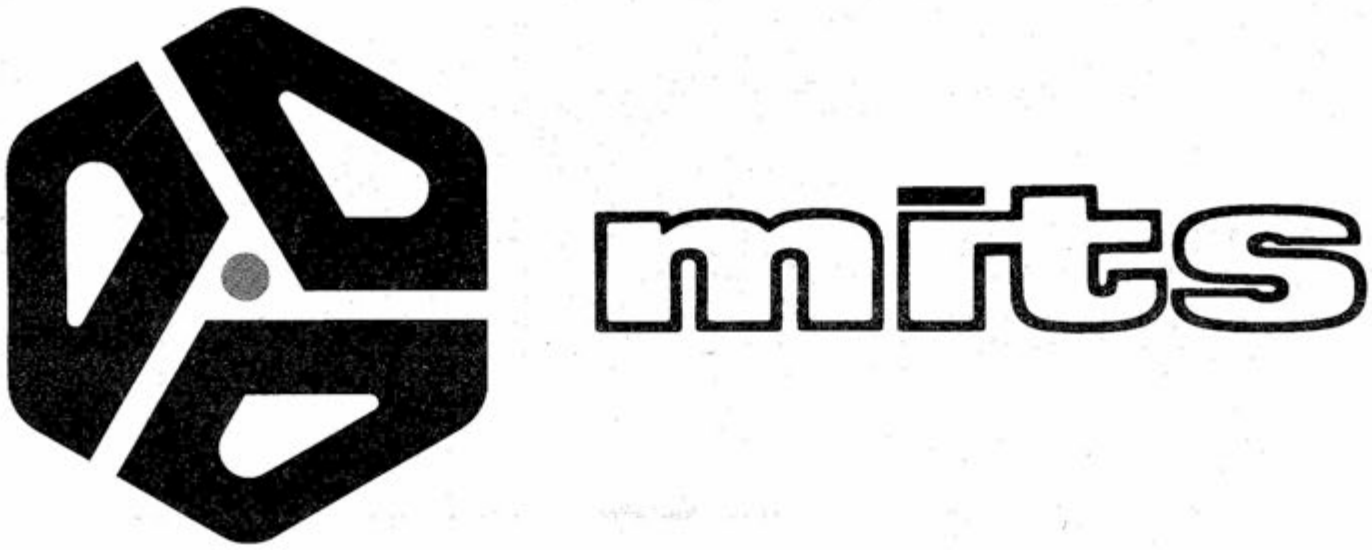
2450 Alamo SE/Albuquerque, NM 87106/505-262-1951



The people who design and manufacture Altair Computer Products.

2450 Alamo SE Albuquerque, NM 87106

505-243-7821

BASIC language was chosen for the Altair 8800 because it is the *easiest language to learn* and because it can be used for an *infinite number of applications*. Literally hundreds of thousands of BASIC programs have been written and are in the public domain. These programs include accounting programs, business programs, scientific programs, educational programs, game programs, engineering programs, and much more.

Altair BASIC is an *interactive language*. This means that you get immediate answers and you can use your Altair as a super programmable calculator as well as for writing complicated programs.

> *"I've seen and used other BASICs, but byte-for-byte, Altair is the most powerful BASIC I've seen. I'm particularly impressed with the n-dimensional arrays (and for strings too!), machine level I/O, and machine language 'function' features. The level of your documentation is, for me, though the high point. Sections for those who know nothing and sections for those who know a lot, plus sections that 'normal' people can read and understand."*
>
> **J. Scott Williams**
> **Bellingham, Washington**

Altair BASIC was written as efficiently as possible to allow for the *maximum number of features in the minimum amount of memory*. You can order one of three Altair BASICs: 4K BASIC-designed to run in an Altair 8800 with as little as 4K of memory, 8K BASIC, or EXTENDED BASIC (12K). Each of these BASICs allows you to have *multiple statements per line* (a memory saving feature), and each of them is capable of executing *700 floating point additions* per second!

The 8K BASIC and EXTENDED BASIC have *multi-dimensioned arrays* for both strings and numbers. This is particularly useful for applications requiring lists of names or numbers such as accounting programs, inventory programs, mailing lists, etc.

The 8K BASIC and EXTENDED BASIC also have an OUT and corresponding INP statement that allows you to use your Altair 8800 *control low speed devices* such as drill presses, lathes, stepping motors, model trains, model airplanes, alarms, heating systems, home entertainment systems, etc.

Altair BASIC comes with complete documentation including a copy of *"My Computer Likes Me When I Speak in BASIC"* by Bob Albrecht, a beginner's BASIC text.

Never before has such a powerful BASIC language been marketed at such low prices!

