the CP/M* and S-100 user's journal

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MICROSYSTEMS™

MAY/JUNE 1981

VOL.2/NO.3

THE COMPUTER COMMUNICATIONS EXPLOSION

See Pages 20–28

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Complete Table of Contents on Page 3

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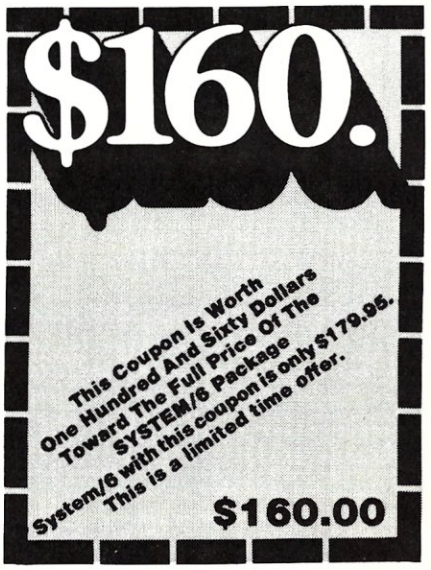

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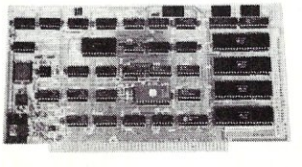

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the CP/M* and S-100 user's journal

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Staff

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For information on commercial advertising, write to: MICROSYSTEMS, 39 East Hanover Ave., Morris Plains, NJ 07950, or call Claudette Moore at (201) 267-4558.

In This Issue

Departments

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EDITOR'S PAGE

by Sol Libes

This issue focuses on modem communications. More and more microcomputer users are using modems, not only for terminal-to-computer communications, but for computer-to-computer communications as well. Specifically, users today transfer whole files from one computer to another via telephone. Many CP/M oriented CBBS systems provide facilities for the user to transfer files from the host system to the user's system and vice-versa. Such applications require the use of programmable modems capable of operating at high baud rates. The three S-100 modem boards reviewed in this issue fill this requirement.

Furthermore, the user requires sophisticated modem driver programs, such as the ones reviewed in this issue, to provide the machine intelligence necessary for handling file transfers in an easy to use, speedy, and reliable manner. The first such CP/M based program was MODEM, originally written by Ward Christensen of CACHE (Chicago Area Computer Hobbyists Exchange) and later enhanced by several other computer hobbyists. The modem programs reviewed in this issue are two of the commercially available CP/M software packages for modem communications.

I have personally been doing file transfers via modem on my S-100 system for well over a year now. I often receive articles over the telephone from authors. I then review and edit these text files using the WORDSTAR word processor software. After editing, I transmit the article via telephone to the typesetter who then runs off the file directly on the typesetting equipment. Occasionally I don't even create a hardcopy of the article.

It is apparent that we are still in the early stages of networking personal computer systems. I envisage a country-wide computer communications network, with enhanced facilities for message handling, bulletin board operations, and software exchange. Presently, all the existing systems are operated independently. System operators often communicate with other system operators. However, in the future these systems could well become nodes (or as Xerox calls them "gateways") in an international network that allows communications via other nodes in the system. The communications, between nodes might be high speed radio links (possibly via satellite for long distance links).

There is no doubt that modem communications will be one of the fastest growing areas of microcomputing in the 80's; hence our devotion of most of the issue to this topic.

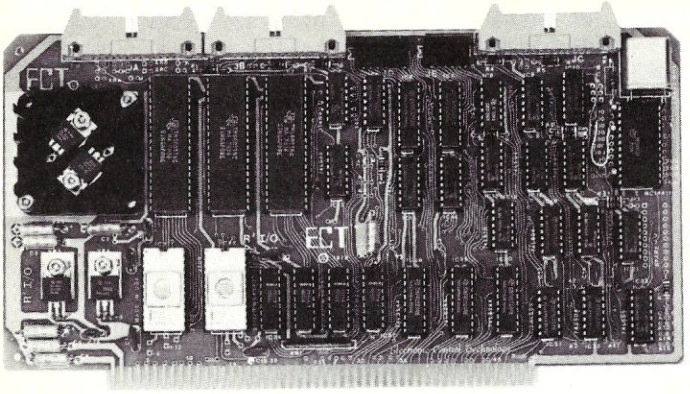
Bypassing Ma Bell

The main operating expense in modem communications is telephone connect charges. If you plan to do a great deal of this work, you might consider using one of the alternatives to the Bell Telephone system for long distance calls. There are now four companies providing alternative long-distance phone service—ITT, MCI Southern Pacific (Sprint) and WU. An article comparing their costs and evaluating their services appeared in the March 1981 issue of *Consumer Reports* (for a reprint write: CU, Box 1949, Marion, OH 43305).

I recently investigated MCI and decided against it. I read an MCI ad telling me that I could save 30-50% on my long distance calls by using their service, so I called them up. They informed me, first of all, that I was not in an area where they had a telephone number I could call toll-free. They were in an adjacent area and there would be an extra $2/month for extended area coverage from Bell. Furthermore, there was a monthly MCI base charge of $10/month, bringing the monthly base charge to $12/month whether I made a long-distance call or not.

I then asked MCI how I could determine the actual costs, and asked that they send me any printed material available on the subject. They said that all they had was some sales literature and that it did not contain any information on specific costs. I was beginning to feel like I was talking to a Ma Bell business office. I had recently called Bell to find out about available services (such as extended area coverage) and their costs. Although they would answer specific questions, they would not send me any printed information on rates and services. If I knew exactly which service I wanted and under what conditions I wanted it, they would tell me what they were going to charge me for it.

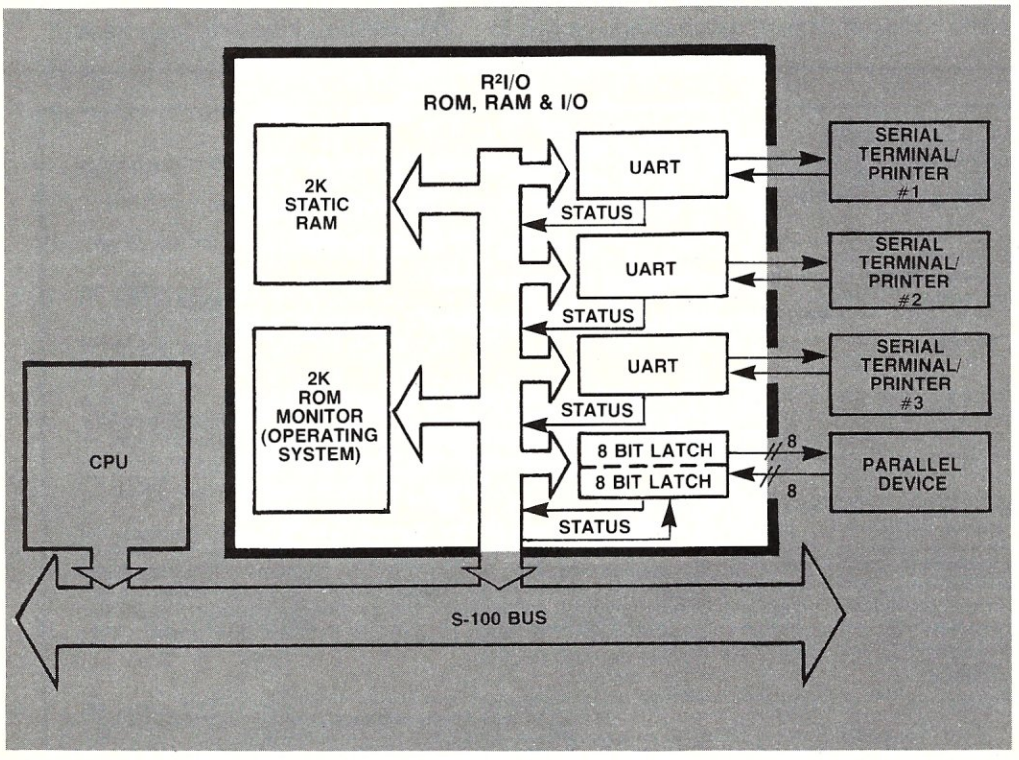
ECT R²I/O... The S-100 ROM, RAM & I/O Board



- S-100 BUS
- 2K ROM
- 2K RAM
- ROM Monitor (Operating System)
- 3 Serial I/O Ports
- 1 Parallel I/O Port
- 4 Status Ports

ELECTRONIC CONTROL TECHNOLOGY's R²I/O is an S-100 Bus I/O Board with 3 Serial I/O Ports (UART's), 1 Parallel I/O Port, 4 Status Ports, 2K of ROM with Monitor Program and 2K of Static RAM. The R²I/O provides a convenient means of interfacing several I/O devices, such as – CRT terminals, line printers, modems or other devices, to an S-100 Bus Microcomputer or dedicated controller. It also provides for convenient Microcomputer system control from a terminal keyboard with the 8080 Apple ROM monitor containing 26 Executive Commands and I/O routines. It can be used in dedicated control applications to produce a system with as few as two boards, since the R²I/O contains ROM, RAM and I/O.

The standard configuration has the Monitor ROM located at F000 Hex with the RAM at F800 Hex and the I/O occupies the first block of 8 ports. Jumper areas provide flexibility to change these locations, within reason, as well as allow the use of ROM's other than the 2708 (e.g. 2716 or similar 24 pin devices). Baud rates are individually selectable from 75 to 9600. Voltage levels of the Serial I/O Ports are RS-232.



8080 APPLE MONITOR COMMANDS

A – Assign I/O
B – Branch to user routine A-Z
C – Undefined
D – Display memory on console in Hex
E – End of file tag for Hex dumps
F – Fill memory with a constant
G – GOTO an address with breakpoints
H – Hex math sum & difference
I – User defined
J – Non-destructive memory test
K – User defined
L – Load a binary format file
M – Move memory block to another address
N – Nulls leader/trailer
O – User defined
P – Put ASCII into memory
Q – Query I/O ports: QI (N)-read I/O; QO(N,V)-send I/O
R – Read a Hex file with checksum
S – Substitute/examine memory in Hex
T – Types the contents of memory in ASCII equivalent
U – Unload memory in Binary format
V – Verify memory block against another memory block
W – Write a checksummed Hex file
X – Examine/modify CPU registers
Y – 'Yes there' search for 'N' Bytes in memory
Z – 'Z END' address of last R/W memory location

Editor's Page, cont'd...

But back to MCI. A friend of mine uses MCI so I obtained a copy of the users guide they sent him. Lo and behold I discovered that MCI only served the larger metropolitan areas, and not all of them, at that. I then took my last telephone bill and totaled up my long distance telephone charges (approximately $46, including tax). I checked which calls could be placed through MCI (approximately two-thirds). I then estimated that I would save about 30% in charges on those calls (a savings of about $9). Deduct from this the base cost of $12/month and it became apparent that MCI would actually cost me $3/month more that Bell. I estimate my break even point to be about $60/month in long distance calls.

I had to also consider that the alternative services do not have as good a reputation for service as does Ma Bell, although I hear that it is improving. I therefore came to the conclusion that if I can restrict my long-distance calls to after 5 PM and preferably after 11 PM, or weekends, alternative services would not really pay for me. If readers have had other experiences with costs and service on alternative systems, I would appreciate hearing from them.

We are also planning, in future issues of *Microsystems*, to emphasize special topics, as we have done in this issue. I would like to hear from readers as to whether you agree or disagree with this approach.

We are scheduling the following special topic issues:

Issue	Topic
Jul/Aug 1981	16-Bit Micros
Sep/Oct 1981	Languages
Nov/Dec 1981	MP/M
Jan/Feb 1982	CP/Net

Although we have some articles on these topics already, we are actively seeking additional ones. If you have brought up a 16-bit microcomputer system, a hard disk system, an MP/M or CP/Net system, we would like to hear from you. We want to know exactly how it is set up. What were your expectations in setting up the system? Were your expectations fulfilled? What problems did you encounter? How did you overcome them? What recommendations do you have for others who wish to get into these systems?

Also, we are looking for specific hardware and software reviews. If you have recently purchased a new software or hardware product and wish to let others know how great, or not so great it is, then *Microsystems* may be the forum for you.

We would be delighted to send you our author's guide. Just write to me at *Microsystems*, Box 1192, Mountainside, NJ 07092. Or, you can call and speak directly at (201)522-9347. If you call, it is best to call after 4PM-EST. You can send manuscripts directly to me at the above address.

Also, if you have specific ideas on subjects that you feel should be covered by *Microsystems*, please let me hear from you. In this way the magazine will be tuned in to your needs.

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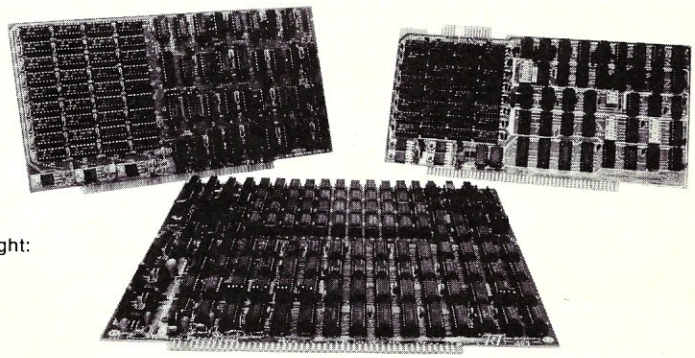

Shown Left to Right:
SUPERAM 4
SUPERMEM-ECC
SUPERAM 2

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LETTERS TO THE EDITOR

Dear Editor:

Regarding Jon Bondy's article on the IDS 440, and Peter Eisenhauer's response—they are both right.

Most of Jon's criticisms were accurate. In fact, if you look closely at the printouts that IDS supplied to demonstrate print quality, you can clearly see the problems that Jon is complaining about. As just one example, look closely at the 3/4 marking on the music score—some horizontal lines are closer together than others.

I have a new IDS 460, and can verify that the 460 also has problems with vertical registration. Although the 460 is improved over the 440, there are still a number of other problems (some left over from the 440, and some new ones), all of which are made worse by poor communications between IDS and their customers and dealers.

On the other hand, the IDS 440 and 460 are excellent printers for the money. You simply cannot have excellent vertical plotting registration with only one set of tractors. For good plotting, you need two tractor sets—one above and one below the print head. Most other printers in this price range don't have ANY plotting capability, and the IDS printers are as good or better than any of the others I've seen.

Don McClimans
Rochester, NY

Dear Editor:

In reference to Bob Weidemann's article on "Double Density Disk Controllers" (Jan/Feb 1981 Microsystems) I would like to point out an inaccuracy relating to his discussion of the Tarbell Double Density Disk Controller. His statement "You can only operate in double density mode with DMA," is not true. I have a Tarbell Double Density controller and have had success implementing double density without the use of DMA. I had to upgrade my CPU and memory to 4 MHz to accomplish this as per Tarbell's directions in their manual. I have not yet successfully implemented the DMA option. Tarbell has come out with an engineering change notice to registered Tarbell board owners to overcome the DMA problems. I have not found time yet to implement the changes for DMA but hope to soon. This mode of operation has been quite successful for about six months on two different types of disk drives, namely the REMEX RFD1000 and SHUGART 800/801 disk drives. Bob's article, overall, was quite good. I wanted to correct this one statement to prevent misconceptions among the readers.

Steve Stolen
Alexandria, VA

Dear Editor:

I received my first copy Vol.2/No.1 of your magazine this week and was intrigued by Lorin Mohler's article on Automatic Cold Boot programs.

My background has been primarily oriented to high level language programming and system design. Lately, however, a significant percentage of our jobs require tinkering with assembly language and modifying the I/O portion of CP/M. With little credit due to manuals accompanying CP/M and Micro-Pro's compiler package (why is it that their technical writers always assume you know everything already?) and a lot of credit to Radio Shack and McGraw Hill's Z-80 programming books, most of the hurdles have been overcome—except one:

Given the fully documented CBIOS.ASM which comes with our systems (Dynabyte), modifying the code becomes relatively straightforward—but once the modifications have been made how do you combine it with the rest of the operating system and get it back on the disc? There must be a simple method. Could Mr. Mohler's methods (using DDT & Save) work with modification? I would appreciate seeing (or being referred to) a good tutorial article on this subject—one that I, as a novice assembly-CP/M person, can understand and apply.

Thank you for your assistance in this matter.

William K. Borsum
Drawer 970
Castle Rock, CO 80104

Dear Editor:

Do any of your readers know of a bootstrap program that can be used to load CP/M SD Versafloppy? The documentation that came with the board shows no way short of either loading in their BIOS, (at an address where I already have ROM, not RAM) modifying it for both my usable addresses and my I/O. Letters to SD Systems haven't gotten me very far. And SD's own BIOS PROM is set up for the I/O of their single board computer, rather than for such "non-standard" systems as a serial console on ports 0 and 1.

Thanks for the help.

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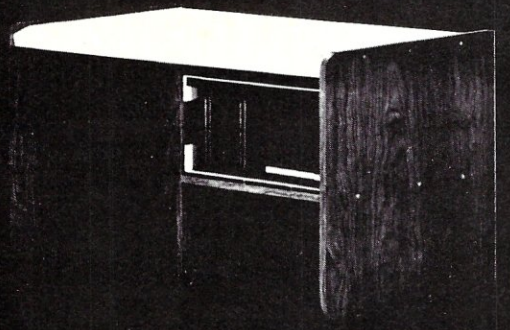

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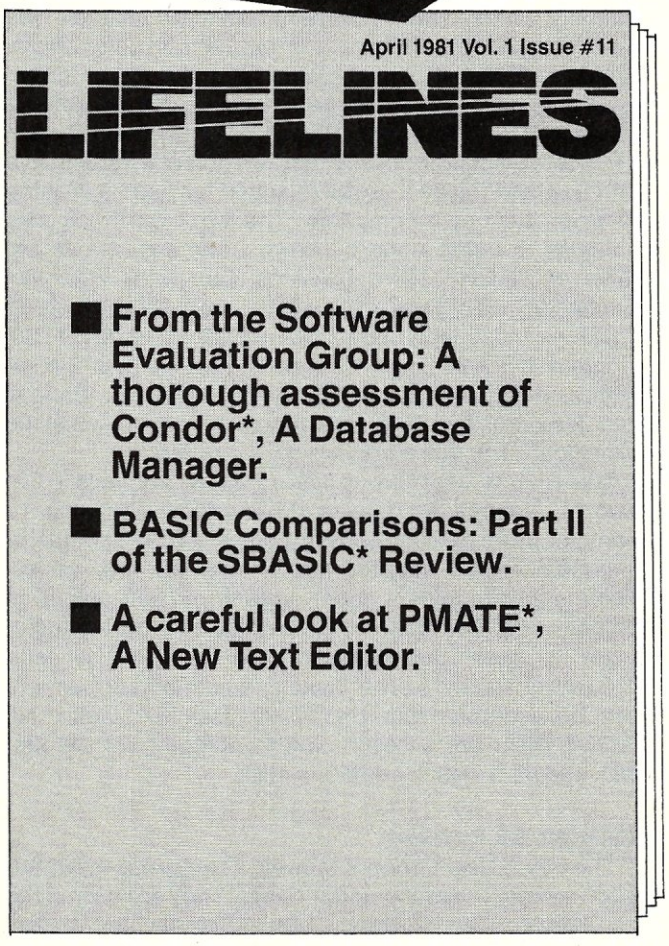

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NEWS & VIEWS

by Sol Libes

Packet Repeater Goes On The Air

The nation's first digital simplex packet radio repeater (KA6M) for use in amateur radio has gone into operation in San Francisco. A prior system went into operation in Vancouver B.C., Canada. The station serves as a packet repeater and beacon. It receives a message or block of data and retransmits that message on the same frequency after verification. The message may have some address or control bytes altered. The repeater extends the range and coverage of fixed and mobile stations. The KA6M/R repeater, which is located in Menlo Park CA, operates at 146.58 MHz and transmits data at a speed of 1200 baud.

As a beacon, it transmits packets every five minutes following its CW id. Each packet contains 70 ASCII characters. Each received packet must have the correct address and CRC checksum. The data field is 256 bytes maximum.