4K BASIC Features

Altair 4K BASIC leaves apporimxately 750 bytes in a 4K Altair for programming which can be increased by deleting the math functions. This powerful BASIC has **16 statements** [IF...THEN, GOTO, GOSUB, RETURN, FOR, NEXT, READ, INPUT, END, DATA, LET, DIM, REM, RESTOR, PRINT, and STOP] in addition to 4 commands [LIST, RUN, CLEAR, SCRATCH] and **6 functions** [RND, SQR, SIN, ABS, INT and SGN]. Other features include: *direct execution* of any statement except INPUT; an "@" *symbol* that deletes a whole line and a "←" that deletes the last character; *two-character error code* and line number printed when error occurs; *Control C* which is used to interrupt a program; *maximum line number of 65,535;* and all results calculated to at least *six decimal digits of precision.*

8K BASIC Features

Altair 8K BASIC leaves approximately 2K bytes in an 8K Altair for programming which can also be increased by deleting the math functions. This BASIC is the same as the 4K BASIC only with **4 additional statements** [ON....GOTO, ON....GOSUB, OUT, DEF], **1 additional command** [CONT] and **8 additional functions** [COS, LOG, EXP, TAN, ATN, INP, FRE, POS]. Other additional features include *multi-dimensioned arrays* for both strings and numbers, *AND, OR, NOT* operators that can be used in IF statements or forumlas, *strings* with a maximum length of 255 characters, *string concatenation (A$ = B$)* and the following string functions: *LEN, ASC, CHAR$, RIGHT$, LEFT$, MID$, STR$, and VAL.*

EXTENDED BASIC

Altair EXTENDED BASIC is the same as 8K BASIC with the addition of *double precision arithmetic, PRINT USING* and *disk file I/O*. A minimum of 12K memory is required to support EXTENDED BASIC.

Other Altair 8800 software includes a Disk Operating System, assembler, text editor, and system monitor. Altair users also have access to the *Altair Library*, which contains a large number of useful programs.

SOFTWARE PRICES:

Altair 4K BASIC	**$150**
Purchasers of an Altair 8800, 4K of Altair memory, and an Altair I/O board	**$ 60**
Altair 8K BASIC	**$200**
Purchasers of an Altair 8800, 8K of Altair memory, and an Altair I/O board	**$ 75**
Altair Extended BASIC	**$350**
Purchasers of an Altair 8800, 12K of Altair memory, and an Altair I/O Board	**$150**
Altair PACKAGE ONE (assembler, text editor, system monitor)	**$175**
Purchasers of an Altair 8800, 8K of Altair memory, and an Altair I/O board	**$ 75**
Altair Disk Operating System	**$500**
Purchasers of an Altair 8800, 12K of Altair memory, Altair I/O and Altair Floppy Disk	**$150**

Note: ***When ordering software, specify paper tape or cassette tape.***

A MITS Altair Computer Report

Technology of Three Altair Computers

MITS Altair Computers are built around recently developed "microprocessor" integrated circuits. These compact, wafer shaped "chips" are about 2 inches long, 1/2 inch wide, and 1/16 inch thick. They represent over 10,000 electronic components, and they contain all the logic circuitry of a full-blown computer.

1. The Altair 8800 Computer is an "open-ended" general purpose computer built around the 8080 microprocessor chip. Its basic configuration includes a CPU (Central Processing Unit) circuit board, front-panel control board, power supply, and case. Up to 16 circuit boards can be added inside the computer simply by plugging them in. These boards could include a wide variety of memory boards, interface boards, and processor option boards.

The Altair 8800 Computer can be programmed from the front panel indicator lights (LED's) and switches, or it can be interfaced to any number of computer peripherals. These peripherals include teletypewriters, line printers, floppy disks, paper tape reader/punch, CRT terminals, and more.

Since the Altair 8800 can be configured to meet the needs of the user, its applications are virtually unlimited.

2. The Altair 680 Computer is built around the 6800 microprocessor chip. It is smaller and more compact than the Altair 8800, measuring just 11 inches wide by 11 inches deep by 4-11/16 inches high.

While the Altair 680 was designed primarily for dedicated programming —such as industrial process control, several hundred Altair 680's have been sold to hobbyists for experimentation. One reason for this is that the Altair 680 is a complete computer in itself. Its main component board contains the CPU, 1,024 words of memory (RAM), a PROM monitor for loading paper tapes and an I/O port that can be wired for one of four different types of peripherals. Like the Altair 8800, it too can be programmed from the front panel.

3. The Altair 8800B Computer, MITS' newest computer, is basically a second generation design of the Altair 8800. This machine incorporates some of the most recent advances in computer technology. More information can be obtained from the factory.

The Advent of the Computer Club

Since the introduction of the Altair 8800 Computer in January of 1975, computer clubs have been springing up across the country. The largest of these, the Southern California Computer Society, now has a membership of over 2000.

Computer clubs are groups of individual computer owners who meet regularly to discuss mutual problems and carry out joint projects. In addition to using computers for traditional applications such as computer games, computer art, and educational programming, many computer hobbyists are experimenting with more bizarre applications. These applications include voice input/output and biofeedback controlled peripherals.