An amateur data network is currently being developed by AMRAD (Amateur Radio Research & Development Corp., a non-profit amateur group located in McLean, VA). It has made a formal proposal for funding of the AMNET project to ARRL (American Radio Relay League). The proposal calls for a computer communications network for North America consisting principally of seven HF nodes (packed radio stations) which are to tie in with local VHF message systems, such as the two already in operation in Menlo Park and Vancouver. The ARRL will serve as the network manager, AMRAD the network developer, and the Vancouver Amateur Digital Communications Group (VADCG) as the leading system designer. AMRAD plans to have their link in operation in the near future. All the current systems are using the Vancouver packet node controller boards. Different message formats are being developed for message transfer, virtual connection (QSO) and file transfer. These repeaters and AMNET are the first steps in what promises someday to be a nationwide network of interconnected computer systems that allows toll-free data communications...sorry AT&T.

CP/M Net News Being Published

Kelly Smith, a leader in the development of Remote CP/M systems, is now publishing a newsletter entitled *CP/M Net News*. It will be printed monthly (or as Kelly says "at worst, quarterly") to inform users of RCPM systems, of the latest in software news, information, and updates of public domain software accessible via telephone/modem transfer. A yearly subscription is $18 U.S. (checks or money orders only). Order from Kelly Smith, CP/M-NET, 3055 Waco Street, Simi Valley, CA 93063.

CP/M & SIG/M User Group News

The CP/M User Group has released volume 48, and volumes 49 and 50 are being readied for release in April and May. Volume 48 is a BDS C sampler disk compiled by Leor Zolman, of BD Software. It contains the BDS C manual to give you a "flavor of the compiler" (incidentally, we have a product review of this package in the works and hope to publish it in the next issue of *Microsystems*). The disk also contains several good programming examples in C and some interesting games. Volume 49 will contain RATFOR software. Volume 50 will contain a Pascal compiler in source that can compile itself in five minutes, serving as a useful example for people wishing to write their own compilers. The work on these new volumes is being done by Ward Christensen and Jim Mills of CACHE (Chicago Area Computer Hobbyist Exchange). The disks are available from CPMUG, 1651 Third Avenue, New York, NY 10028, (212)722-1700; single density $8 (U.S., Canada and Mexico), $12 elsewhere. North Star double density is $12 (U.S., Canada and Mexico), and $16 elsewhere. All orders must be prepaid in U.S. dollars drawn on a U.S. Bank.

The SIG/M User Group has released volumes 9, 10 and 11. Volume 9 contains CP/M utilities, volume 10 contains more utilities, MBasic games, a CDOS simulator and RESOURCE adapted for TDL and Zilog op codes. Volume 11 contains a super adventure (550 points) in object code. The SIG/MUG has also printed a supplement to their published catalog of CP/MUG and SIG/MUG software. The disks and catalog supplement can be ordered from SIG/MUG, Box 97, Iselin, NJ 08830. Disks are $4 each plus $2 shipping for the first disk and $1 for each additional disk.

CPMUG-86 Formed

The CP/M User Group is forming a sub-group for 8088/8086 software running under CP/M. They are now in the process of collecting software for their first volume. Also, they are looking for volunteer reviewers. Write to: CPMUG-86, 1651 Third Avenue, New York, NY 10028.

WIREMASTER
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• WIREMASTER is a software tool to aid in the design, layout, and construction of electronic hardware. It is intended primarily for wire wrap, though it is also highly useful in the layout, error-checking, and trouble-shooting of PC boards.

• Computer aids to do these things have long been available on large computers, and WIREMASTER now brings these tools inexpensively to the microcomputer environment.

• Inputs are easily derived directly from the schematic diagram and fed to WIREMASTER in a CP/M[1] text file. WIREMASTER checks for errors and inconsistencies, and produces a number of outputs. These include a network map that graphically shows all pins and wires, a wire list sorted by lengths and levels, a parts list, wrap count and continuity checklists, plus signal and pin cross-references.

• The resulting information is then used for PC board layouts, error checking, wiring, component stuffing, and system debugging. Together with the schematic, this forms a complete and easily updated documentation package for an electronic product. Although it runs on small computers, WIREMASTER can handle large projects (limited only by disk storage space).

• WIREMASTER checks for syntax errors, wires that go nowhere, and duplicated pins. Wire lengths are calculated and sorted in descending order so that the shorter wires on top hold down the longer wires beneath for a neat wiring job.

• WIREMASTER runs on Z80[2] and TRS-80[3] Model-II CP/M systems of 48K or larger and is shipped on a single density eight-inch diskette. The diskette contains WIREMASTER, a sort utility, and a pagination and multi-column printing program. Also included is FIX, a program which finds all bad spots on a disk, tells you which files they are in (if any), attempts a repair, and places the bad sectors in a single file.

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CBasic Available For 16-Bit Systems

Compiler Systems Inc., of Sierra Madre CA, has announced CBasic/16 for 16-bit microprocessor based systems. The first version to be released runs on the ONYX C8002 which uses ONIX (Onyx's version of UNIX); the cost is $250. They expect to release a CP/M version shortly.

UCSD Pascal V4.0 Now In Test

Softech Microsystems has disclosed that the new version 4.0 of UCSD Pascal is being tested at a few selected user sites. Softech has not yet set a release date. The new version adds multi-tasking and upgrades screen-handling functions. Four new p-codes have been added which will unfortunately create problems for version 3 users.

First PC System With Built-In Winchester

Vector Graphics, of Westlake Village CA, has brought out the first desktop personal computer system with a built-in Winchester disk drive. Called the Model 3005, it houses a CRT, keyboard, S-100 mainframe, Z80 CPU, 64K RAM, a flashwriter video system, dual mode disk controller and a Seagate Technology 5-1/4" miniwinnie drive and "as many as three quad-density 5-1/4" floppies." The system with the miniwinnie and one floppy is $7950.

First S-100 Bubble Memory Board Introduced

Pacific Cyber/Metrix Inc., of Dublin CA, has introduced an S-100 bubble memory card called the MBC-100 which contains as many as 16 "Bubbl-Pacs" (46Kbytes/pac) and its own 8-bit microprocessor that handles formatting and error checking. A CP/M-type software driver is furnished with the board. The board is equivalent to about 320 floppy disk sectors and has an access time of less than 4 msec, yet requires less than 25W of power. The MBC-100 card is $361 and the MBB-100 Bubbl-pac modules are $772 (in 100-unit quantities). PC/M Inc., 6800 Sierra Court, Dublin, CA 94566.

User Groups News

The Forth Interest Group (Box 1105, San Carlos, CA 94070) reports that they now have over 2,500 members. They publish a bimonthly newsletter and sell manuals, books and other materials relating to the Forth language. Membership is $12/year ($24 foreign).

The BDS C User Group has a new coordinator. He is Robert Ward, Dedicated Micro Systems, Inc., 409 E. Kansas, Yates Center, KS 66783, (316)625-3554.

The CP/M User Group, of the Ottawa Computer Group has changed its name (the old name was S-100 User Group). Their address is: Box 5691 Station F, Ontario Canada K2C 3M1. The contact people are John Mainwaring (613)725-9441, and Denis Tubie (819)561-1645.

The MAPS Users Group which supports MP/M users (operated by Digiac Corp, 175 Engineers Rd., Smithtown, NY 11787) has published the first issue of their *MAPS Digest*. It is 26 pages, and contains four short articles and one program. There was also a list of the eleven programs now in the MAPS library (prices unknown). A one year membership is $50 (no mention of how many copies of the *MAPS Digest* you get). □

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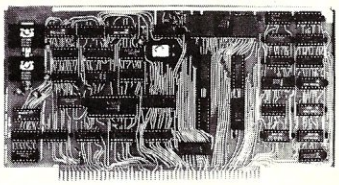
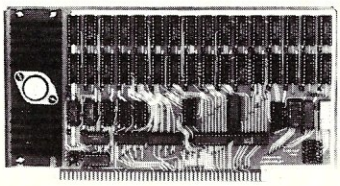


8086 CPU with Vectored Interrupts



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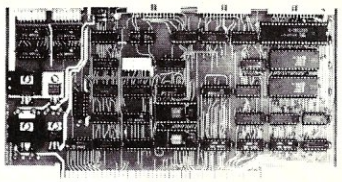

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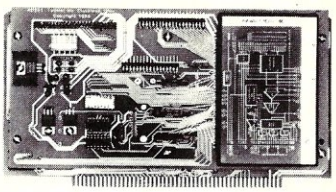

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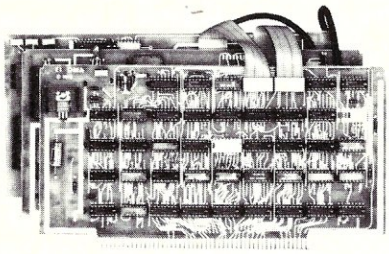
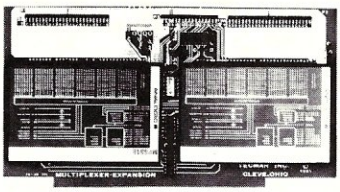
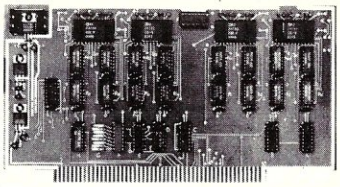


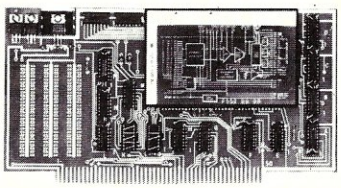
Real Time Video Digitizer and Display



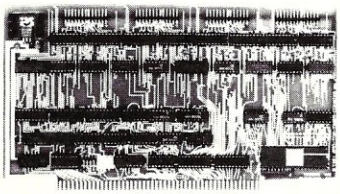
Expansion Multiplexer



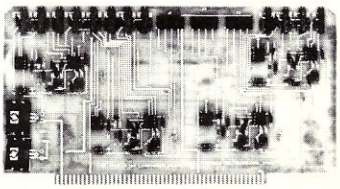
Digital to Analog Converter
4 channels - 12 bit accuracy
3 microsecond conversion rate



Analog to Digital Converter
16 channels - 12 bit accuracy
30 KHz Conversion rate

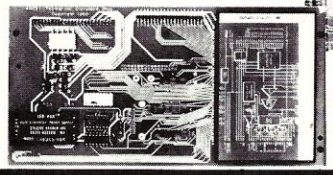


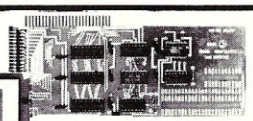
4 PIO and Timer/Counter



Digital to Analog Companion
4-20 mA output - Filters

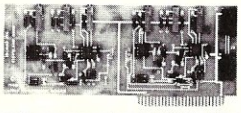
Apple Boards

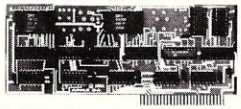




Analog to Digital Converter
16 channels
12, 14, or 16 bit accuracy
30, 40, 100, or 125 KHz

Digital to Analog Companion
4-20 mA output - Filters





Digital to Analog Converter
2 channels - 12 bit accuracy
3 microsecond conversion rate
1 parallel output port

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The CP/M* Bus

*CP/M is a registered trademark of Digital Research.

by Anthony Skjellum

The major topic of this column is a proposal for further enhancements of the CP/M operating system, including new types of file operations which would greatly increase the power of the operating system without consuming large amounts of memory. Also included is an overview of the book *PASCAL* by David L. Heiserman, a second look at *The CP/M Handbook*, and a look at Supersoft Associates' Tiny Pascal and the book *PASCAL*, which could well be used to learn about compilers and system software without use or knowledge of assembly language programming.

More Features for CP/M

Before good software is actually written, a design specification is carefully made and reviewed time and again to ensure that the resulting product will be logical, consistent and expandable. Updates and improvements of such software must fit within the original scheme and be downward compatible with older versions. It is especially important that operating systems be logically extended in order that the existing software base can continue to be used with little or no modification. Furthermore, the extensions should be compatible with the features previously provided so that the new and existing software can readily incorporate these enhancements. In the last installment of this column, we discussed the enhancements included in CP/M2. Here we will discuss a proposal for major additions to the operating system which would provide greater power but still remain quite feasible for use on existing 8-bit systems. The next installment of this column will discuss another facet of enhancement known as link files.

Variable Record Lengths and Input-Output

When performing file operations, the CP/M programmer is forced to work in 128 byte sector units. The maximum amount of data which can be read or written with a BDOS call is 128 bytes. In general, BIOS (Basic input-output system) software will provide buffering if the disk hardware uses physical sector sizes greater than 128 bytes. However, it would be very useful if two additional file modes could be added to permit more efficient handling of sizes. (We will refer to these data segments as records.) Primarily, we would want the capability to make files whose record size differs from 128 bytes. For example, we might want to have a file with 350 or 35 byte records. Each data transfer would be in increments of this record size. Secondly, we would want the ability to

transfer multiple records with a BDOS call. This would apply to both standard CP/M files and to the variable length record (VLR) files just oulined.

Approach to Implementation

VLR files will require special declaration. For example, at the time of creation the record length would be specified. The random and sequential file modes will have to recognize VLR files and act accordingly. In addition, the facet of multiple record transfer would have to be considered.

In order to produce the multiple record transfer capability, bit 7 of the command code will be used. In release two, no BDOS call has a function number greater than 127 (the largest is 36). CP/M would be modified to detect the bit 7 as an indication that multiple transfer mode is to be used. The HL register will contain the number of records to transfer, and the program will be responsible for maintaining a DMA buffer of appropriate size.

The system will also have to recognize VLR type files. This will be done by using a file attribute bit on the file name as provided by CP/M2. BDOS function 30 provides a way to set and reset these attributes. It should be noted that Digital Research has reserved bits f5' through f8' and t3', leaving the four bits f1' through f4' for non-system use. Bits t1' and t2' are already used to provide the R/W-R/O and DIR-SYS attributes respectively.

Since my recommendations are for system expansion, one of the reserved bits might be used. However, we will denote the VLR bit as b1' and this would correspond in an actual implementation to either f1' through f8' or t3'. (For more information on file attribute bits, see page 16 of Digital Research's *CP/M 2.0 Users' Guide for CP/M 1.4 Owners*.)

By using this file attribute technique, we make it possible for the existing BDOS commands to test for the VLR condition by examining b1'. This eliminates the need for inefficient reproduction of BDOS file commands for VLR files. It will only be necessary to generalize the existing file transfer commands, and the only new command needed will be the VLR file make command. This new command will still involve a slight generalization of the standard make file function. We will use the bit 7 technique again here to indicate that an extended command is being executed. The file make command is BDOS call 22 so the VLR make command would be 128+22 or 150. Since the record length could well be greater than 256, its value will be held in the HL register when calling the VLR make command. Futhermore, this quantity will be stored at locations s1,s2 in the directory entry.

At this stage, two examples will be presented to illustrate the VLR concept and multiple transfers. Let us suppose that we have to store mailing addresses in a data file. We determine the maximum length of such a record to be 52 bytes as follows:

Heading	Length
Name	15
Street and number	20
City	10
State	2
Zip	5

We would then want to declare the file as follows:

```
        LXI   D,FCB       ; point to file name
        LXI   H,RECL      ; record length
                          ; must be double precision
                          ; value since could exceed
                          ; 256.
        MVI   C,VMAKE     ; code to make vlr file
        CALL  BDOS        ; perform function
        ...
VMAKE   EQU   MAKE+128    ; new function has bit 7 on
MAKE    EQU   22          ;
RECL    EQU   52          ; length of record.
```

This file would require a DMA buffer of 52 bytes or greater. Each data transfer would be in a unit of one mailing address. Conceivably, we could make files with 1024 or 512 byte records for other applications.

Now let's explore the idea of multiple transfer. Imagine that we have a standard CP/M file with 128 byte records, which we want to read four at a time. As stated above, the HL register indicates the number of records to read and returns the actual number of records which were read. In the case of an end of file condition, this would be less than the requested number:

```
        LXI   D,FCB       ; point to file fcb
        MVI   C,MREAD     ; multiple read
                          ; DMA buffer must be
                          ; long enough to handle
                          ; long transfer.
                          ; i.e. record length times
                          ; number of records to read.
        MVI   H,4         ; read four records per
                          ; call (i.e. 512 bytes
                          ; in this case)
        CALL  BDOS        ; perform operation
        ...
MREAD   EQU   READ+128    ; multiple read has bit
                          ; seven set.
READ    EQU   20          ; sequential read.
```


It is good to note that a VLR file would be treated exactly the same way as a standard 128 byte record file. If we read four records of our mailing list file, we would get a total of 208 bytes returned (208=52*4). We should also note that multiple transfers for random input-output would clearly not be useful, and would be omitted from the implementation.

These proposed features would provide powerful and consistent commands which could be widely exploited in system and applications software. We will continue next month with a discussion of link files. This concept will prove very useful for the maintenance of information and will even have applications in data access methods. The concept of the subdirectory will also be discussed.

'PASCAL' and Supersoft Tiny Pascal

Supersoft Associates (of Champaign, IL) markets a software package known as Tiny Pascal. Currently they have a version which runs under CP/M and includes the complete source code written in Pascal. The cost is $85.00. It is an improvement of the Tiny Pascal which appeared in *Byte*. The package is very interesting and educational since it gives the user an opportunity to add features to the compiler and to learn the internal workings of such software. Additionally, it is a working compiler which can be used for utility software. Its disk routines are somewhat minimal in scope, but it is possible to expand even without modifying the compiler itself. The one unfortunate part of Supersoft's Tiny Pascal package is the minimal amount of documentation. This is why Heiserman's book, *PASCAL* is useful.

PASCAL is essentially dedicated to the TRS-80 version of Supersoft Tiny Pascal. However, many useful programs are presented which could be readily adapted to 8080 and Z80 systems running the CP/M version of Tiny Pascal. Some programs make use of the graphics capabilities of the TRS-80, and many S-100 systems have memory-mapped displays providing similar capability. Although the CP/M version of Pascal has no graphic intrinsics, the user could implement graphic functions directly in Tiny Pascal without great difficulty. The Pascal compiler and this text together provide a way for the user to gain experience in writing system software in Pascal without the need to resort to assembly language. The book is $9.95 and is published by TAB Books, Inc.

Another Look at 'The CP/M Handbook'

In the last column I reported some errors found in *The CP/M Handbook with MP/M*. I have re-read it since then and must report that it has more errors and inconsistencies. A letter in the March 1981 issue of *Doctor Dobb's Journal* illustrates my point. A novice could easily be confused by this text, and I recommend that a potential buyer carefully consider other sources of information about CP/M before purchasing this book. □

CP/M Bus Corrections

There were some bugs in the "CP/M Library Via Phone" listings published in the Jan/Feb 1981 *Microsystems'* CP/M Bus column. They are:

1. Kevin O'Connell was erroneously listed as a remote CP/M dial-up system.
2. Howard Moulton's system does not require a password. Also, forgive us for misspelling Howards' name.
3. The correct name is the New York Amateur Computer Club, not society.
4. And finally, donations of software should be sent directly to the CPM-UG, 1651 Third Ave., New York, NY 10028, who will then forward them to Jim Mills. Jim prefers to receive the donations via CPM-UG.

Is There an Alternative to CP/M — Try it — You'll Like it say the developers. — Westport, CT

InfoSoft Systems, Inc., the developers of I/OS 2, think they have an answer to the complaints about CP/M (the trademarked product of Digital Research). InfoSoft's head of development revealed many of the advanced features that I/OS allows while still supporting all previous CP/M programs. He discussed what the development group learned from their previous development of Cromemco's CDOS, with over 15,000 installations. I/OS 2 is geared, he stated, toward the turnkey system and the developer, yet presents a friendly face to the user. Such features as turnkey startup, local batches, no system on the 'A' disk, and terminal controls are integrated into the design.

Taking concepts from Unix, I/OS 2 has full hard disk support, the ability to mix various sized disks; and a clean documentation format. For the developer, I/OS is the only system available with a full mix of devices and disks supported by the developer, and a question and answer system creation process. End user price is similiar to CP/M, yet the dealer has a greater margin to work with, and far more support from the factory.

The spokesman refused to comment upon rumors that other, lesser developed programs were being released for the more sophisticated hacker.

• • •

Software Beasts released from the dungeons — Westport, CT

A spokesman for InfoSoft Systems today admitted that strange creatures were being released from their development dungeons below their software sales offices in beautiful downtown Westport. "These creatures are totally unrelated to our normal superb line of micro-processor software", stated the speaker.

Stressing that the beasts were not harmful, she admitted they did tend to bewitch hackers, forcing them to tinker till all hours. Under intense cross-examination he disclosed that these creatures, while only half-formed, were very useful as assistants or homunculi for would-be software wizards. Before disolving into a puff of green smoke, she (???) intimated that full details on capturing the creatures were available from the sales desk.

The Computer Communications Explosion

by Fred Lepow

The personal experiences of the author of the communications program 'MODKOM'

My first venture into computer communications came about in order to solve a common problem—How to exchange programs with a friend whose computer had different disk drives. CP/M had solved the problem of system software standardization. It couldn't, however, transport software from one system to another. I decided to extend CP/M into computer communications by incorporating all modem driver software into BIOS area of CP/M. Communications programs could then be equipment independent and use standard CP/M I/O techniques.

The result of this activity was MODKOM, an intensely CP/M oriented communications package. It solved my initial problem of accurate program interchange. Because MODKOM uses standard BIOS techniques, it also allows one CP/M system user to remotely control the CP/M system of another user. This proves very useful when one user needs to help another or to view the operation of a program by remote control.

This, however, proved to be only the beginning of the usefulness of computer communications. I incorporated into MODKOM a very general conversational program to communicate with all sorts of computer systems, with uploading and downloading of software in the conversational mode. This allows the interchange of programs with large time-sharing systems such as Micronet and with non-CP/M bulletin boards run by Apple or TRS oriented users. A whole new world of computer activity had opened up.

Fred Lepow, Cordura Publications, Inc., San Diego, CA.

Computer Bulletin Boards

The computerized hobbyist bulletin board system was first devised in 1978 by Ward Christensen and Randy Suess. (See the November 1978 issue of Byte for a detailed description of their initial system.) Over the last three years, the bulletin board concept has experienced truly explosive growth. Today there are hundreds of bulletin boards in the United States, Canada and around the world. See figure 1 for a fairly complete listing.

The People's Message System

Users in the San Diego area are fortunate to have an outstanding bulletin board system. This is the People's Message System devised by Bill Blue of Santee, California. The system is so good that versions of PMS are emerging all around the country. (See PMS on the CBBS directory.) A list of the system commands for PMS is shown in figure 2 and the special features in figure 3. Of particular interest are the excerpted articles of importance to the computer community. Figure 4 is an example of one such article. This system also has the capability for uploading and downloading of programs.

What type of messages do you find on these systems? While much trivia exists, there are some real gems to be found. Figure 5 is an example of an astute political discussion. Figure 6 shows the kind of hardware information rarely found in the printed media. I have learned much from a regular perusal of the computer bulletin board systems.

Time-Sharing Services: Micronet

During 1979, two major time-sharing services, Micronet and The Source, began offering computer time to hobbyists. I elected to go with Micronet. Today, Micronet is part of the Compuserve Information Service. The master menu for Compuserve is shown in figure 7. The electronic mail features a user-to-user mailbox and a national bulletin board. This is similar to the local boards, but has users from all around the country. Also featured is a "CB" mode with real-time communications with other Micronet users.

Of great importance to investors is the "Microquote" financial data base. For those who have implemented a computerized securities system requiring input of price volume data, Microquote can be set up to automatically supply the required data on a regular basis, saving much time and eliminating entry errors.

The index for Micronet itself is shown in figure 8. Another useful feature is the CP/M special interest group which has developed on Micronet. The goals of this system are explained by its "sysop," Charlie Strom, in figure 9. The list of programs currently available for downloading is shown in figure 10.

The CP/M Software Distribution Systems

The latest trend in computer communications is CP/M Software Distribution Systems. These systems exist solely for the distribution of public domain software. A current list of CP/M systems around the country is given in figure 11. The directory for the CP/M-Net of Semi Valley, California is shown in figure 12.* This is an incredible amount of high quality software to be had for the price of a phone call. I heartily agree with the CP/M-Net sysop, Kelly Smith, who states: "Do not despise things that are free. It is a curious fact in the computer world that value bears almost no relation to price. Some of the best programs for personal computers are in the public domain."

Thus, I have come full circle in my exploration of computer communications. I began to interchange programs with a friend. Now I can obtain software from regional systems containing the best public domain software available. Because of my non-standard disk drives, I could not obtain user group software directly on disk. With the proliferation of many new types of hardware, I believe that computer communications will continue to be the best solution to program and information interchange for many years to come. □

**Editor's Note: Due to space limitations we were not able to include this figure. It showed the CP/M Disk Menu of Kelley Smith's CP/M Net system containing 903 files which a caller may read or download to his own system. The listing would have taken up more than 5 pages in this magazine. We suggest that you call your system to see exactly what is on it.*

Figure 1—*A Complete Bulletin Board Directory*

```
Public access message systems
    last updated 02/07/81

8BBS Santa Clara Ca.....(408) 296 5799*24
AABB CP/M, NY.....(212) 787 5520
ABBS ABACUS II, Toledo Oh.....(419) 865 1594
ABBS A.C.E.S., Ft. Lauderdale Fl.....(305) 524 2237
ABBS ACG-NJ, NJ.....(201) 753 1225
ABBS Agoura, Ca.....(213) 991 9269
ABBS AGS, Augusta Ga.....(404) 733 3461
ABBS Akron Oh.....(216) 867 7463
ABBS Akcom, Akron Oh.....(216) 644 1965*24
ABBS Akron Digital Group, Akron Oh.....(216) 745 7855*24
ABBS Ames Ia.....(515) 294 8204
ABBS Apple Crate I, Vancouver Wa.....(206) 524 0203
ABBS Apple Crate II, Vancouver Wa.....(206) 244 5438
ABBS Apple Bin, Tacoma Wa.....(206) 937 0444
ABBS Apple Cider, Las Vegas Nv.....(702) 454 3417
ABBS Apple Group N.J., Piccataway NJ.....(201) 968 1074
ABBS Apple-Med, Iowa City Ia.....(319) 353 6528
ABBS Apple Orchard, Vacaville Ca.....(707) 448 9055
ABBS Apple Tree, Huntington Beach Ca.....(714) 963 7222
ABBS Atlanta, Ga.....(404) 939 8429
ABBS Augusta, Ga.....(404) 793 1045
ABBS Baileys Computer Store, Augusta Ga.....(404) 790 8614
```

ABBS Boston, Ma.....(617) 354 4682
ABBS Bowling Green, Oh.....(419) 352 4477
ABBS Byte Shop, Miami Fl.....(305) 261 3639
ABBS CCNJ, Pompton Plains NJ.....(201) 835 7228
ABBS Chesapeake, Va.....(804) 543 7194
ABBS Cleveland Oh.....(216) 779 1338
ABBS Computerland, Arlington Heights Il.....(312) 255 6489
ABBS Computer Center, Birmingham Al.....(205) 945 1489
ABBS Computer Corner, Amarillo Tx.....(806) 355 5610
ABBS Computer Emporium, Des Moines Ia.....(515) 279 8863
ABBS Computer Forum, Sante Fe Springs Ca.....(714) 739 0711
ABBS Computer Lab, Memphis Tn.....(901) 761 4743
ABBS Computer Room, Chicago Il.....(312) 337 6631
ABBS Computer Store, Cincinnati Oh.....(513) 671 2753
ABBS Computer Store, Toledo Oh.....(419) 531 3845
ABBS Computer-Video Room, Kansas City Mo.....(816) 531 1050
ABBS Dayton Oh.....(513) 223 3672
ABBS Denver, Co.....(303) 759 2625
ABBS Desert Technology, Phoenix Az.....(602) 957 4428*24
ABBS Detroit, Mi.....(313) 477 4471
ABBS Downers Grove, Il.....(312) 964 7768
ABBS Dubuque, Ia.....(319) 557 9618
ABBS El Paso Tx.....(915) 533 6255
ABBS Fort Lauderdale, Fl.....(305) 486 2983
ABBS Fort Walton Beach, Destin Fl.....(904) 243 1257
ABBS GLTC.DV1, Hollywood Fl.....(305) 989 9647
ABBS Houston, Tx.....(713) 977 7019
ABBS Illini Microcomputer, Naperville Ill....(312) 420 7995
ABBS Kansas City, Mo.....(913) 341 3502
ABBS Ketchikan, Ketchikan Ak.....(907) 225 6789
ABBS Korsmeyer Elect., Huntington Beach Ca...(714) 962 7979*24
ABBS Laguna Niguel, Ca.....(714) 495 6458
ABBS Lawton, Ok.....(405) 353 2554
ABBS Lincoln, Ne.....(402) 423 8086*24
ABBS Logical Choice, Baltimore Md.....(301) 465 3176
ABBS Louisville, Ky.....(502) 426 2975*24
ABBS Magnetic Fantasies, Los Angeles Ca.....(213) 465 1431
ABBS MC^3, Decatur Il.....(217) 429 5505
ABBS McGraw-Hill, NY.....(212) 997 2186
ABBS Memphis Tn.....(901) 725 5691
ABBS Michigan Apple-Fone, Southfield Mi.....(313) 357 1422
ABBS Morris Microproducts, Inglewood Ca.....(213) 673 2206
ABBS MSS, Washington DC.....(703) 255 2192
ABBS Munch, Stamford Ct.....(203) 356 1921
ABBS NIAUG, Lake Forest Il.....(312) 295 6926
ABBS NIBS, Chicago, Il.....(312) 289 1198
ABBS NJAUC, Marlton NJ.....(609) 983 5970
ABBS Oak Brook Computer, Oak Brook Il.....(312) 941 9009
ABBS OKC, Oklahoma City Ok.....(405) 528 8009
ABBS Original Applecorps, Los Angeles Ca.....(213) 340 0135*24
ABBS Pacific Palasades, Los Angeles Ca.....(213) 459 6400
ABBS PCnet, Menlo Park Ca.....(415) 863 4703
ABBS Peoria, Il.....(309) 692 6502
ABBS Portland, Or.....(503) 224 6409*24
ABBS Portola Valley.....(415) 851 3453
ABBS Rainbow Computing, Los Angeles Ca.....(213) 349 5728
ABBS Saddlebrook, NJ.....(201) 843 4563
ABBS San Antonio, Tx.....(512) 737 0214*24
ABBS San Francisco, Ca.....(415) 661 0705
ABBS Seattle, Wa.....(206) 248 2600

ABBS South of Market, San Francisco Ca.....(415) 821 1714-so
ABBS Spokane Wa..... (509) 456 8900
ABBS St. Louis, Mo.....(314) 838 7784*24
ABBS Torrance, Ca.....(213) 316 5706
ABBS Vermont, Essex Junction Vt.....(802) 879 4981*24
ABBS West Palm Beach, Fl.....(305) 689 3234
ABBS Wyckoff, NJ.....(201) 891 7441
ABBS Youngs Elect Svc., College Station Tx...(713) 693 3462*24
ABBS Zim Computers, Minneapolis Mn.....(612) 561 6311
ABBS Zoram Associates, Fremont Ca.....(415) 794 8287
ARBB Seattle Wa.....(206) 546 6239
Aviators Bulletin Board, Sacramento Ca.....(916) 393 4459
BAMS, St. Louis Mo.....(314) 227 8495
BBS-80, Cincinnati Oh.....(513) 224 2983
BBS Pensacola Fl.....(904) 477 8783
BILLBOARD 80, San Jose Ca.....(408) 263 0248
Bronx BBS, NY.....(212) 933 9459
BTBBS Centereach Ny.....(516) 588 5836
BULLET-80, Danbury Ct.....(203) 744 4644
CBBS AMRAD, Washington DC.....(703) 734 1387*24
CBBS Atlanta, Ga.....(404) 394 4220*24
CBBS Cambridge, Ma.....(617) 864 3819*24
CBBS Chicago, Il.....#1 (312) 545 8086*24
CBBS Columbus, Oh.....(614) 268 2227*24
CBBS Corpus Christi, Tx.....(512) 855 1512
CBBS Detroit, Mi.....(313) 288 0335*24
CBBS LICA LIMBS, L.I. NY.....(516) 561 6590*24
CBBS L.I. Comp Assoc, Long Island NY.....(516) 938 9043
CBBS Minneapolis Mn.....(612) 869 5780
CBBS Nasa, Greenbelt Md.....(301) 344 9156
CBBS Nova Scotia, NS Canada.....(902) 794 8198
CBBS NW, Portland Or.....(503) 646 5510*24
CBBS Pittsburg, Pa.....(412) 822 7176*24
CBBS Proxima, Berkeley Ca.....(415) 527 0400
CBBS Sacramento Ca.....(916) 483 8718*24
CBBS Santa Clara, Ca.....(408) 241 1956
CBBS Stamford, Ct.....(203) 348 6353*24
CMMS Chicago, Il.....(312) 767 0202*24
CMS-80 Fort Lauderdale Fl.....(305) 462 8677
COMM-80 Orange County, Fullerton Ca.....(714) 526 3687
Communique-80, NJ.....(201) 992 4847
Compunews, St. Louis Mo.....(314) 838 7784
CP/M Baltimore Micro-mail, Baltimore Md.....(301) 655 0393-rb
Compusystems, Columbia SC.....(803) 771 0922
Connection-80, Centereach NY.....(516) 588 5836
CP/M CBBS, Long Island NY.....(516) 698 8619-rb
CP/M CBBS, Pasadena Ca.....(213) 799 1632*24
CP/M CBBS Prodigy Systems, Baltimore Md.....(301) 337 8825*24
CP/M CBBS, Vancouver BC Canada.....(604) 687 2640*24
CP/M CCCC Lake Forest, Il.....(312) 234 9257
CP/M Ed's Comm Svc., NY.....(607) 797 6416
CP/M Hank Szyszka, Bearsville NY.....(914) 679 6559
CP/M RIBBS, Iselin NJ.....(201) 283 2724-rb
CP/M RIBBS, Rochester NY.....(716) 334 4604
CP/M Rick Martinek, Milwaukee Wi.....(414) 774 2683
CP/M Keith Petersen, Royal Oak Mi.....(313) 588 7054-rb
CP/M SJBBS, Amesbury Ma.....(617) 388 5125
CP/M SJBBS, Johnson City NY.....(607) 797 6416
CP/M TCBBS, Dearborn Mi.....(313) 846 6127
CP/M Tho Hogan, Bloomington In.....(812) 334 2522

```
CP/M Net, Simi Valley Ca.....(805) 527 9321
CP/M VCC, Los Angeles Ca.....(213) 709 5423
Download-80 Fraser, Mi.....(313) 294 8248
Download, Kansas City Mo.....(816) 523 9121
EBBS, Phoenix Az.....(602) 957 9282
Family Historians Forum 80, Fairfax Va.....(703) 978 7561
FORUM-80 Augusta, Ga.....(803) 279 5392
FORUM-80 Chicago, Il.....(312) 782 8180
FORUM-80 Cleveland, Oh.....(216) 486 4176
FORUM-80 Dallas, Tx.....(214) 288 4859
FORUM-80 Denver, Co.....(303) 771 3826
FORUM-80 Ft. Lauderdale, Fl.....(305) 772 4444
FORUM-80 Hull England.....(011) 44 482 859169
FORUM-80 Kansas City Mo.....#1 (816) 861 7040
FORUM-80 Las Vegas, Nv.....(702) 873 9491
FORUM-80 Los Angeles, Ca.....(213) 631 3186
FORUM-80 Memphis, Tn.....(901) 276 8196*24
FORUM-80 Montgomery, Al.....(205) 272 5069
FORUM-80 Orange County, Anaheim Ca.....(714) 952 2110
FORUM-80 Orlando, Fl.....(305) 830 8194
FORUM-80 Seattle, Wa.....(206) 723 3282
FORUM-80 Tampa, Fl.....(813) 223 7688
FORUM-80 Tulsa, Ok.....(918) 224 5347
FORUM-80 Union, NJ.....(201) 688 7117
FORUM-80 Wellesley, Boston Ma.....(617) 431 1699
FORUM-80 Westford, Ma.....(617) 692 3973
FORUM-80 Wichita, Ks.....(316) 746 2078
FORUM-80 Wichita Falls, Tx.....(817) 855 3916
Kinky Kumputer, San Francisco Ca.....(415) 647 9524-so
Market 80, Kansas City Mo.....(816) 931 9316
MAUDE, Milwaukee Wi.....(414) 241 8364*24
Medical FORUM-80, Mt. Clemens Mi.....(313) 465 9531
M.O.M., Manhattan NY.....(212) 245 4363
MSG-80 Everett Wa.....(206) 334 7394
NET-WORK St. Louis Mo.....(314) 781 1308
NET-WORK Apple Jacks, Fontana Ca.....(714) 823 1451
New England Comp. Soc., Maynard Ma.....(617) 897 0346
Orange County Data Exchange, Garden Grove Ca.(714) 537 7913
PHOTO-80, Haledon N.J.....(201) 790 6795
PMS - **IF**, Anaheim Ca.....(714) 772 8868*24
PMS - Gulfcoast, Freeport Tx.....(713) 233 7943*24
PMS - Los Angeles Ca.....(213) 291 9314*24
PMS - Minneapolis Mn.....(612) 929 6699*24
PMS - Mission Valley, San Diego Ca.....(714) 295 8280*24
PMS - Palo Alto Ca.....(415) 493 7691*24
PMS - San Diego Ca.....(714) 582 9557*24
PMS - Santee Ca.....#1 (714) 449 5689*24
PMS - Shrewsbury NJ.....(201) 747 6768
Pet Bulletin Board, Ypsilanti Mi.....(313) 484 0732*24
Potomac Micro Magic Inc., Falls Church Va....(703) 379 0303
Powercom 2.2, Largo Fl.....(813) 577 3095*24
PSBBS Washington DC.....(202) 337 4694
PSBBS Gaithersburg, Md.....(703) 840 8588*24
PSBBS TCUG, Reston Va.....(703) 620 4990
Remote Northstar, Atlanta Ga.....#1 (404) 939 1520*24
Remote Northstar, Virginia Beach Va.....(804) 340 5246
SEACOMM-80.....(206) 763 8879
SLAMS St. Louis Mo.....(314) 839 4307
SLUMS St. Louis Mo.....(314) 394 7233
TCUG, Washington DC.....(703) 620 4990
Triple Cities Bulletin Board, Endicott Ny....(607) 754 5571*24
```



```
Compliments of Peoples  Message System, Santee Ca.
                (714) 449-5689

*24 denotes 24-hour operation
#1  denotes original system of that type
rb  denotes call, let ring once and call back
so  sexually oriented messages

 Please send any corrections to PMS - Santee Ca.
```

Figure 2—*PMS Commands*

```
---->> System Commands

E  = Enter a message into system.
F  = Features, articles, excerpts.
G  = Goodbye. Leave system. (hangup)
H  = Help with various functions.
I  = Information about system.
K  = Kill a message from the files.
M  = Message alert. Messages for you?
N  = News -- System news.
O  = Other systems current summary.
Q  = Quickscan of message headers.
R  = Retrieve a message from the files.
S  = Scan of message headers.
SR = Selective message retrieval.
T  = Time, date and connect time.
U  = User modifiable system functions.
X  = eXpert user mode. (on/off toggle)
Z  = Continue message entry after abort
?  = Prints list of commands.
*  = Flagged message memory retrieval.
ALT  = Switch msg files. (toggle)
TEST  = Modem continuous test loop.
ASCII  = Pntr frmttd ascii char chart.
USERS  = File of system users/interests
CAL1981  = 1981 calendar/printer format
NEWCALL  = Information for new callers.
GENERAL14 = Download programs.
GENERAL15 = Upload programs/files.
```

Figure 3—*PMS Special Features*

```
---->> Special Features & Articles

NSA  = National Security Agcy. - mail
CONF  = Conferencing and the computer.
SOFT  = Apple Dos soft sector & proms.
CPM1  = CP/M Tips part 1.
CPM2  = CP/M Tips part 2.
DOS1  = Article on Apple DOS, part 1.
DOS2  = Article on Apple DOS, part 2.
DOS3  = Article on Apple DOS, part 3.
HACK  = The Hacker Papers -- G. Gandalf
TECH  = The Talking Chip.
COMSAT = Changes in Satellite tv.
SECRET = Secret research - article
PASRET = Salvage deleted files - Pascal
ARPAHUM   = Arpanet and 60 mins?-humor
ARPANEWS  = Selected msgs of interest.
```

Figure 4—*An Article Found On PMS*

I found this article in the Aug. '80 issue of Psychology Today. The opinions expressed by "G. GANDALF" (Kenneth Peter) are definitely thought provoking for any computer hobbyist or professional. There will be the Hackers who look at this and then block it out as irrelevant to them. I would hope though the majority who see this will consider the full meaning of his words.