The Computer as a Household Pet

One computer hobbyist has an Altair based computer, named Ralph, which he regards as a household pet. Besides being inexpensive to feed and care for, Ralph can perform a number of entertaining and practical tricks. These include playing blackjack, balancing a checkbook, teaching basic mathematics, turning on the coffee pot in the morning, controlling the temperature and humidity of the house, flipping on the yard-lights at dusk, and acting as a burglar alarm if need be.

Computer Costs

Altair computers, marketed in both kit and assembled units, have helped to bring about drastic cuts in the price of computing. The Altair 680, for instance, is currently selling for $345 in kit form. A complete Altair 8800 system with 16K of memory, a floppy disk, Teletype, and Extended BASIC language software sells for under $4,000.

These low costs have opened the doors to thousands of individuals and small businesses. And they have made it practical to use the computer for a wide range of new applications.

Altair Customers

While the majority of Altair owners have some sort of technical background, they include a broad range of people from engineers to retail managers to artists, teachers, doctors, editors, housewives, musicians, lab technicians, businessmen, attorneys, and factory workers. In addition to some of the above mentioned applications, they are using their Altairs for such applications as medical electronics, instrument control, model train and airplane control, text editing, mailing list maintenance, software development, music synthesis, interface to larger computers, graphics display, OSCAR tracking, bookkeeping, and timeshare services.

More Information

Space does not permit us to present a complete discussion of low-cost computing here, but we have prepared a complete Altair documentation notebook for those of you who wish to investigate the matter further. This notebook includes a catalog of all Altair products, technical literature, a more complete discussion of the home computer, a list of computer clubs, a list of authorized Altair dealers, a sample Altair Computer Notes newsletter, and much more in a sturdy 3-ring binder. Until April 30, 1976, it will sell for $5 plus $1 for postage and handling.

mits

Altair Coupon

☐ Please send me a copy of your Altair Documentation Notebook.
Enclosed is $5 plus $1 to cover postage and handling.
☐ Please send me a free catalog
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First Annual

WACC!

World Altair Computer Convention

This year's most exciting computer convention could very well be the First Annual WORLD ALTAIR COMPUTER CONVENTION. Computer hobbyists from all over the World will gather in Albuquerque, New Mexico on Saturday and Sunday, March 27 & 28. Many of them will be bringing their Altair systems in order to compete for the $10,000 worth of Altair equipment to be given away at the convention. In addition to demonstrations of Altair product applications, there will be FOUR SEMINARS presented during this dynamic weekend.

SEMINAR ONE will be a seminar on LOW COST COMPUTING conducted by some of the leading figures in the field. A preliminary list of speakers includes Larry Steckler, technical editor of Radio Electronics, Carl Helmers, editor of Byte magazine, Art Childs, editor of Interface magazine, David Ahl, publisher of Creative Computing, Judge Pierce Young, president and founder of the Southern California Computer Society, and Terry Silver, also of the SCCS. And this is only the beginning.

SEMINAR TWO will be a complete discussion of ALTAIR PRODUCTS and Altair design philosophy. Speakers will include H. Edward Roberts, president of MITS, Inc.; Project Engineers Bill Yates, Bob Zaller, Tom Durston, and Pat Goding; Software Writers Paul Allen and Bill Gates; and Computer Notes editor, David Bunnell.

SEMINAR THREE will be a presentation of the updated MITS TRAVELING SEMINAR presented by Pat Ward. Altair technical binders will be given away free to people attending this seminar.

SEMINAR FOUR will be an organizational meeting of the Altair Users Group conducted by Barbara Sims and David Bunnell. Topics will include organization of the Users Group and ways to improve MITS service to Altair users. All seminars will be opened to the audience for questions.

Attendance to the WORLD ALTAIR COMPUTER CONVENTION will be **free to all Altair owners and out of town guests.** The convention will be held at the new MITS building at 2450 Alamo SE, within walking distance of the Albuquerque Airport Terminal. The entire Airport Marina Hotel has been reserved for this occasion. Reservations at this hotel (which is also within walking distance of MITS and the Airport Terminal) can be made by filling out the coupon in this ad and returning it prior to February 26. Cost of reservations are $20 per night for a single and $24 for a double.

$10,000

MITS will be presenting door prizes and prizes for the best demonstrations at the convention. These prizes will include Altair 8800's, Altair 680's, and related equipment of a retail value not less than $10,000. To enter in this contest or to have a booth at the convention, you must fill out an official application form from MITS, Inc. Rules and regulations governing demonstrations and booths are available with application forms.

ALTAIR CONVENTION COUPON

Name_____

Address_____

City_____ State & Zip_____

☐ Yes, I plan to attend the first annual WACC to be held in Albuquerque, New Mexico on March 27 and 28, 1976.

☐ Please reserve a room for me at the Albuquerque Marina Hotel. I will need a ☐ single ☐ double room. I plan on staying in Albuquerque the following nights: ☐ Friday ☐ Saturday ☐ Sunday.

☐ Please send me the official entry form for the Altair Demonstration Contest.

MITS/2450 Alamo SE/Albuquerque, 87106 505-262-1951