I have only extracted the initial essay that was entered by G. GANDALF. The total article is of course well worth reading; however, I am interested in the response that will be generated by the users of this system.

The name of the article is "The Hacker Papers", for those who are interested in reading the responses to this essay. The follow up article "The Age of Indifference" By Philip G. Zimbardo (not entered here) is directly relevant and should also be read.

Mike Nogrady

THE HACKER PAPERS (PSYCHOLOGY TODAY AUG. '80)
DRAWN FROM THE STANFORD UNIVERSITY
LOW OVERHEAD TIME-SHARING SYSTEM(LOTS)

FROM: G. GANDALF (Kenneth Peter)
TO: BULLETIN BOARD
SUBJECT:ESSAY ON HACKING

Dedicated to all my friends at LOTS who will live their lives in a alien culture surrounded by humanity, and to Ernest, who was too human for it.

As much as an essay, this is a story. It is a true story of people paying $9,000 a year to lose elements of their humanity. It is a story of the breaking of wills and of people. It is a story of addictions, and of misplaced values. In a large part, it is my own story.

There is no one field in particular in academia that has a monopoly on production of single-interest people, and this practice can exist almost anywhere. There is the political power seeker, all-consumed by climbing up the bureaucratic rungs. There is the stereotyped pre-med, ignoring all but his MCAT scores. There is the compulsive artist or writer, forever lost in his work. Narrowness is widespread. But there is one field that seems to be more consistent in this practice. This essay, rooted in personal and painful experience, is about the people in computer science.

In the middle of Stanford University there is a large concrete-and-glass building filled with computer terminals. When one enters this building through the glass doors, one steps into a different culture. Fifty people stare at terminal screens. Fifty faces connected to 50 bodies, connected to 50 sets of fingers that pound on 50 keyboards ultimately linked to a computer. If you go further inside, you can discover the true addicts: the members of the Establishment. These are the people who spend their lives with computers and fellow "hackers". These are the members of a subculture so foreign to most outsiders that it not only walls itself off but is walled off, in turn, by those who cannot understand it. The wall is built from both sides at once.

These people deserve a description. In very few ways do they seem average. First, they are all bright, so bright, in fact, that they experienced social problems even before they became interested in computers. Second, they are self-contained. Their entire social existence usually centers around one another. Very, very few remain close to their families. Very, very few associate much with anyone who is not at least partially a member of the hacking group. While they do sometimes enjoy entertainment unrelated to their field, it is almost always with fellow hackers. Third, all aspects of their existence reinforce one another. They go to school in order to learn about computers, they work at jobs in programming and computer maintenance, and they lead their social lives with hackers. Academically, socially, and in the world of cash, computers are the focus of their existence.

The hacker will probably not strongly disagree with what has been said so far. But he will ask the question, "So what?" The answer is: in creating a subculture and isolating it, we are destroying the chance that computers might be used wisely as an integral part of our society. We are precluding the human values so necessary for the wise application of this technological achievement. The most brilliant young minds at our top universities are learning how to play with multi-million dollar toys first, and how to utilize them constructively second.

Even if we ignore the costs to society as a whole, we have to look at the costs to the people involved. The computer is a modifier of personalities. It is highly addictive. People who gain this addiction for a period of several months tend never to give it up. And the symptoms are very sad.

The first thing to go is other academic interests. Basically what occurs is that the hackers motivation to challenge themselves in any field not directly linked to computers gradually disintegrates. On the level of grades, straight-A students tacitly accept C's in noncomputer courses. On the level of actual learning, the same students shut off outside subjects even more completely than their grades would indicate. This is common in many areas of specialization, but nothing compares with the incredible consumption of computer science students for computer science courses, and their non-chalant attitude toward every other class.

Figure 5—*A Political Discussion Found On PMS*

Msg# 5490 on 01/28/81 @01:10 (23)
Subj: Space, To: !Phil Reed/All
From: Jamie Hanrahan, San Diego Ca

Phil, I don't know what there is to cheer about in the news that the Reagan administration plans "no major changes" in space-program funding. The sad fact is that current funding is woefully inadequate. NASA's inability to keep the shuttle on time and on budget has lost them a great deal of funding for other projects, such as planetary probes -- those of you

who have been enjoying the wonderful pictures from the Viking and Voyager probes may not realize that these were the results of projects that were begun in the early 70's, and that there were no new starts for planetary probes in 1980, or even in 1979.

With the current shakeup in Washington, right now may be the best opportunity we'll have in years to change all this. There was such a huge turnover on Capitol Hill that all of them will be watching their constituents' attitudes VERY carefully for a little while, so now is our chance. So few people write letters that an individual letter (other than obvious form letters from pressure groups) is considered to represent from 100 to 1000 people who feel the same way, but won't bother to write, so a few letters WILL be noticed. Ten letters a day on a single subject is considered to be a flood! So write; you WILL be doing some good!

Stars were made for reaching. Let's reach.

End msg #5490

Figure 6—*A Hardware Survey Found on PMS*

```
Msg# 5708 on 02/09/81 @11:48 (24)
Subj: Diskette Survey Results, To: All
From: David Gardner, Las Vegas Nevada

After a couple of weeks of polling
I have learned a lot about 5.25"
diskettes.  It is the general
opinion that Dysan and Maxell
are the best, followed by 3M Scotch.
According to a diskette test by
Hewlett-Packard, Dysan & Maxell were
rated #1, grouped together as #2
were 3M Scotch, BASF, & Memorex.  And
rated last were Georgia Magnetics, and
the clear loser... Verbatim.  The
results of my poll were much of
the same.  Although some people
did recommend Verbatim Datalife.
There were others that thought that
3M was as good as Dysan & Maxell,
but that Memorex was as bad as Verbatim.
BASF was said to be best for the
money, but of average quality.
Almost everyone recommended center
hole reinforcements.  By the way,
the Dysan part # for soft sectored
disks with pre-installed hub ring
reinfocement is... con't next msg!

End msg #5708
```

Figure 7—*Compuserve's Master Menu*

```
CompuServe              Page CIS-1

CompuServe Information Service

1 News, Weather, Sports
2 Finance
3 Entertainment
4 Electronic Mail
5 CompuServe User Information
6 Special Services
7 Home Information

9 MicroNET

Enter your selection number,
or H for more information.
```

The second thing to go is a normal living pattern. Eating and sleeping are completly rearranged to fit the addiction. The typical hacker thinks nothing of eating one meal a day and subsisting on junk food, or of sleeping from 4 a.m. to noon almost every day of the week. Families are soon disregarded, to an extent uncommon even when one considers the separtion that generally occurs in college. It is simply that the parents of hackers are ignorant of the subculture and cannot relate.

The third thing to go is a balanced social life. The hackers' narrowness and strange schedule simply compound the social problems they experienced before hackerdom. Soon, no one except a hacker has the capability to understand other hackers. No one except a hacker will go out with other hackers. No one except a hacker can talk to another hacker.

The forth and final thing that happens is also the saddest. The personality of the hacker shifts, in order to permanently adjust to the new social conditions. Emotions always hurt before so they are effectively isolated. Relations with nonhackers become strained, so why force the effort? It is so much easier just to accept social rejection and isolation, and to do it with a spirit of camraderie that's shared by the rest of the subculture.

An essay should make an attempt to resolve the problem it points out. In this case, the pointing may be enough, or at least enough to do whatever can be done. I know from personal experience what a trauma it can be. I was one of the top 10 among several thousand LOTS users last spring for the amount of time I spent here. I have watched people close to me undergo the transformation. I narrowly escaped it.

The tragedy is that I am so involved in piecing my personality and social life back together that I think I have learned very little about how to prevent this from happening in the first place. I am lucky. I will go on to some sort of a balanced life (although my hacker friends will laugh at me, since, to them, my involvment was never serious enough to make me one of them). Weak-willed people, people with unstable social lives, people in formative stages of their lives, should not become involved in computer science. It should be left until they are truly able to make decisions and be aware of all the consequences. Computers are most often used by people who start when they are immature. This is what causes the single-minded addiction. This is what takes some of the brightest and most capable minds in college today and turns them to narrowness.

..ahem.. There you have it, folks. Any comments?

Figure 8—*Micronet's Index*

```
Purposes and Aims of this "System"

  The MicroNet system provides a means for exchange of
public domain software that is currently circulating in the
various remote CP/M systems throughout the United States &
Canada. My major non-work related microcomputing intersts
center around these systems (see RCPMLST file) and public-
domain CP/M compatible software in general, particularly
assembly language (8080 & Z-80) programs.
  Rather than trying to retain interesting programs for an
extended period, I have decided that, given my limited
storage space, it would make more sense to regularly
transfer new programs to this system and leave them on for a
couple of weeks or so. I will also retain files relating to
the remote systems and suggest all interested explore them
fully. I also welcome files from others; we must all contri
bute if a real non-profit CP/M interst group is to continue
as productively as it has in recent months. Please contact
me via EMAIL if you have any comments or any files that you
wish to share.
```

Figure 9—*The Micronet CP/M Special Interest Group*

```
**************************************
MicroNET Program and Information Index
**************************************

Each category of the following menu contains descriptions of programs,
languages, and information files available on the MicroNET system.
Some categories contain many items.  If you want to terminate lengthy
output early, type a control-O or control-C.

NOTE - You must be in the command mode to type system files or run programs.


0  - Exit Index                Last Update

1  - MicroNET News              19-FEB-81
2  - Communications             18-SEP-80
3  - Programming Languages      30-APR-80
4  - Text Editors               29-JAN-80
5  - Financial                  12-SEP-80
6  - Word Processing            29-JAN-80
7  - Utilities                  18-SEP-80
8  - Mathematics & Statistics   29-JAN-80
9  - Games                      19-SEP-80
10 - MicroNET Information       12-SEP-80
11 - Special Features           29-JAN-80
12 - Software Exchange          29-JAN-80
13 - Executive software         19-SEP-80
14 - CS information service     19-SEP-80
Please enter category number:
```

Figure 10—*Micronet's CP/M Special Interest Group Directory*

```
CHARLES H. STROM [70210,104]
PUBLIC ACCESS FILES                    (last updated 2/12/81)

  1. FILES.DOC  - This file.
  2. THIS.SYS - Message re purposes and aims of this "system".
  3. MBOOT3.ASM - A condensed version of MODEM.ASM, allowing
     access to remote CP/M systems. See also RCPM.LST.
  4. RCPM7.DOC  - An updated listing of all known remote CP/M
     systems available for public-domain software exchange.
  5. MLIS42.ASM - This is the latest version of a listing
     utility which features wildcard options and output to the
     list device.
  6. SIGM.DEC  -  The December issue of the SIG/M newsletter.
     SIG/M is a non-commercial CP/M software group run by
     members of the New York & New Jersey groups.
  7. MNPTCH.ASM  -  This is a patch to the CP/M version of the
     MicroNet Executive program allowing automatic logon.
  8. XFER.TIP - A tip to save wear and tear when using FILTRN.
  9. FLT11.ASM - This program, similar to TEXCLEAN, filters
     bit 7 from each character of the input file. It also
     removes all control characters, form feeds and so on, and
     does not replace the input file; rather, it opens a new
     file called FILTER.FIL. Good for preparing Wordstar
     documents for transmission to Micronet.
 10.CPY12.ASM - A disk copy program for one or two drives.
```

Figure 11—*Remote CP/M Software Distribution Systems*

```
Remote CP/M Systems, List #10

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+ A summary of all known (and running) Remote CP/M software    +
+ exchange systems using XMODEM for file transfers. Assembled  +
+ by KELLY SMITH with additions by BEN BRONSON & BRUCE RATOFF  +
+ Note: Please add any new RCPM systems "Top Down" and XMODEM  +
+ to CP/M-Net, (805) 527-9321 as RCPMLIST.NEW; Thanks...(KS).  +
+                                                              +
+          List #10 revised and updated, courtesy of           +
+           Kelly Smith, CP/M-Net (tm) 805-527-9321            +
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

          +++ Remote CP/M Software Exchange Systems +++

                Last Revised March 8, 1981

----------------------------------------------------------------
Remote CP/M and Bulletin Board System of Cranford, New Jersey
(201) 272-1874, Bruce Ratoff. Call back system. Eves., etc.
110 & 300 baud. SPRINT, MCI.  Up on 03/07/81.  2-3 Mb of files
on-line.  [New Jersey]
----------------------------------------------------------------
Allentown RBBS/RCPM System, (215) 398-3937, Bill Earnest.  24
hrs.  300 baud.  SPRINT (& ?).  Up 02/27/81.  @ 1 Mb (?) of
files on-line.  [E. Pennsylvania]
----------------------------------------------------------------
Hyde Park RCPM System, 312-955-4493, Ben Bronson.  Late nights
& days.  300, 450, 600 baud.  SPRINT, ITT, MCI.  Up on 02/27/
81.  @ 2 Mb of files on-line. [Chicago]
----------------------------------------------------------------
Chicago RAPM (Remote Apple CP/M), (312) 384-4762, David Moritz.
24 hrs/7 days (Initially sporadic). 300 baud. SPRINT, ITT, MCI.
```

Up on 02/27/81. @ 250 K files on-line. [Illinois]

Columbus CBBS, (614) 268-2227 [268-CBBS]. 24 hrs. 110-600 baud. SPRINT, ITT, (MCI?). Up on 01/23/81. @ 200 K of files on-line. [Ohio]

Rochester RCPM and RBBS, (716) 334-4604, David Kozinn. Call back. 24 Hrs./7 days. 110 & 300 baud. SPRINT, ITT and MCI. Up on 02/27/81. 500 Kb (?) of files on-line. [New York]

CP/M-Net (tm), (805) 527-9321, Kelly Smith. 7 PM to 11 PM (PST) Mon - Fri, 7 PM Fri to 7 AM Mon (24 Hrs., weekends). 300 baud. No alternative long-distance service. Up on 02/27/81 with 500 Kb floppies (A: and B:) and 10 Mb hard disk (A:, B:, C:, and D:) files on-line. [S. California, Bakersfield area]

Technical CBBS, (313) 846-6127, Dave Hardy. 24 hrs. 110-600+ baud. ITT, SPRINT, MCI. Up on 02/27/81 @ 3 Mb of files (A:, B: and C: floppies) on-line. [Detroit area]

Calamity Cliffs Computer Center, (312) 234-9257, 2 pm-2 am. 300, 450 & 600 baud. ITT, SPRINT, MCI. Up on 02/27/81. @ 1 Mb of files on-line. [Chicago area]

Royal Oak CP/M, (313) 588-7054, Keith Petersen. Call back. 24 hrs. 300-600+ baud. ITT, SPRINT, MCI. Up on 02/27/81. @ 700 K + 10 Mb of files on-line. [Detroit area]

Ed's Communication Services, (607) 797-6416. Eves., etc. 300 baud. No alternative long-distance service. Up 11/20/80. @ 500 K(?) of files on-line. [Upstate New York]

Rick Martinek's System, (414) 774-2683. Days & Eves. 110 & 300 baud. ITT, SPRINT, MCI. Up on 11/12/80. @ 500 K(?) of files on-line. [Milwaukee] * 02/27 query: still up? *

Amesbury BBS, (617) 388-5125, Howard Moulton. Call back. 24 hrs. 300 baud. No alternative long-distance service? Up on 11/07/80. @ 500 K of files on-line. [E. Massachusetts]

Pasadena CBBS, (213) 799-1632, Dick Mead. 24 hrs. 110-600+ baud. ITT, SPRINT, MCI. Up on 02/27/81. @ 1 Mb of files on-line. [Los Angeles area]

Long Island CBBS, (516) 698-8619, Tim Nicholas. Call back. 24 hrs. 300 & 1200 baud. SPRINT, MCI. Up on 02/27/81. @ 1 Mb of files on-line. [New York area]

Bearsville Town SJBBS, (914) 679-6559, Hank Sryszka. Call back. Eves. 110-600+ baud. No a.l.d.s.? Up on 12/13/80. @ 500 K of files on-line. [Downstate New York]

Prodigy Systems CBBS, (301) 337-8825. 24 hrs. 300 baud. ITT & SPRINT (& MCI?). Up on 01/20/81. @ 500 K of files on-line. [Baltimore area]

Vancouver CBBS, (604) 687-2640, Steve Vinokouroff. 24 hrs? 300 baud. no a.l.d.s. Up on 01/30/81. 500-1000 K of files on-line. [British Columbia]

Tho. Hogan's System, (812) 334-2522. Wkends. baud rate? no a.l.d.s. Up on 08/15/80. [Bloomington, S. Indiana] [perhaps no XMODEM -- system mainly for Alpha Micro users]

NOTES:

1. Several program exchange systems, though often found on lists of CBBS's, have become extinct in recent months:

   Baltimore, Md. (301) 655-0393, Baltimore Micro-Mail.

   Los Angeles, California (213) 709-5423, Valley Computer Club (until further notice)

   Provo, Utah (801) 375-7000

   St. Johnsbury, Vermont (802) 748-9089

   NOTE: Bruce Ratoff's RBBS/RCPM system is now relocated in Cranford, New Jersey. The new number is: (201) 272-1874. Problems? Call Bruce at: (201) 272-1793.

2. Whether a program exchange system is accessible by an alternative long-distance service should be considered when planning to modem over long programs. Charges on SPRINT, ITT/CITYCALL and MCI are 50-60% of Ma Bell's regular long-distance rates.

3. Call-back systems are those where a computer and real people share the same telephone line. To contact the people, just dial & let the phone ring until you get an answer. To contact the computer: (1) dial, (2) let the phone ring once, (3) hang up just before the 2nd ring, & (4) re-dial.

4. The systems listed here only carry programs that will run under the CP/M operating system, most of them public domain software distributed by CPMUG or SIG/M, the two main CP/M users' groups. Some of the programs involved (especially those in BASIC and PASCAL but also a few in Z-80 or 8080 assembly language) can be converted to run on other machines quite easily. But systems dedicated to downloading programs for the PET, APPLE, TRS-80 and NORTHSTAR do exist. Ask experienced users in your area, or check through "other systems" listings on local CBBS's, ABBS's, FORUM-80's, etc.

5. XMODEM is a modification of Ward Christensen's original MODEM program designed to allow the transfer of files between the exchange system and yours. The exchange system needs the program, not you; you will probably be using one of the many versions of MODEM itself: e.g., MODEM2, MODEM527, MODEM7, MBOOT, etc.

6. Non-XMODEM program transfer systems are starting to appear: e.g., LICA's BBS on Long Island [at (516) 561-6590; 110-600+ baud; 24 hrs] has a few downloadable ASCII files but at present (01/81) these must be captured like CBBS messages

and then saved to disk, without any error-checking protocol. Santa Clara CBBS [at (408) 241-1956;110-600+ baud; 24 hrs) has announced plans to implement late-night exchanges; whether these will use XMODEM is not yet clear.

7. Some XMODEM systems also operate as real CBBS's, including those operated by Dick Mead and Steve Vinokouroff. Others, like Keith Petersen's & CCCC's use a skeletal subprogram for handling messages called "MINICBBS". Their emphasis is on exchanging software, not bulletin board-type information.

8. A few CBBSs have software exchange functions that require the use of a password. Such systems are not listed here.

9. At present (03/81) the systems with the largest disk capacity and the most programs up at once are Kelly Smith's and Keith Petersen's, both running 9-10 Mb hard disks. Dave Hardy's, with 3 Morrow-controlled drives giving @ 3 Mb is in 3rd place. Rick Martinek & Calamity Cliffs say they have plans to go over to hard disk quite soon. Dick Mead (Pasedena CBBS) will have a 10 Mb hard disk up in 2 weeks.

10. Note: look for the appearance of a new RCPM on this list to appear in 2-3 weeks based in Resada, California (213 area code), with 500 Kb floppies and 10 Mb hard disk. System is checked out (XMODEM, RIBBS, etc.), SYSOP (Ed Currie) now waiting for installation of telephone. Look also for a new Chicago area system running on TRS-80/Omicron CP/M.

11. No RCPM (or straight CBBS) system is currently running MP/M or another multi-tasking OS in combination with more than one modem & telephone line. Footnote: Kelly Smith did have MP/M running (2 user's) for 3 months, but reverted back to "normal" CP/M because the average caller did not utilize most of the new facilities or were overwhelmed by the the system capabilities. After hard disks,this is expected to be the next important development in non-profit computer communications. Tim Nicholas is currently working on a two-modem system and expects to be up with it shortly.

12. The fastest system is Tim Nicholas's, with a Bell 212-type modem capable of 1200 baud, full duplex, at the same frequencies other micro modems use. He will soon have a half-duplex 1200-baud modem running as well. Any of the systems using PMMIs can sometimes reach 710 baud but usually are untrustworthy beyond 600 baud. Systems based on D.C.Hayes & other brands of modem cannot send or receive faster than 300 baud.

13. Do not despise things that are free. It is a curious fact in the computer world that value bears almost no relation to price. Some of the best programs for personal computers are in the public domain. They often work better and are better supported than software costing hundreds of dollars and in terms of documentation, commercial programs do not even come close. And please, most of these systems operate from private home telephones...be courteous and call only during the posted operating hours.

Introduction to Data Communications

by Lawrence E. Hughes

Basic Concepts—Information encoding

One of the fundamental concepts in the data communications field is that of encoding information from human-sensible form into machine-sensible form, and decoding machine-sensible back to human-sensible. A teletype compatible terminal is a simple hardware device which is capable of performing both of these actions. There are several common means of encoding information so that a machine can sense it, almost all of which involve reducing the information to binary as a first step. Information theory tells us that in general, any informaton can be reduced (reversibly) in this manner. A single binary digit (bit) can be represented by the presence or absence of a current, one of two possible voltages, one of two possible audio frequencies, etc. Likewise, there are several common conventions for associating a group of bits to represent a particular character, numeric value, or machine instruction.

The TTL Link

From one point to another within a terminal (e.g. the link between the keyboard and the rest of the terminal), a simple encoding scheme called "TTL level parallel" would be used. The TTL stands for *Transistor-Transistor Logic*. Under the TTL encoding scheme, a logic 0 is represented by a voltage in the range 0 to 1.3 VDC, and a logic 1 is represented by a voltage in the range 3.6 to 5.0 VDC. The current involved is very small, hence TTL links must be physically very short (2 to 3 feet at most). There are no widely adopted conventions concerning how to arrange the signals on a TTL link, or even which signals to have present.

The Current Loop Link

From one device to another (e.g. terminal to modem) one would typically use either current loop on older equipment, or EIA RS-232-C on most recent equipment. A current loop is implemented by physically making or breaking a wire loop, or its equivalent, in which as 20 mA current is flowing. Here a logic 1 is represented by the presence of current (MARK) and a logic 0 by the absence of same (SPACE). Historically, a long chain of half duplex teletypes were hooked up serially on a single loop, often with the return wire being one rail of a train track. When any one terminal was typed on, the entire loop was made and broken; hence the current was present and absent, in a binary representation of the character that was typed. Since all the printer mechanisms in the loop decoded the information present in the current and printed the character corresponding to whatever pattern or patterns were detected, they all printed the character typed. Once again, no real standards exist concerning the type of connectors to use—hence moving a current loop device from one environment to another usually involves rewiring connectors.

The RS-232 Link

As computer peripherals began to proliferate, and all of them had their own proprietary (and incompatible) interface conventions, the Electronics Industries Association (EIA) decided to provide a generalized interface standard. If a given manufacturer stuck reasonably close to it, he stood an excellent chance of being able to plug his equipment directly into other such devices using standard, readily available cables and/or connectors. Although there are a bewildering variety of subsets of this standard (rarely does anyone implement the entire standard), one can usually connect two RS-232 compatible devices together with a minimum of hassle. The RS-232-C specification not only specifies the physical encoding scheme (logic 0 = +3 to +25 VDC, usually +12, logic 1 = -3 to -25 VDC, typically -12), it also specifies which pins of a recommended connector (DB25P/DB25S) are to carry which signals, and how those signals interact (handshaking). As somewhat higher currents are used than in TTL, a simple RS-232 link may be somewhat longer, even up to 50 feet.

Often, one needs to connect two devices over even longer distances, possibly even over thousands of miles. As the switched telephone network is already there, and reasonably inexpensive to use, engineers have designed devices which allow one to couple two RS-232 devices via a voice grade phone line, such that the information is encoded into one of two possible audio frequencies in the one to three kilohertz range, and back again. Since this process involves both modulation and demodulation of a carrier frequency, these devices are called *modems*. Here the distance is limited only by the extent of the phone network. As in all other areas of data communications, there are a number of similar, yet incompatible

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mechanisms for encoding information—each method optimized for some combination of bandwidth, signal quality and cost.

Basic Concepts—Information Structure

The next level above representing individual bits in some machine sensible form is to impose structure on groups of such bits. Once again, there are several commonly used conventions, each optimized for a given set of parameters.

Returning to the example of the keyboard TTL link—due to the short length of the connecting cable, chances are that such a link would use a *byte parallel* interface. That is, the bits (in this case seven) that represent a given character would all be transmitted simultaneously over separate wires. By maintaining an order among the various wires the character can be received intact by the rest of the terminal's circuitry.

Often, one wishes to reduce the required number of wires over a link to a minimum. An RS-232 link can be established with as a few as three wires, or two if information flows in only one direction. This is achieved by allowing multiple bits to "timeshare" a single wire. Once again, there is more than one convention for doing this: asynchronous serial and synchronous serial. The connection between a terminal and its modem is typically RS-232 asynchronous serial.

Asychronous Serial Transmission

Asynchronous serial involves sending information with precise timing between bits of a given character, but with intervals of arbitrary length (including zero-length) between characters. In order to allow this variable length interval, certain overhead information is required on each character. Normally, during an inter-character gap, the line is in the logic 1 (MARK) state. When a character starts, there is a single start bit which is always logic 0 (SPACE). Once the start bit has occurred, then the data bits occur, least significant bit first. One might find either seven or eight such data bits on recent equipment. Following these, one often finds a parity bit, which is a simple error detection mechanism. If running with even parity, this bit will be chosen so that the total number of bits (in the data bits + parity bit part of the character) is an even number. Following the parity bit, if it is present, are one or two stop bits (always logic 1 (MARK)). Stop bits simply insure that the line returns to the idle (MARK) state for at least one or two bit times, so that the hardware can re-cycle and be ready to detect the next start bit. This technique is commonly employed in situations where a human determines the times between characters, such as in most terminals with keyboards. It is suitable for relatively low speed applications (1 to 1000 characters per second). A single, inexpensive ($5.00) LSI chip, called a UART (Universal Asynchronous Receiver/Transmitter) is available to convert parallel data to or from asynchronous serial data. Note that all connections to the UART are at TTL levels, hence TTL to RS232 and RS232 to TTL level shifters, such as 1488 and 1489, are usually found in conjunction with a UART.

Synchronous Serial Transmission

Synchronous serial involves sending characters not only with precise timing between bits of a given character, but at regular intervals (no gap between characters) and in relatively long (e.g. 1024 character) blocks. No overhead is required on each character, although parity is still sometimes used. However, certain overhead information is required at the start and end of each block. There are two main types of synchronous serial, namely byte control protocols (BCP), such as DDCMP (DEC's Digital Data Communications Message Protocol) and BISYNC (the older IBM standard); and bit oriented protocols (BOP) such as SDLC (Synchronous Data Link Control) and HDLC (High-level Data Link Control). A BCP can function with conventional byte-oriented hardware, but a BOP requires special bit-oriented hardware. The primary function of the overhead information is to achieve synchronization, such that both ends agree where the boundaries between bytes are in the continuous stream of bits. Most often this overhead information also supplies a certain amount of redundancy for sophisticated detection (or even correction) of errors, and is used in relatively high speed applications (100 to 100,000 characters per second). Note that since the timing is more critical (and must be sent along with the data) and the speed is generally higher, modems for synchronous serial data are typically more complex and expensive than those for asynchronous serial data.

Even higher levels of organization than this are regularly imposed on synchronous serial data, up to the message level and beyond. This includes mechanisms to support acknowledgement of messages received intact, request for retransmission of messages received with errors, end of transmission status, etc.

Simplex, Half-Duplex And Full-Duplex

Any serial communications link can be set up in one of three modes: *simplex*, *half-duplex*, or *full-duplex*. The term *echoplex* is often used to refer to a full-duplex channel which is being used primarily in one direction, with only echos of the primary data returning from the other end. The hardware is the same as in full-duplex.

A *simplex* channel is one in which information travels in just one direction. Typical applications might include receive only printers and plotters. Simplex channels are usually very easy to setup and develop software for.

A *half-duplex* channel is one in which information travels in just one direction at any given time, with the possibility of turning the line around (for information to travel in the opposite direction). There is characteristically a relatively high overhead time associated with turning a line around. This type channel is found in older, less sophisticated equipment. Higher speed modems often employ half-duplex in order to obtain maximum utilization of a given bandwidth.

A *full-duplex* channel is one in which information may travel in both directions simultaneously. Note that such a channel may be used to emulate either of the simpler modes. This type channel is the most demanding on the communication hardware and software. One usually must resort to assembly language in order to provide the sort of concurrency required to support a full-duplex link.

Data Communications Hardware

There are several hardware building blocks used to create a communications system. Among these are

computer ports, terminals, multiplexors, line drivers, modems, and phone system interfaces.

Almost all computers have facilities for connection to one or more serial devices. These are implemented as serial ports. Such a port may be as simple as a single UART with RS-232 conversion circuits and some mechanism to allow the CPU to read and write parallel data and status from (to) the UART. Such ports are usually implemented as DTE (Data Terminal Equipment) so that they may be connected to a DCE (Data Communication Equipment), such as a modem with a simple, un-flipped RS-232 cable. To connect such a port directly to another DTE, such as a terminal, a special cable is required which flips several signal pairs. (Note that the DTE and DCE ends of an RS-232 interface are symmetric.) Some computers actually have smaller processors (front ends) which oversee the operation of some, or all, of the ports connected to the overall computer system. These front end processors free up the main CPU for more complex tasks, and interrupt it only when a mass transfer of data between the main CPU and front end is required. In a reasonable front end system, the main CPU would be interrupted only once an entire line has been received from a given terminal, and the front end would be able to accept an entire line of output at once for a given terminal. This means that the front end processor must have at least enough memory for both input and output buffers for each terminal connected through it.

Dumb Versus Intelligent Terminals

There are a wide variety of currently available terminals which may be used in communications systems. These may be asynchronous or synchronous, hard copy or CRT, intelligent or "dumb."

By now, the distinction between asynchronous and synchronous should be clear. Suffice it to say that asynchronous terminals typically are character-oriented, whereas synchronous terminals most often are message (line or page) oriented. This refers to the amount of information that is transmitted or received in a single operation. Most synchronous terminals are more intelligent than asynchronous terminals, so that a line (or page) of text may be entered and edited locally, and also so that a line protocol may be supported.

Hard copy terminals use some mechanism for physically imprinting (impact, thermal or otherwise) characters on paper. A CRT terminal employs a Cathode Ray Tube much like a TV picture tube to display characters and/or graphics. An RO terminal is Receive Only (no keyboard). A KSR terminal can both send (from the keyboard) and receive. An ASR (Automatic Send/Receive) terminal can also send and receive from some machine readable media, such as paper tape, cassette tape, or diskette.

An intelligent terminal typically has various local capabilities, such as forms generation, screen editing, possibly a calculator mode and/or stand alone operation as a general purpose computer.

At times it is necessary to collapse multiple low speed lines into a single high speed line, and/or expand such a line back into multiple low speed lines. This is usually done to save on phone line costs, or to take advantage of a wide bandwidth channel, such as a coax cable. There are two mechanisms for multiplexing lines in this manner: time division and frequency division.

In a Time Division Multiplexor (TDM), the high speed line is time sliced, usually at the character level. Certain recent Time Division Multiplexors have used a technique called statistical multiplexing, whereby more than "n" terminals running at baud rate "m" can be multiplexed onto a single line running at baud rate "nm," so long as not all of them run at full speed all the time. Note that this is a valid assumption most of the time. This is also an ideal application for a dedicated microprocessor system.

In a Frequency Division Multiplexor (FDM), the bandwidth of an analog channel is divided into multiple sub-bands, and a separate channel is maintained in each sub-band through simple frequency shifting techniques. The sub-bands are split back into separate signals at the other end using bandpass filters and frequency down-shifters. This is similar to the method whereby the phone company multiplexes many 3 kilohertz wide voice channels onto a single physical wire.

A concentrator is a device which allows the first "n" phone lines out of "m" possible lines ($n <= m$) to actually connect through to modems, and hence to a computer system. The n+1st dial in gets a busy signal. This sort of device is quite useful at any site with more users than dial in ports (such as a university).

Modems

Modems are used to transduce serial digital data to and from analog audio frequency tones which may then be sent over voice-grade phone lines without undue distortion and/or disruption of other phone company services. The Bell System markets an extensive (and expensive) line of modems which basically have set the standards for the industry as a whole. Most available modems claim to be compatible with one or more of Bell's standard models, hence it is sufficient to describe the characteristics of the Bell units.

Several different modulation techniques are used in modems, such as FSK (Frequency Shift Keying) and PM (Phase Modulation). FSK involves shifting a base, or carrier, frequency up or down a given incremental frequency to represent a logic 1 or 0 respectively. PM is typically used in conjunction with FSK to achieve multiple bit per baud speeds. Most 4800 and 9600 bit per second modems actually run at 1200 baud, with either 4PM (4 phase) or 8PM (8 phase) modulation superimposed. Note that PM type modems tend to be quite expensive.

As modems are useful only in groups of two or more, and are often symmetric in nature, the terms "originate" and "answer" are used to distinguish between the two possible roles. Some full-duplex modems are originate only, some are answer only, and some can swing either way. This primarily refers to which frequency they listen on, and which they talk on.

An originate modem typically transmits on the lower carrier frequency, and receives on the higher one. An answer modem is the mirror image of this, receiving on the lower and transmitting on the higher. Hence with full duplex modems, you need one Originate modem, and one Answer modem to establish a connection. The Answer modem is usually at a central computer site, while the Originate modem is at a remote terminal site.

With half-duplex modems (on a single phone circuit), a given modem runs as an Originate modem for a while, then the line is turned around and it runs as an Answer modem. Note that since data will always be traveling in one direction at any given time, only one carrier frequency is used.

Currently Available Modems

The Bell 103A is an asynchronous, originate/answer modem which has a maximum throughput of 300 bits per second. It uses simple FSK and can be run full-duplex. It leases for $25-$35 per month. Almost all modems used by hobbyists are compatible with this unit, such as the Novation Cat, D.C. Hayes Micromodem 100 and Apple modem, to name a few.

The Bell 201C is a synchronous modem which uses 4PM. It has a maximum throughput of 2400 bits per second. With a single phone circuit (2 wire) it must be run half-duplex. With a dual circuit (4 wire), it can be run full-duplex. It leases for $70 per month.

The Bell 202C is an asynchronous modem which uses FSK. It has a maximum throughput of 1200 bits per second, and may be run only half-duplex. The 202D allows full-duplex operation at speeds up to 1800 bits per second over 4 wire circuits. The modem leases for $35-$50 per month.

The Bell 208B, at $150 per month, is a synchronous modem which uses 8PM. It has a maximum throughput of 4800 bits per second, and runs only half-duplex.

Vadic has a unit which is not compatible with any Bell model, yet which is in widespread use (the VA3400 series). It is an asynchronous FSK modem with a maximum throughput of 1200 bits per second, and can run full-duplex on a 2 wire circuit. It leases for $55 per month. This is used in many commercial timesharing systems, such as TYMNET and TELENET. Note that this device appears to the computer or terminals as a 103A type device, except for baud rate.

Bell has recently announced a 212A model, which can run full-duplex 1200 baud asynchronous over a 2 wire circuit (as well as 103A style) to do battle with the Vadic 3400 (ah, competition!).

Connection to the Switched Telephone Network

In order to protect your equipment from possible voltage spikes, etc. from the phone system, and vice versa, a DAA (Data Access Arrangement) is inserted in the line between a modem and the actual wall jack. This is simply a circuit which will not allow any kind of damaging signals to get through in either direction. The phone company used to lease these units for approximately $5 per month, but no longer provides this service. DAA's are available for purchase from a number of companies (such as UDS). Most new modems being sold now include the DAA as an integral part of the modem (usually referred to as "Direct Connect").

Some modem/DAA combinations are capable of detecting an incoming call, and either answering by themselves or alerting the device to which they are connected. The device can then request it to go off-hook. Likewise, it is possible for a modem/DAA combination to originate a call (Auto-dial). This is sometimes done with touch tones, but usually with carefully timed clicks (on-hook/off-hook). If the device connected to the modem/DAA has a mechanism for going off-hook in order to answer an incoming call, it can also dial using timing loops. There is a Bell device called the 801C which can be used to implement Auto-dialing.

Some modems avoid the need for a DAA by using an *acoustic coupler*. This is a speaker/microphone pair which allows the audio signal to be coupled into the phone system through the microphone/speaker in a standard handset. This makes it easier to connect into the phone system, but has the undesirable side effect of being much lower level (by a factor of 8 or so) than a direct connect system, hence is much more subject to error. The reason for this lower level is to prevent interference of the outgoing signal with the incoming one. A standard handset feeds some of the signal from the mouthpiece microphone back into the earpiece speaker to make the user feel more comfortable. This unfortunately does not make the acoustic coupler at all happy, so the transmit level must be held very low to prevent interference.

A normal, randomly chosen switched line on the phone system typically has a 3 kilohertz bandwidth, and widely separated burst noise characteristics, averaging 10 msec in length, with an average error rate of one bit in 100,000. Better error rates can be obtained by going to "leased lines" with or without conditioning (which is very costly).

Simple Communications Systems

The first example of a communications system is a simple DTE-DCE link, such as a terminal to modem connection. In this case, we will need a straight (unflipped) 8 line cable, on the following pins:

2	TD	Transmitted Data	DTE ——→ DCE
3	RD	Received Data	DTE ←—— DCE
4	RTS	Request To Send	DTE ——→ DCE
5	CTS	Clear To Send	DTE ←—— DCE
6	DSR	Data Set Ready	DTE ←—— DCE
7	SG	Signal Ground	DTE —— DCE
8	DCD	Data Carrier Detect	DTE ←—— DCE
20	DTR	Data Terminal Ready	DTE ——→ DCE

If fewer lines are desired in the connecting cable, the absolute minimum is lines 2,3 and 7 with wraparounds on both ends to convince both parties that the other is really there. Note that in normal use, the terminal brings up DTR and the modem brings up DSR when they are powered on. Many terminals require an incoming DSR (and modems an incoming DTR) before they will operate. In an asynchronous, full-duplex environment, the terminal then brings up RTS, and awaits CTS from the modem (which is brought up, along with DCD, by the modem, once the incoming carrier has been detected). At this point, the terminal may transmit data to the modem over line 2, and the modem may transmit data to the terminal over line 3. In a half-duplex system, the RTS and CTS lines are used to determine which direction the data will be going over the phone line.

If the terminal (DTE) were to be connected to another DTE (for example a serial printer), the following pairs would have to be flipped: (2,3), (4,5) and (6,20); everything else should work as before.

Communications, cont'd...

As a slightly more elaborate communications system, we will connect a remote terminal to a local computer via the phone system:

- The first interface is a simple RS232 DTE to DCE connection between the terminal and the originate modem (Bell 103A), as described in the previous example.
- The second interface is between the modem and the phone system. In this case, we will be using an acoustic coupler, into a standard phone handset, using manual dialing.
- The third interface is between the phone system and the answer modem. In this case, we will use a direct connect auto answer modem, such as the D-CAT (also Bell 103A).
- The fourth interface is another simple DCE to DTE link from the answer modem to a computer port which is configured as a DTE, as described in the previous example.

Once software is installed to handle handshaking and auto answer, this communications system allows the remote terminal to dial in and use the system as if connected directly to it at 300 baud. □

More in a future article on the software used in data communications systems.

MODKOM

by Dennis Thovson

MODKOM is a set of programs that allows you to use your computer to communicate with other computers via a modem and the telephone system. Included in the package are programs that permit your computer to function as a local terminal to a remote computer system (or in a conversational mode with another computer) and a complimentary set of programs to transfer files between computers. The programs are available from Data Systems Inc. and are written in 8080 assembly language for the CP/M operating system.

These programs provide a general purpose CP/M communications capability. All input/output (I/O) from the programs are handled by calls to the console, reader and punch through the standard CP/M I/O BDOS entry at 05H. This technique allows these programs to run on any system using CP/M. However, the penalty paid for universal applicability, as implemented in MODKOM, is that you are restricted to a 7-bit plus parity ASCII format for all data transmitted. This is not too severe a penalty, for a couple of reasons. First, most information transferred by the average microcomputer user is text or ASM files, and second, there is a technique for transmitting 8-bit information (e.g., COM files) via the standard hex format which converts each 8-bit byte into two ASCII characters. The standard hex format can be converted back to 8-bit information by using the CP/M LOAD command.

The terminal program is called "Converse" and its principal function is to permit terminal-to-terminal communication between two computers. There are a number of modes which can be toggled on and off by entering specific control characters while in the Converse program (the control characters are not sent to the distant terminal). A set of control characters enables you to: transmit a named CP/M file to the distant computer system; save all incoming information in memory and subsequently write the saved information to a named CP/M file; and send incoming information to the printer. Control D toggles a full/half-duplex software switch. In the half-duplex mode, all characters entered at your terminal are echoed to your console. In the full-duplex mode, characters are not echoed locally, so if you want to see the characters entered at your terminal, the remote system must echo its received characters to you. (Most time sharing systems echo all received characters.) A control G (Goodbye) returns you to CP/M.

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Files transmitted while in the Converse program are sent without any error checking and as a single block. Therefore, the receiving end must be able to accommodate the entire incoming file in memory if no information is to be lost. Large files transmitted in this manner will have to be broken into smaller files and transmitted individually. Transmission of large files is better handled by the specialized file transfer programs called "Transmit" and "Receive."

Transmit and Receive are complementary programs for transferring CP/M files in a block mode with error checking. The command line syntax for both TRANSMIT and RECEIVE includes, respectively, the source and destination file names. The Receive program must be ready and waiting before the Transmit program starts to send the data. Files are sent in 2K blocks with no handshake protocol between the transmit and receive ends. The sequence of operations is as follows: the Transmit program reads a 2K block from the file, sends an ASCII "STX" (start of text) and starts transmitting the 2K block of characters. At the receive end, the Receive program detects the STX and reads the incoming 2K block of information into memory. When the Receive program has received 2K characters, it writes them to disk, resets its pointers and looks for the start of another block. While the Receive program is writing that 2K block to disk, the Transmit program reads in the next 2K block and transmits a predefined number of nulls. The Receive program ignores the nulls while waiting for the start of the next block. This sequence continues until the end of the file is reached. At the end of the file, the Transmit program sends an ASCII "ETX" (end of text) and a checksum for the entire file. The Receive program detects the ETX, calculates its own checksum, compares it with the received checksum and informs the user if the transfer was successful or not.

This type of file transfer sequence is an open loop system, i.e., the transmit and receive ends run independent of one another. This imposes some constraints on the timing of the data transfer to ensure that the receiver is ready when the transmitter starts to send data. In this case, the number of nulls sent by the transmit end has be be chosen to allow sufficient time for the receiving end to write the previous 2K block to disk before the next block is transmitted. If the disk systems at both ends are similar, the time difference between reading and writing a 2K block ought to be small, so the number of nulls required should be small. However, to be safe with

an unknown system, the instructions recommend setting the number of nulls to 200.

A pair of programs called "Unload" and "Hexcheck" are included as utility programs to handle non-ASCII files such as COM files. Unload converts 8 bit information into the standard hex format and saves it as a disk file. This file can then be transferred by the Transmit and Receive programs. The Hexcheck program reads a disk file containing a HEX file and calculates the checksum for each line of information. This intended as an error check on a received hex file. A hex file can be converted back to 8 bit information using the standard CP/M LOAD utility.

All programs are furnished in 8080 assembly language and can be assembled using either the standard CP/M ASM or MAC. The program developers intend that you modify your CP/M BIOS to incorporate the console I/O, reader and punch routines to handle the CP/M IOBYTE logical to physical device assignment. Also, your modem status, input and output routines will have to be integrated into your BIOS. The documentation furnished with MODKOM contains two sample BIOS listings as a guide to the modifications required. If you do not want to modify your BIOS, a program called "Mkbios" is furnished which must be assembled as part of each of the main programs, Converse, Transmit and Receive. At run time Mkbios replaces your BIOS jump table console related entries with jumps into Mkbios instead of your normal console routines. Your modem I/O requirements will have to be incorporated into MKbios for this method of operation.

If you modify your BIOS as instructed, there is a mode available which allows you to put your computer into a condition where it can be controlled directly by a remote terminal operating in the Converse mode. The remote terminal then functions exactly the same as your own local console. This mode is not available with the Mkbios option.

You must know and be comfortable with assembly language and your CP/M BIOS (or know someone who is) to bring these programs up. The documentation received was an early version and, while complete, was quite difficult to decipher. In talking with Fred Lepow, who wrote the programs, we discussed a different method of presentation for future documentation which should make it easier to understand.

I have used the primary MODKOM programs and they all function as intended by the authors. My principal use has been as an intelligent terminal on a time-share system. Files have been successfully transferred both up and down without any difficulty. Some of the console handling routines required modification for user convenience and these were passed along to the authors for consideration in future releases of MODKOM. Source code is furnished for all programs so you can, of course, add your own favorite features. One feature that I would like to see as standard is Transmit and Receive callable options from Converse so that large files can be transmitted without having to worry about available memory at the receive end. Also, in the normal Converse file transfer mode, I would like to be able to interrupt the file transfer at any point rather than lose control until the entire file is transmitted.

These programs fill a definite need in the expanding world of communications between micro computer users. The approach taken by the authors was to stay strictly within CP/M conventions so Converse, Transmit and Receive would be portable, without modification, to any CP/M system. These are no-frills programs that provide a basic communications capability that should meet most user needs. However, there are two areas that I think could be improved—file transfer synchronization and error checking. Although the open loop method of transferring files works with relative safety and without much loss of efficiency, it could be improved by implementing a simple "hand-shake" protocol for each block of data transferred. For example, Ward Christensen's MODEM program in the CP/M User's Group Library sends one sector along with a checksum and waits for an acknowledge (ACK) from the receiving end before transmitting the next sector. This solves two problems: The receiving end can delay sending an acknowledge to the transmitter until it finishes writing a block to disk, thus eliminating any synchronization problem between disk operations at either end; and any transmission errors are quickly detected so the sector can be immediately retransmitted in file sequence. The MODKOM approach of sending a single checksum for the entire file instead of for each block probably works well most of the time at 300 baud. However, it seems to me that block error checking has very little, if any, disadvantage and it certainly has potentially significant advantage.

MODKOM is available in 8 inch single density and 5 inch North Star disk formats. It can be purchased from: Datastat Systems Inc., 631 B Street, San Diego, California 92101, tel: (714) 235-6602. The cost is $60.00 □

COMMX and MCALL - Two Terminal and File Transfer Programs

by Glenn A. Hart

The growing interest in telecommunications with personal computers has led to a proliferation of software products designed to make the information interchange easier and more reliable. Programs are available for almost any hardware configuration and offer many features not previously available. These two programs are designed for use with a wide spectrum of systems running the CP/M and MP/M operating systems.

COMMX

COMMX acts as an intelligent interface between a personal computer and a time-sharing system, or between two personal computers. In addition to normal "dumb terminal" communications with a host system, COMMX handles file transfers both to and from the host system if the system supports the standard X-ON/X-OFF start/stop protocol. COMMX has provisions to route the entire dialog with the host system to a local disk file for later reference, allowing for "post-mortem" analysis of the session.

As with most such programs, communication between two personal computer systems requires that *both* systems operate with COMMX. Full conversational intercommunications are possible between the two systems, as are file transfers in either direction. A 16-bit CRC checking protocol is used as described later. COMMX will operate with either CP/M 1.4 or 2.2 (determining which version is being used and adjusting its operation accordingly) or with MP/M.

While the full source code for COMMX is available from the supplier, Hawkeye Grafix (23914 Mobile Street, Canoga Park, California 91307) for $250, most purchasers will undoubtedly order the object code only version which costs $75. This is an obvious attempt by Hawkeye Grafix to discourage purchase of the source, which does allow for the configuration to systems other than that of the purchaser, or at least to maximize their income from the dissemination of the full source code. I have not seen the source, but Will Pierce of Hawkeye indicates that it is heavily documented, with over 50K of code assembling down to the 6K executable object file. In any event, the buyer of the object code must specify the hardware environment in which COMMX will operate, including what I/O board will be used. Hawkeye will provide *two* implemented versions to a buyer of the object code version for the same $75 if both hardware configurations are specified when the program is ordered. COMMX versions are available for a broad spectrum of boards and systems listed in Table I. Documentation is direct and to the point (some might say a bit sparse) and clearly indicates how to use the program.

If the PMMI or Hayes versions are used, COMMX offers three initial options: answer, originate without dialing, or auto dialing. If auto dialing is chosen, the program dials a number input at the console and establishes the connection. An interesting feature is that the program works correctly with either 2 MHz or 4 MHz clock speeds automatically; it determines the system clock rate and adjusts internal timing loops.

Table I:
COMMX Available Configurations

Solid State Music 4SIO
IMSAI MIO and 2SIO
Micro-Da-Sys 4P4S
Delta Products CPU board
Apple Z-80 Slot 2 serial cards
Apple D. C. Hayes Micromodem
S-100 D. C. Hayes Micromodem
Vector Graphics Bitstreamer 2
Industrial Micro Systems 440
Datapro I/O Master
SuperBrain
TRS-80 Model II
PMMI modem card

Glenn A. Hart, 51 Church Road, Monsey, New York 10952.

Once the connection is made, the command mode menu shown in Table II is displayed. Most of the modes are self-explanatory. If the local mode is chosen, the menu in Table III is displayed. In Local Mode several choices duplicate standard CP/M functions without the need to leave COMMX. This is quite convenient, since these functions can be executed while the connection to the host computer is maintained. Turning console echo off can be useful if high speed file transfers are being made between two computers in the same room over a direct three-wire serial channel and a slow terminal is in use, or if a particular memory-mapped video display system would result in lost characters on the communications port while the CPU is scrolling the display. Such transfers can be made at speeds up to 9600 baud, and console echoing would obviously not allow such rates. The newest version of COMMX (6.0) displays a period for each 128 byte block transferred, which allows the user to know that things are progressing during such operations.

Table II
COMMX Command Mode Menu

COMMAND MODE FUNCTIONS:

1) LOCAL MODE
2) TERMINAL MODE
3) COPY HOST TO LOCAL
4) COPY LOCAL TO HOST
5) CONVERSATIONAL MODE
6) COPY COMM HOST TO LOCAL
7) COPY LOCAL TO COMM HOST
8) EXIT

Table III
COMMX Local Mode Menu

LOCAL MODE FUNCTIONS:
PRESS A THRU H FOR DIRECTORY OR:

1) COMMAND MODE
2) RENAME FILE
3) DELETE FILE
4) LOGIN NEW DISKS
5) CONSOLE ECHO IS: ON
6) TERMINAL MODE LOG
7) CTRL CHARACTER DISPLAY IS: OFF
8) 8 BIT DATA ENABLED

The control character display option is interesting. It causes all received control characters to display as the standard carat sign (^) plus the letter of the control character. This can be useful in unusual situations to determine what control characters are being transmitted.

COMMX allows direct transfer of full 8-bit files, but only if the serial board used supports more than the ASCII minimum 7 bits and the board has been correctly configured for such use. When set up this way, COM, INT and REL files can be transferred directly, without the need to use the supplied UNLOAD program to convert the file to HEX format.

Returning to Command Mode, normal terminal mode operates in full-duplex mode only, which is usually the desired method. As mentioned, terminal mode can be exited at any time, local mode operations performed and terminal mode resumed without losing the connection.

File transfers from the time-sharing host use the standard Control-S/Control-Q handshaking. A Control-G from the host is interpreted as an end-of-page indicator; the Control-G is not entered as data but is automatically acknowledged with a Control-Q to continue the transmission. This method worked on three time-sharing systems I tried; I gather these signals are quite standard on mainframe systems, but this is no guarantee of universality.

COMMX automatically allocates the largest disk buffer available given the user's memory. When the disk buffer fills up, COMMX sends a Control-S to stop the transmission, watching the line for a brief time to pick up any characters sent before the host stops transmitting. The buffer is written to a disk and a Control-Q sent to the host to resume sending. If the host does not recognize the standard handshaking, the size of the file which can be held in the disk buffer is about 50K bytes in a 64K system; this is the largest file downloadable without loss of characters in a non-handshaking environment. COMMX does not determine the end-of-file situation; the user must enter a Control-E to end the download.

Sending a file to the host works similarly. Whenever the commands that are necessary to set up the mainframe for accepting data are issued, the file to be sent is specified and transmission begins, continuing until the CP/M end-of-file marker Control-Z is encountered. COMMX prints a message to indicate that the complete file has been sent and the operator issues the necessary commands to the host system to close the newly input file.

Communication between two COMMX computers is even easier and more accurate. The conversational mode causes data keyed to be echoed to the terminal and simultaneously sent to the connected system. File transfers are similar to the host methods described above except that file operations are more automatic and a Cyclic Redundancy Check 16 protocol is used to assure perfect transmission and reception. The program calculates an ASCII equivalent of a full CRC 16 check as used in IBM 2780/3780 protocol and sends ACK or NAK signals to indicate good or bad transmission/reception. The program will re-try up to seven times to insure accuracy; after seven failures the operators are notified of the probability of a bad line. If an entire file is transmitted to its conclusion, it is a virtual certainty that the file has been conveyed with 100% accuracy.

MCALL

MCALL is available in two distinct versions, one for a wide spectrum of serial boards and computer systems, the other, designated AMCALL for its automatic dialing functions, specifically designed for either the PMMI or IDS modem boards. A version for Hayes Microcomputer Products boards is in development. The differences between the two versions are much more basic than the target hardware environment. While both function more or less similarly, the standard MCALL is written in 8080 assembly language while the modem board version is written in BDS C.

Both versions are provided in full source code. MCALL costs $85 and AMCALL $95 from Micro-Call Services, 9655-M Homestead Court, Laurel, Maryland 20810. I have never seen a better documented source listing than the MCALL assembly listing. It is virtually a tutorial on both good assembly language programming techniques and how UARTS and telecommunications hardware

work. An indication of how extensive the comments are is the fact that the soure file is over 104K bytes and produces an executable COM file of only 9K.

The AMCALL version is a veritable "Rosetta Stone" for those not yet familiar with this excellent C language. Tim Pugh, MCALL's author, mentions that he was attempting to verify the assertion that C could replace assembly in systems type programming. AMCALL is a very positive indication that is indeed the case. Tim also includes an interesting discussion of the relative merits of C versus Pascal and other high level languages. He focuses on C's superior handling of pointers, and his arguments seem compelling.

The documentation provided with each version is excellent—detailed and informative. AMCALL is sold configured for either of the modem boards now supported and is ready to run as provided. Full instructions on modifying MCALL for the user's hardware configuration are provided; anyone with even the most rudimentary knowledge of assembly language should have no problem. All that is necessary is to set flags to indicate the system clock rate, default duplex mode desired (the default can be changed during operation), the number of retransmissions allowed during transfers and the CRT screen clear code.

I have never seen a better documented source listing than the MCALL assembly listing. It is virtually a tutorial on both good assembly language programming techniques and how UARTS and telecommunications hardware work.

In addition to these parameters, two other choices must be made. Both versions of MCALL offer a choice of two buffering methods for file transfers. The normal mode is called Big Buffer, and works exactly like the COMMX method; the entire TPA is available to hold incoming data; when this fills up the host system is paused while the buffer is written out to disk. Big Buffer mode works perfectly with most host systems that accept standard handshaking, and the user could patch in non-standard handshaking characters into the MCALL source if necessary.

If the host system doesn't use *any* handshaking, the Double Buffer mode may work. This mode requires the host to send seven null characters at the end of each data line. MCALL maintains two buffers. While one is filling up, the other is written to disk during the sending of the nulls. This is dependent on critical timing, but can work. It is less desirable than the normal Big Buffer mode because of the constant disk accesses and somewhat touchy nature of the whole process.

MCALL also offers provisions for loading under DDT or SID. If a flag is set during assembly and the resulting MCALL file loaded with DDT or SID, a special escape character will transfer control from MCALL to the debugging program used.

Table IV
Boards/Systems supported by MCALL

The following systems/boards are currently supported:

1. TDL System Monitor Board (SMB)
2. Cromemco TU-ART board
3. INFO 2000 DISCO controller board
4. TEI Processor Terminal
5. JADE I/O Board
6. HEATH H-8
7. IMSAI MPUB processor board
8. Vector Graphics Bitstreamer II
9. SCION Microslice (Wordsmith computer)
10. AMD AmSYS 8/8 Microcomputer Dev. Sys.
11. SD Systems SBC-100/200
12. SSM I/O-4
13. Processor Technology (PTC) 3P+S
14. Digital Group System
15. Industrial Micro Systems IMS-440 I/O board
16. TRS-80 Model II with P&T CP/M 2.2
17. Godbout Interfacer II

MCALL supports a very large number of systems and/or boards, listed in Table IV. By virtue of supporting these boards, almost all UART's used in microcomputers are also supported (Table V). The documentation explains how to configure MCALL for a system not shown if the serial device is supported; if not, Tim Pugh will configure the unusual system for a modest fee.

When MCALL is invoked, a summary of the default configuration is displayed and the user is given the option of changing duplex mode, baud rate (if the serial board supports software controllable baud rate), protocol, "list status" (whether received files go to the printer or to a disk file) and the file name to be used in file transfers. All these factors can be changed during communications as well.

MCALL offers several protocols. The standard X-ON/X-OFF (Control-Q/Control-S) is normally used for communicating with time-sharing systems, but an alternate BREAK/RETURN protocol used mostly on Univac computers is also provided. MCALL uses its own protocol for transfers between personal computers. The protocol is based on similar concepts as that used by COMMX but has a few differences. A checksum system is used rather than COMMX's CRC 16, which is simpler but not quite as sophisticated. An article written by Tim Pugh for *Dr. Dobbs* is included on the distribution disk; it is very well written and informative, teaching the reader about protocols in one painless lesson.

As with modem board versions of COMMX, the AMCALL version offers the choice of auto-answer or originate modes. An excellent enhancement is provided

Table V
UARTS/USARTS Supported by MCALL

Intel 8251
Motorola MC6850
National INS8250
National INS6402
Signetics 2651
Texas Instruments TMS5501
Texas Instruments TMS6011
Various AY-(3,4,5)-(1013,1014,1015)

in originate mode. A disk file of commonly called numbers is maintained, and when originate mode is selected these numbers appear on the screen preceded by a single letter. Simply entering the chosen letter will dial up the system selected, establish connection and begin communications.

Once the user is satisfied with his initial configuration, a summary of the control characters support by MCALL is displayed (see Table VI). Note that escape characters are used to communicate with the program rather than normal control characters; this avoids problems with computers which intercept standard control characters and thus makes them available for sending to the connected system.

Table VI
MCALL Control Characters

ESC B	TRANSMIT A "BREAK"
ESC C	CLEAR BIG BUFFER (FILE RX MODE)
ESC D	DUPLEX MODE SELECTION
ESC E	EXIT CURRENT MODE
ESC F	FILE NAME SPECIFIED FOR SUBSEQUENT TX/RX
ESC H	HELP - DISPLAYS THIS COMMAND LIST
ESC L	LIST ON/OFF SWITCH (FILE RX MODE)
ESC P	PROTOCOL SELECTION
ESC R	RECEIVE (RX) A DISK FILE FROM A REMOTE DEVICE
ESC S	SIGNAL (BAUD) RATE SELECTION
ESC T	TRANSMIT (TX) A DISK FILE TO A REMOTE DEVICE
ESC W	WRITE BIG BUFFER TO DISK (FILE RX MODE)
ESC X	X'FER CONTROL TO DDT (ASSUMES PROGRAM LOADED BY DDT)
ESC ?	WHAT IS THE CURRENT SYSTEM CONFIGURATION?
ESC ESC	CONTROL CHARACTER DISPLAY ON/OFF SWITCH

Issuing any of the escape sequences pauses the communication process and clears the screen to display the command menu. The user can execute any sequence of commands and return to communications without losing the linkup. Several of the commands duplicate those in the configuration dialog which preceded connection; this allows parameters to be changed "on the fly" if the initial settings prove to be wrong.

ESC-B transmits a legitimate BREAK character to the host. This is necessary since CP/M does not support "break detect" and thus the BREAK keys found on many terminals will not work.

ESC-C works with ESC-W to provide complete control over the receiver buffer. A normal receipt of the file proceeds automatically, without operator intervention. The ESC-C/ESC-W mechanism allows the user to set up a receive file, talk with a remote system, and write to disk (or printer if the list flag is set) only those parts of the dialog worth saving. Thus MCALL has a more flexible logging system than COMMX since *either* complete dialogs or only selected portions may be retained for future reference.

ESC-^ toggles the display of control characters from the host on or off, while ESC-# allows the user to screen out any such control characters. This can be quite useful when first accessing a new host system; if strange things happen these commands can often isolate the problem, and sometimes solve it.

The AMCALL version offers one additional command. ESC-Z exits AMCALL and returns to CP/M without breaking the connection. AMCALL can be re-entered and communications resumed at any time. Regular MCALL also allows such exiting and restarting, but without a special command for that purpose.

Evaluation

COMMX and MCALL were tested in both serial board and modem board versions with an Industrial Micro Systems 440 I-O board and an Omnitec acoustic coupler and a borrowed PMMI modem board. Over a dozen CBBS systems, three mainframe hosts and several other personal computer systems were contacted. Files were transmitted in both directions, logs kept, etc.

Everyone likes clear-cut winners in confrontations, and I would love to say program A is clearly superior to program B, but this is simply not the case. BOTH programs worked perfectly. Any problems encountered with either when communicating with a remote system were always caused by inordinate line noise. This noise could sometimes be seen during normal terminal communications, but either program would make an accurate file transfer with another personal computer using the same software even under such adverse conditions (sometimes with quite a few retransmissions).

Thus the choice between COMMX and MCALL should be made on other considerations. COMMX comes preconfigured, is easy to use, and offers direct transfer of 8-bit files. MCALL is more flexible and has a larger command set, offers several features not available with COMMX and is even easier to use. Given that full source in either assembly language or C is available for about the same cost as the object code for COMMX, and MCALL is available for more systems, I expect that many purchasers would opt for either version of MCALL. □

S-100 Modems

by Mark Zeiger

An evaluation of the three plug-in modem boards currently available for S-100 systems.

During the past few years, modems have become very popular with computer enthusiasts. The modem may be used to communicate with timesharing systems and the ever growing number of computer bulletin board systems (CBBS) springing up throughout the country. The modem also serves as a means of transferring data from one computer to another without having to worry about disk or cassette compatibility. Incompatibility is no problem because most modems use the Bell Systems 103 standard.

If you want a modem for your computer, you have a choice of one that uses an acoustic coupler (a device that sends and receives through the earphone and mouthpiece of your phone) or a modem that connects directly to your phone lines. There are three firms making direct connect modem boards that plug into S-100 based computers. They are the Potomac Micro-Magic MM-103 Modem, the Hayes Micromodem 100, and the International Data Systems 88-Modem.

Acoustic Coupler vs. Direct-To-Line Modems

The S-100 modem boards each list for about $400, whereas an acoustic coupler type modem can be purchased for approximately $150 (or as low as $30 in a flea market, if you're brave)—so why should you buy the more expensive board? The reason is that they do have features that make the extra cost worthwhile. The most important of the features is the ring detect and auto-answer capability that makes it possible to run a computer bulletin board system or software exchange. Also, two of the boards are capable of operation at rates of up to 600 baud, which is very important if you plan a great deal of transfer.

The S-100 modems are also capable of detecting when communications have ceased and disconnecting the phone automatically. They all have an auto-dial feature which will allow another remote system.

Using these features the following scenario is possible, although the software to accomplish it is not trivial: your computer waits until a certain time of the day and then dials another remote computer. If it detects that the other computer has answered, it will send the information with checksums and retries on error (software implemented) to the other system, and then send a "break" to end the connection. If the remote does not answer (probably busy), your computer is programmed to try again after a certain period of time. This could be done over and over, calling different computers each time; thus a large amount of data transfer could be effected without any human intervention.

Mark M. Zeiger, 198-01 B 67th Ave., Flushing, NY 11365.

Physical Construction

Now for the details on these three boards. Each package consists of a completely assembled and tested S-100 board, a coupler that serves as an interface between the modem and the phone line (required by the telephone company), connectors and documentation. The Potomac Micro-Magic (PMMI) and Hayes Microcomputer Products' boards are both neatly laid out and seem to be professionally constructed, while the International Data Systems (IDS) 88-Modem looks like some of the boards that I've put together. This is not a compliment! The board is so dense that resistors and diodes must be stood on end to fit them on the layout, and some of those diodes were piggybacked onto other diodes. There are also a number of jumpers that have to be soldered or resoldered to change the IDS modem functions. The protective couplers that come with the PMMI and Hayes boards are neat, attractive boxes that seem to have been manufactured specifically for each firm; the coupler for the IDS is a type CBT and is larger and not as attractive as the other two. However, the boards are going to be inside a computer and the couplers can be hidden, so who cares what they look like, as long as they work? (More on that later.)

Documentation & Software

Documentation is important with these boards since the software needed to run them can be complicated. Even using the simplest functions, the modem chip and UART must be initialized and the correct mode and baud rate must be selected. The PMMI and Hayes documentation are in attractively bound booklets (forty-nine and

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eighty-eight pages, respectively) while the IDS documentation is unbound and punched for a three-ring binder. However, appearances can be deceiving and the IDS documentation has some very good points. Each function of the board is explained separately and in detail. It also gives examples in both Basic and Assembly language showing how to program each function. Thus the reader is not overwhelmed by one large program and does not have to try to figure out what each group of instructions is attempting to accomplish. Most of the software in the back of the IDS manual is skeletal and probably cannot be used as written if you want a convenient, complete program to run your modem. In some cases the Basic programs can only operate with one type of Basic (Mits Basic 3.2) since it requires "peeks" and "pokes" to disable the control-C function. The instructions dealing with how to program the jumpers on the IDS are complicated and require multiple readings.

The Hayes documentation is very nicely done. It starts off with an excellent description of the history of the Bell 103 type modem and goes on to explain how a modem works. It describes, in understandable terms, each of the board's functions and the registers associated with that function. Finally, it lists a series of CP/M programs that can be used with the board. The listings are thirty-eight pages long and very well commented. The programs are comprehensive and well thought-out, using most of the capabilities of the board. The main program is menu driven, a feature I believe is extremely important in any modem program. However, one of the Hayes programs requires an eight inch CP/M single density disk in order to operate properly (the program actually rewrites some of the sectors on the system tracks).

I feel the PMMI documentation is the poorest. The phrases used to describe some of the functions and registers are unclear and not always in layman's terms. For instance, in one section they refer to the transmit data input as being "unclamped from the steady mark." If you're new to the data communications game, you have to guess what these terms mean. The documentation includes some examples of programs in Basic and assembly language. Unfortunately, none of the assembly language programs worked as written, and when I finally got them working, they were not very useful.

All three vendors offer their programs on disk at an extra charge. The PMMI disk consists of all the programs in the manual, plus a few extra. In my opinion, the best program on the disk was one from the CP/M users group written by Ward Christensen. PMMI also has a disk consisting of programs that run under North Star DOS. Each disk costs $15. Hayes sells a disk containing only the programs that are listed in their manual. I feel their $25 charge is out of line. IDS sent me a disk containing programs for North Star DOS, but the documentation was poor and the source was not included (thus, if you cannot use the standard ports on their boards you have to type the source code to assemble it yourself). Their magazine advertisements indicate that they also have software for a number of different systems.

Setting Up The Modems

All three boards are very easy to set up. Each uses four consecutive port addresses for modem and UART control. The base port is selected by DIP switches and the other ports are addressed consecutively above the base port. The board is then put in one of the S-100 slots and a connector from the coupler is attached to the modem board. The other wire from the coupler is a modular plug that connects to the phone line. Instructions from all three companies tell you that you must inform your local phone company when tying into the phone network.

Some adjustments might be necessary on the boards. The PMMI board has a potentiometer that must be set for optimum dial tone detection. This is accomplished quite easily with the aid of a short Basic program listed in the manual. There is also a threshold adjustment that shouldn't have to be changed from the factory setting. On the Hayes board, the carrier detect sensitivity can be changed from -40db to -50db via a DIP switch. In most cases it should be left at the -50db setting. The IDS modem has five potentiometer adjustments which are factory set. However, if a user chooses to adjust them, he will have to follow instructions for this operation that take up six pages and require a VU meter or a voltmeter. If you aren't familar with using these instruments, the adjustments may be tricky.

Feature Differences

These three boards do have many similar features, but they also have important differences. They all have auto-dial, ring detect, and auto-answer. They are Bell 103 compatible and can be set up in originate or answer mode. They each can send from five to eight data bits, one or two stop bits (1.5 when 5 data bits are selected) and odd, even, or no parity. They all function at the standard rates of 110 or 300 baud (plus other rates), and they can all generate interrupts in special situations.

One of the most important differences between the three boards is in baud rate. The PMMI and IDS have baud rates from 60 to 600 baud. The rate is selected by software and can be changed during communication if necessary. The Hayes board can select 300 baud and one of the following: 45.5, 50, 75, 110, 134.5, 150 or 200. The lower choice is selected by changing diodes on the board; the choice between 300 and the lower rate may then be made by software. The board is shipped with the lower rate set at 110. It should be pointed out that the higher rates (above 300) of the PMMI and IDS may be used only with other modems having similar ability, but it is a nice feature to have and you'll find enough people with these boards to make the higher rates worth having. At 600 baud the PMMI usually works well, with occasional difficulty when calling certain exchanges. For instance, I find it difficult to send or receive at rates greater than 450 baud between New Jersey and New York City, but I have been able to transfer a great deal of data at 600 baud between myself and California with no errors. I had a great deal of trouble getting the IDS board to function, and I was not able to extensively test its reliability at rates other than 300 baud.

While all three boards can generate interrupts, their capabilities for doing this are quite different. The IDS only generates an interrupt on ring detect, or when the receive buffer is full (DAV). The choice is made by a jumper and not by software. The Hayes board may generate interrupts on the following: ring detect, transmit buffer empty (TBMT), receive buffer full, 50 ms timer, or carrier lost. These interrupts are chosen by jumpers on a

FEATURES OF S-100 MODEM CARDS

Features	PMMI MM-103	IDS 88—Modem	D.C. Hayes	IDS 100-Modem
Modem IC	Motorola MC6860	Motorola MC6860	Motorola MC14412	Motorola MC6860
Modes	Answer/Originate	Answer/Originate/ Self Test	Answer/Originate	Answer/Originate/ Self Test
UART	D3-6402C-9	AY-5-1014/1015	AY-5-1013A	AY-5-1014/AY-5-1015
I/O Ports Used	4	4	4	4
Number Data Bits	5 - 8	5 - 8	5 - 8	5 - 8
Number Stop Bits	1 - 2	1 - 2 (1.5 with 5 data bits) (1.42 with 5 data bits)	1 - 2	1 - 2
Parity	odd, even, none	odd, even, none	odd, even, none	odd, even, none
UART Status				
Data Available	yes	yes	yes	yes
Transmit Buffer Empty	yes	yes	yes	yes
Receive Parity Error	yes	yes	yes	yes
Overrun	yes	yes	yes	yes
Framing Error	yes	either FE or break from Modem jumper selectable	yes	yes (either framing error or break detect)
Baud Rates	61 - 600	61 - 600	45 - 300	61 - 600
Number Baud Rates	256	256	2 (300 baud and hardware strapped lower rate)	256
Timer	256 values from 40 microseconds to 100 millisec	not required, dialing and timing implemented in hardware	50 milliseconds	not required, dialing and timing implemented in hardware
Receive Sensitivity	-50 db	-60 db	-50 or -40 db switch sel.	-50 db
Carrier Detect LED	no	no	yes	yes
Dial Tone Detect	yes	yes	no	yes
Ring Detect	yes	yes	yes	yes
Auto Dial	yes	yes	yes	yes
Power-up on Ring	optional	no	no	no
Long and Short and Detection Break Generation	yes	yes	yes	yes
Self Test Feature	yes	yes	yes	yes
Interrupts	5 software sel.	1 of 2 possible jumper sel.	5 jumper sel.	1 of 2 jumper selected
Control of External Devices	possible	no	no	no (a buffered audio output is provided)
Schematic	none supplied	none supplied	yes	yes
Warranty	1 year	90 days	2 years	90 days
Software	North Star $25-30 8" CP/M $25	8" CP/M $10 8" CDOS $95 5" NorthStar $10	8" CP/M $25	8" CP/M $10 5" North Star $10 8" CDOS $95
Price (with coupler) assembled and tested	$359.95	$395	$399	$395

Addresses:

Potomac Micro-Magic, Inc.
5201 Leesburg Pike
Suite 604
Fallschurch, VA 22041
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(703)661-8442
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D.C. Hayes Associates
10 Perimeter Park Drive
Atlanta, GA 30341
(404)455-7663

header socket, but more than one interrupt may be jumpered. In addition, the Hayes provides for jumpering these signals to the reset line of the S-100 bus so that the system can be reset instead of being interrupted when a condition is met. The interrupt on carrier lost can be particularly useful when setting the computer up as a timesharing system. Instead of all software constantly having to poll the clear-to-send (CTS) status to see if the caller has hung up prematurely, a reset or interrupt can be used to reboot the system and restart the software.

On both the IDS and the Hayes board, the modem must be in answer mode before interrupt on ring detect can be effected. The PMMI modem board can be set to generate interrupts upon TBMT, DAV, ring detect, dial tone detect, and a pulse from the timer. The choice of interrupt is made via software; no jumpers are needed. This board does not generate an interrupt when the carrier is lost, as does the Hayes. On all three boards an interrupt flip-flop must be set before interrupts can be generated and the system CPU must naturally have interrupts enabled.

The Hayes and PMMI modems both have timer capabilities besides those inherent in the modem chip itself. The timer pulse on the Hayes is set at 50 milliseconds and its status is read via an 8080 input instruction from a port. The PMMI has a variable timer from 40 microsends to 100 milliseconds that is set from the baudrate port. This timer cannot be used while communications are in progress since it uses the baud rate generator, but it can be used for timing that is needed while communications are being established or while dialing. The timer can also be used for non-modem purposes; I use it for delay loops when driving a Selectric typewriter. It is also possible to connect auxilary devices to the PMMI and control them with software. One suggestion made in the manual is for a circuit that will power up the computer when the phone rings (the coupler of the PMMI does detect ringing and is powered by the phone line). The other two boards don't have this capability.

I stated that I had trouble getting the IDS modem to work. I received the board late from the company and used all combinations of software trying to enable the modem. When I contacted the people at IDS, they were friendly but not very helpful. They told me that they would have one of their software experts call me with some advice, but I was never contacted by them again. I finally got the modem to work by using the IMSAI 8080 CPU board instead of the Cromemco Z-80 that I usually use. So beware! It seems that the IDS modem will not function with a Z-80—or at least not with a Cromemco Z-80. *(Refer to editorial comments in the gray box.)*

I have had reason to contact the people at PMMI for information and to return a board that was not functioning. They were courteous on the phone and spent time answering my questions. When I had to send the board back for repair (a bad 7400), they had it back to me within the week. A letter sent to Hayes was answered quickly and to my satisfaction. Their board worked well from the start.

The table compares the features of the modems. This should help you choose a modem, if you want one of the S-100 type boards. Hayes Microcomputer Products also makes a modem board for the Apple Computer that presumably has features similar to their S-100 board, but that's an article for another magazine. □

Editor's Comments On IDS 88-Modem

After this article was written we checked with IDS regarding the inability of the 88-Modem to operate with the Cromemco Z-80 CPU. They informed us that the PWR signal for the CPU is different from that of most other 8080/Z80 CPU cards on the market and that two jumpers on their modem card must be changed to accommodate the Cromemco CPU. They report that they have a great many Cromemco users and in fact furnish a Cromemco CDOS software disk which contains special software for dedicated time/calendar operated system applications.

Furthermore, IDS pointed out that the 88-Modem is shipped from the factory for a CBT type data access arrangement (unless specified otherwise) but that it can be rewired (via jumpers on the board) for the type CBS data access arrangement. IDS also furnishes a balanced line transformer as option, which is necessary when two modems are wired directly to one another. This versatility, combined with the fact that the 88-Modem had 10db more sensitivity (8-pole filter circuit), explains why there are more components and jumper options on the 88-Modem board. IDS plans to continue selling both the 88-Modem and 100-Modem boards.

The 100-Modem board was just going into production as this article was being edited and hence was not actually tested. IDS furnished the specifications for the 100-Modem board and they were integrated into the article by the editor. □

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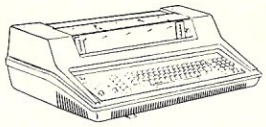

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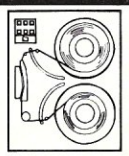

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The CP/M Connection, Part 5

by Chris Terry

Part V-A Real Application

What, Another BLEEDIN' PRINT UTILITY? Grrrr!

That's right! But it's not that big, has some new features that you may like, and gives me a chance to talk about the hooks into CP/M, as well as a few other things.

All those print utilities in the CP/M Users' Group library are fine as far as they go, and work well, but they have one big failing and some minor inconveniences. The big failing is that they follow too strictly Humpty Dumpty's prescription for a good story: "Begin at the beginning, go on till you come to the end, and then stop." That's alright for a first printing, but what about the times when we have drastically changed one routine on page 18 of 24? Can we print just that page? No way! I got so frustrated with this that the first change in my new version is the ability to print from any page to any later page or, of course, from page one to the end.

The print utilities' minor inconveniences are:

- They are set for 60 lines on a page 66 lines deep. Well, I have a Hytype printer that likes an elite wheel, with a page 88 lines deep. So the next change was to vary the number of lines printed. You can set the first line and the last line, so if you want you can print twelve lines in the middle of each page.
- Error messages are not helpful, usually consisting of just one word "ERROR." Yech! Was it a file open error, a read error, or what? Let's at least distinguish between those two.
- The very first operation is a form feed. This makes no sense to me. If we didn't tear off the last printout, we are already at top of form. If we did, we had to move the paper up to bring the inter-page perforations clear of the printer, so we have to wind it up again to the top of the next page— and the program now skips yet another page. My version prompts you to set a new page and initialize the printer, waits till you have done so, and then starts with the title of page one.

I am sure some of you will think these are idiotic gripes. But in these days of cheap memory, there's no excuse for being chintzy about prompts, error messages and operating procedures, when a few more lines of code will make the program "user-friendly" (if you'll forgive the Madison Avenue hype). This is something I feel strongly about. I spend a lot of time at my work cooking up data entry programs for non-technical people who need explicit (but not verbose) directions from the program. If they don't get these, they infallibly find new ways to defeat the data validations, and sometimes even manage to give the Operating System hiccups.

Chris Terry, 324 E. 35th Street, New York, NY 10016.

The Structure Of NEWPRINT

Before I get into specifics on the CP/M hooks and on some of the routines, I want to talk about the general structure of NEWPRINT. I am not pushing "structured programming," since nineteen programmers will have seventeen different ideas on just what that is. There is even a myth going around that assembly language is unsuitable for structured programs. It's true that it is much easier to write spaghetti-bowl assembly code than to write easily understandable and maintainable code. But any structure is better than none; I strongly believe that each of us should develop for ourselves a style that is logically sound and visually striking, and that we should follow our guidelines in all our programs. It is not necessary to be rigid, that is why I use the term "guidelines" instead of "rules." My own guidelines are set out below, and may make it easier for you to follow what's going on in NEWPRINT. My particular style has grown out of the fact that I'm a technical writer, and I have come to look on the language and the visual impact of the listing as a precision instrument for communicating the logic.

History and Operation

I always start a source listing with a brief introduction giving the date of coding, and subsequent modifications. I like to have a brief statement of what the program does, and a summary of any special features or hardware and software constraints. If these grow too large, they should go into a separate .DOC text file, but the source listing should have a reference to such a file. And finally, it should have brief operating instructions, or at least how to enter the program and perform its major functions.

Constants and External References

All constants and the addresses of external routines called by the program should be defined by EQU statements and grouped right at the beginning or end of the program. My preference is to put them at the beginning,

because they are usually known by the time coding starts; then if I forget what I called something, i can go back to the Equate section and look it up. It helps me to be consistent as I am working, and so avoid those "UNDEFINED" error messages at assembly time.

It is obvious that the addresses of external routines must be defined here, but what about constants? Yes indeed, ALL constants too! To my mind, dropping numeric constants into a program is like dropping one's contact lenses onto a patch of wet pebbles—you have to find them again before they are any good to you. And when modifying some value, it's all too easy for me to miss one occurrence of it. But when it comes time to change the program all occurrences of a symbolic constant can be changed simultaneously merely by redefining it in a single EQU statement up front. In NEWPRINT, for example, if you think my buffers are too long or too short, you can change the space alloted merely by redefining STAKLEN or NUMSEC. If you don't have elite type, redefining MINL and MAXL to 4 and 63 will give you 60 pica lines per page and take care of all references to these values at assembly time.

One joy of assembly language is that there is a comment field on every single line, just waiting to be filled up.

The Main Program and the Subroutines

I have found that I understand my programs better, six months after I have written them, if I have a setup section (which may call subroutines), a main program which is little more than a loop consisting of subroutine calls, and a subroutine for each important logical function. Where I have to jump out of the main line, I prefer to jump forward to a separate block which performs its function and then returns to the appropriate point. I am well aware that this is not always efficient, either in keystrokes or in execution time, but then most of my programs are I/O bound (I don't do much number crunching)so efficiency is not of prime importance. On the other hand, this way of working allows code lines that perform a particular function to be separated out and made visible by blank or comment lines. If you look at the main printing loop from 0121 to 0138, you will see what I mean. The TBLP tab expander and the PCLF end-of-line code were originally embedded in the main line between the end of LOOP (at 0132) and the beginning of LOOPX (at 0133). They were perfectly functional, but it was not so easy to spot what they were for, especially as they were very sparsely commented.

A logical function should have only one entry and one exit. This is not easy, and sometimes not feasible in assembly language, so I'm not rigid about it, but when it can be done it makes changes much easier. I prefer to follow logic downward, even if this results in jumps to another jump which then takes us back to the top of a loop, rather than have several exits that go backward—and all too often land us right in the spaghetti bowl.

Comments

One joy of assembly language is that there is a comment field on every single line, just waiting to be filled up. None of this nonsense about a GOTO or a GOSUB having to be the last statement on a line (which precludes comments). Let us be generous with comments, but let us also make them work for us. Better no comment than:

```
SUB  B  ;Subtract content of B reg.
```

What, in heaven's name, have we got in the B register? Or in A? It's no more work, and a lot more helpful, to say:

```
SUB  B  ;BOTM-TOPM
```

when we know what BOTM and TOPM contain (from previous comments or definitions).

CP/M Hooks (And Traps)

Console Functions

Now we are getting to the meat and potatoes. At 0115 we have a call to SETUP, which uses the CP/M Write Console Buffer function to output prompts, and the Read Console Buffer function to collect the responses. Write Console is simple to use; just put the function code (09H) in C and the address of the message in DE. Writing continues until a $ sign is found; thus, a multiline message that includes CR-LF sequences can be written with a single call to BDOS; MARMSG (the prompt for line numbers) and PAGMSG (the prompt for page numbers) are examples of this.

Read Console is a little more tricky. You have to define a buffer (in this case, ABUF) and put the maximum length (in bytes) in the first byte. ZBUF (0383) does this, and also initializes the rest of the buffer to 00. To collect keyboard input, we put the function code (0AH) in C, the address of the first byte of ABUF (which has the maximum length value) in DE, and call BDOS. A CR-LF is issued to the console and BDOS waits for keyboard input. As each key is struck the character is echoed to the console and put in ABUF, starting at ABUF+2, until CR is hit; the CR does not go into the buffer but writes CR-LF to the display. The second byte now contains the number of characters just received. This is useful if you don't want to clear the buffer every time you use it.

You can, if you wish, use the standard Console/Disk buffer (TBUF) from 80H through OFFH. However, my own tests (CP/M 1.4) on this showed the message starting at TBUF+4—TBUF contained a 2-byte length and TBUF+2 a 2-byte count, which is not kosher according to the manual. I have not figured this out yet, and I was getting unpredictable results, so I kept things simple and used ABUF for responses. When scanning, I first check ABUF+2 for a slash (indicating default values). If it's not a slash, ADEC scans ASCII decimal digits from ABUF+2 until it finds a non-decimal delimiter, converts the decimal number to binary, and stashes it away. Then ADEC is called a second time to convert the second number. ABUF is ten bytes long to hold two 3-digit numbers and a delimiter. ADEC can convert up to five digits to a 16-bit binary number.

One other Console function is used, Interrogate Status. You will find this in the PBYT routine starting at 01C6. This is the routine that outputs bytes from the file to the list device, provided that the Print Enable flag is set to indicate that the current page is within the printing range you gave it. Interrogate Status does not look at the

DE register pair; just put OBH in the C register and call BDOS. It is used at 01E4 after printing each byte to see if an abort has been signalled by pressing some key. But BEWARE. This function drove me crazy for nearly a week. The original code (composed for CP/M 1.3) had CPI 0 instead of ANI 1 to test the response, but the contents of bits 1 through 7 of the A register are undefined on the return from BDOS; only bit 0 is significant—0 for no input, 1 if any key was pressed. The CPI 0 had worked in previous versions of the program, but now some bit other than 0 was consistently set, so that the program always aborted before printing anything. At first I thought I had an unbalanced stack, but examination of the stack area showed that the last return address was 01E9, and consultation with a friend reminded me to read the manual again; it clearly specifies bit 0 as the test criterion. *Always* read the manual carefully, and *never* take anybody else's coding as gospel truth.

Always read the manual carefully, and never take anybody else's coding as gospel truth.

An error in opening the file causes a branch to NOFILE at 01F7. This piece of code (a CALL instruction followed by non-executable message text) has caused raised eyebrows and baffled mutterings in some quarters. In fact, it is a perfectly standard method of passing the address of a parameter list to the destination routine. Don't think of it as a subroutine CALL expecting a RET, think of it as a simulated JS (Jump and Store) instruction that pushes an address on the stack and expects the destination routine to recover that address with a POP instruction. If you look at ERR (0165) you will see that the address of the "CANNOT OPEN FILE" message is popped off the stack into DE, the Write Console Buffer code is put in C, and BDOS is called to write the message. On return from BDOS, a jump to EREXIT picks up the CP/M stack pointer and reboots the system. Parameter passing methods are discussed in more detail in an article by S. Mazor and C. Pitchford, entitled "Develop Cooperative Microprocessor Subroutines" (Electronic Design, No. 12, June 7, 1978).

Let's take a look at GETBT (0310.) When we first enter the program, the pointer stash INPTR (03C3) is initialized to contain the address of the first byte past the end of the disk buffer. The first call to GETBT sets DE to that address, loads the contents of INPTR into HL, and compares them. Since they are equal, the buffer is obviously empty and control is transferred to FILBUF (032D) which will refill the buffer from the disk. On completion of the Read, INPTR is loaded with the address of the start of the buffer and is incremented each time a byte is taken off the buffer and printed. Thus, each time the buffer is emptied by GETBT, FILBUF replenishes it until End-of-File is reached.

Since we are not using the standard 1-sector buffer at TBUF (80H), we have to tell BDOS where to load memory from the disk. On the first pass through FILBUF, we put the buffer start address in LOADA and in DE, put the SETDMA (or here DEFDMA) code in C and call BDOS. To do the read, we put the Read code in C, the address of the File Control Block in DE, and call BDOS. There are several ways of setting up for multiple sector reads. I have chosen to initialize a counter (CURSEC) in memory to NUMSEC and count it down to zero. After each read, we get the starting point of the completed read from LOADAD, add SECLEN to it (128 for single density, 256 for double density), stash the updated address back in LOADAD and in DE, and call BDOS to update the starting address of the new read.

A good read within the file returns 00 in the A register, and we continue reading until the buffer is full. There are two other possible conditions, handled by CKEOF (0366) if we do not get a 0 (good read) back from BDOS. One of these is the End-of-File condition (1 in the A register); we stop reading, but go back to GETBT to allow printing to continue. When the main loop fetches the first EOF marker (1AH) from the disk buffer, we take a normal exit to CP/M via DONE (0159). The other condition is non-recoverable disk error which returns something other than 0 or 1 in the A register. In that case we drop through CKEOF into RDERR (036B), which is similar to NOFILE. ERR prints the "READ ERROR" message on the console, and EREXIT cleans up and reboots CP/M.

Disk Functions

Three disk I/O functions are used in NEWPRINT: Open File, Set DMA, and Read next sector. The initialization section calls the FOPEN subroutine (at 02E8) to open the file passed as an argument in the PRINT command. To open a file for sequential reading, put 0FH in the C register, the address of the File Control Block (in this case, the standard TFCB at 5CH) in DE, and call BDOS. On return, the A register contains either 0FFH if the file was not found, or the byte address of the FCB containing the directory entry. BDOS transfers the entry from the disk to the specified FCB. A successful open initializes the NR (next record) byte of the FCB, and subsequent Read operations update it.

Writing the List Device

The last CP/M function to be described is Write Character to List Device. This is used in PBYT (01C6) to send characters (fetched out of the disk buffer by GETBT) to the list device. To ouput a character, put the function code (1AH) in C, clear D, put the character itself in E, and call BDOS. The Write List function does not trap or filter characters; it is transparent to the user. All character trapping must be done by the calling program—refer again to LOOP-LOOPX and the associated special processing routines TBLP (Tab expander), PCLF (end-of-line processor), and DONE (normal exit on end-of-file).

With this guide to the structure of the program, I believe that the comments in the listing are adequate to fill in the details. I have tried to be explicit about multi-sector reading from a sequential file. Writing to a sequential file is similar except that the application fills OBUF until OPTR points beyond the end of the buffer; then we do a Write (instead of the Read used in this program). In a future installment I shall discuss and illustrate reading and writing to a random file, which is a little more complex. □

```
                ;*********************************;
                ;     FILE PRINT UTILITY          ;
                ;*********************************;

                ;       ORIGINAL CODED BY JEFF KRAVITZ AND MODIFIED
                ;       10/15/77 BY A. GOLD FOR <FF> HARDWARE.
                ;       LARGELY RECODED BY CHRIS TERRY, 1/15/81 FOR
                ;       DAISY WHEEL OR SPINWRITER PRINTERS.
                ;This print utility is for use with any CP/M system;
                ;it is an enhancement of the PRNT utility in Volume 1
                ;of the CP/M Users' Group library.  The revision:
                ;       1)  Assumes a printer that responds to Form Feed (0CH);
                ;       2)  Assumes a printer that can be manually set for
                ;           pica or elite type, and that any hardware
                ;           automatic form feed at page end can be turned off;
                ;       3)  Requests line numbers for 1st and last lines
                ;           on each page (on /, defaults to 5 and 84 for elite,
                ;           giving 80 lines with equal 1/2" top and bottom
                ;           margins for elite type);
                ;       4)  Requests numbers of 1st and last pages to be
                ;           printed (on /, prints all to max. 255);
                ;       5)  Requests that paper be set to top of new page and
                ;           any hardware auto form-feed turned OFF.
                ;       6)  Multisector disk buffer to reduce number of disk head
                ;           loads, especially when not printing.

                ;Invoke the utility with the PRINT
                ;command and the name and type of the file to be
                ;printed.  When asked for line numbers or page
                ;boundaries for printing, type the first and last
                ;numbers separated by a space (Page limit is 255)
                ;or a slash to keep defaults.
                ;       A>PRINT file.typ

                ;*********************************;
                ;     MISCELLANEOUS EQUATES       ;
                ;*********************************;

                ;       *** CP/M ADDRESSES***
0000 =          BOOT    EQU     0000H   ;REBOOT ENTRY POINT
0005 =          BDOS    EQU     0005H   ;BDOS ENTRY POINT
005C =          TFCB    EQU     005CH   ;TRANSIENT PROGRAM FCB
                ;
                ;       ***CP/M FUNCTION CODES***
000F =          OPEN    EQU     15      ;OPEN FILE
0014 =          READ    EQU     20      ;READ SECTOR
000A =          RDCON   EQU     10      ;FILL CONSOLE BUFFER FROM KEYBOARD
000B =          CSTAT   EQU     11      ;GET CONSOLE STATUS
0001 =          RDCHAR  EQU      1      ;GET A CHARACTER FROM KEYBOARD
0002 =          WRCHAR  EQU      2      ;WRITE A CHARACTER TO CONSOLE DISPLAY
0009 =          WRMSG   EQU      9      ;WRITE A STRING TO CONSOLE DISPLAY
0005 =          WRLST   EQU      5      ;WRITE A CHARACTER TO LIST DEVICE

001A =          DEFDMA  EQU     26      ;SET DMA (I/O BUFFER ADDRESS)

                ;       ***ASCII CHARACTERS AND OTHER CONSTANTS***
0009 =          TAB     EQU     09H     ;ASCII TAB CODE
000A =          ASLF    EQU     10      ;ASCII LINE FEED
000D =          ASCR    EQU     13      ;ASCII CAR.RET
000C =          FORM    EQU     12      ;ASCII FORM-FEED
001A =          EOF     EQU     1AH     ;END-OF-FILE MARKER
0000 =          PAD     EQU     00      ;SOME PRINTERS PREFER RUBOUTS (FF)

000C =          TOFNULLS EQU    12      ;NULLS AFTER A FORM FEED
0004 =          CRNULLS EQU      4      ;NULLS AFTER A CR

000A =          ABUFLEN EQU     10      ;ENOUGH TO HOLD 2 3-DIGIT NUMBERS & SPACE
0080 =          SECLEN  EQU     128     ;SECTOR LENGTH (IN BYTES)
0008 =          NUMSEC  EQU     8       ;NUMBER OF SECTORS IN THE DISK BUFFER
0400 =          BUFLEN  EQU     SECLEN*NUMSEC  ;LENGTH IN BYTES OF DISK BUFFER
0040 =          STAKLEN EQU     64      ;LENGTH OF STACK AREA;
0005 =          MINL    EQU     5       ;DEFAULT 1ST PRINT LINE (FOR ELITE)
0054 =          MAXL    EQU     84      ;DEFAULT LAST PRINT LINE (FOR ELITE
0001 =          MINP    EQU     1       ;LOWER PRINT RANGE BOUNDARY (DEFAULT)
00FF =          MAXP    EQU     255     ;UPPER PRINT RANGE BOUNDARY (DEFAULT)

0100            ORG     100H

                ;*********************************;
                ;          MAIN LOOP              ;
                ;*********************************;

                ;
                ;       *** INITIALIZATION ***
                ;
0100 210000     START:  LXI     H,0
0103 39                 DAD     SP      ;PUT THE CP/M STACK POINTER IN HL
0104 22BA05             SHLD    OSTAK   ;AND SAVE IT;
0107 31B605             LXI     SP,STACK;THEN SET UP A LOCAL STACK
010A AF                 XRA     A
010B 32C103             STA     PFLAG   ;CLEAR THE PRINT FLAG.
010E 32BE03             STA     PAGE    ;INITIALIZE PAGE COUNT TO 0.
0111 3C                 INR     A
0112 32BD03             STA     LINE    ;INITIALIZE LINE COUNT TO 1.
0115 CD6B02             CALL    SETUP   ;GET LINES PER PAGE & PRINT PAGE RANGE
0118 CD4902             CALL    PCHEK   ;SEE IF PAGE 1 IS TO BE PRINTED (INCREMENTS COUNT)
                ;
011B CDE802             CALL    FOPEN   ;OPEN FILE
                ;
011E CD7E01             CALL    TOF3    ;PRINT HEADING ON PAGE 1 (BUT NO FORM-FEED).

                ;********** MAIN PROGRAM & EXITS TO CP/M **************************

                ;               ***Main Printing Loop***
0121 CD1003     LOOP:   CALL    GETBT   ;GET A BYTE
0124 FE1A               CPI     EOF     ;EOF?
0126 CA5901             JZ      DONE    ;YES, GO CLEAN UP AND DO NORMAL EXIT.

0129 FE0A               CPI     ASLF    ;LF?
012B CA3901             JZ      PCLF    ;YES, END OF LINE.
012E FE09               CPI     TAB     ;TAB?
0130 CA4901             JZ      TBLP    ;YES, GO EXPAND TO 8 SPACES
                ;
0133 CDC601     LOOPX:  CALL    PBYT    ;ALPHANUMERIC, SO PRINT BYTE.
0136 C32101             JMP     LOOP

                ;       ***PROCESS LINE FEED***
0139 CD2602     PCLF:   CALL    LINCHK  ;ARE WE AT END OF PAGE (CARRY SET)?
013C F5                 PUSH    PSW     ;SAVE THE FLAGS
013D DC4902             CC      PCHEK   ;IF EOP, ARE WE IN PRINT RANGE?
0140 F1                 POP     PSW     ;GET THE FLAGS BACK;
0141 DC6E01             CC      TOF     ;IF EOP, SET UP TITLE & PAGE NO.,
0144 3E0A               MVI     A,ASLF  ;EXECUTE THE LF AND
0146 C33301             JMP     LOOPX   ;CONTINUE

0149 3E20       TBLP    MVI     A,' '   ;EXPAND TAB CHARACTER
014B CDC601             CALL    PBYT
014E 3ABB03             LDA     COL
0151 E607               ANI     07H
0153 C24901             JNZ     TBLP
0156 C32101             JMP     LOOP

                ;       ***DONE & EREXIT clean up before exit to CP/M******

0159 3E0C       DONE:   MVI     A,0CH   ;FORM FEED ON NORMAL EXIT
015B CDC601             CALL    PBYT
015E 2ABA05     EREXIT: LHLD    OSTAK   ;RESTORE THE
0161 F9                 SPHL            ;CP/M STACK POINTER.
0162 C30000             JMP     BOOT    ;EXIT TO CP/M

                ;       ***Get here on any error call with message address on stack***
0165 D1         ERR:    POP     D       ;GET MSG ADDRESS PUT ON STACK BY CALL
0166 0E09               MVI     C,WRMSG ;WRITE ERROR MSG TO CONSOLE
0168 CD0500             CALL    BDOS
016B C35E01             JMP     EREXIT  ;GO RESTORE CP/M STACK BEFORE ERROR EXIT.
```

```
                ;**************END OF MAIN PROGRAM*****************
                ;                SUBROUTINES FOLLOW
                ;
                ;       ***PROCESS END OF PAGE AND NEW TITLE***
016E 3E0C       TOF:    MVI     A,FORM  ;FORM FEED
0170 CDC601             CALL    PBYT
0173 060C               MVI     B,TOFNULLS
0175 3E00       TOF2:   MVI     A,PAD
0177 CDC601             CALL    PBYT


017A 05                 DCR     B
017B C27501             JNZ     TOF2
                ;
017E 21CA03     TOF3:   LXI     H,FMSG  ;POINT TO 'FILE' MESSAGE
0181 CDF101             CALL    PSTRNG  ;PRINT STRING
0184 215D00             LXI     H,TFCB+1 ;POINT TO NAME


0187 0608               MVI     B,8     ;SIZE OF NAME
0189 CDFC01             CALL    PCNT    ;PRINT 8 NAME CHARACTERS
018C 3E2E               MVI     A,'.'   ;PRINT A PERIOD
018E CDC601             CALL    PBYT
0191 216500             LXI     H,TFCB+9 ;POINT TO TYPE
0194 0603               MVI     B,03    ;SIZE OF TYPE
0196 CDFC01             CALL    PCNT    ;PRINT 3 TYPE CHARACTERS
0199 21D303             LXI     H,PMSG  ;POINT TO 'PAGE' MESSAGE
019C CDF101             CALL    PSTRNG  ;PRINT STRING
019F 3ABE03             LDA     PAGE    ;GET PAGE NUMBER
01A2 CD0602             CALL    DEC     ;CONVERT TO DECIMAL
01A5 21C703             LXI     H,DECWRK ;POINT TO DEC STRING
01A8 0603               MVI     B,3
01AA CDFC01             CALL    PCNT    ;PRINT PAGE NUMBER
01AD 3E0D               MVI     A,ASCR  ;PRINT CR
01AF CDC601             CALL    PBYT
01B2 3E0A               MVI     A,ASLF
01B4 CDC601             CALL    PBYT    ;PRINT LF
01B7 3E0A               MVI     A,ASLF
01B9 CDC601             CALL    PBYT    ;AND ANOTHER
01BC E5                 PUSH    H
01BD 21BD03             LXI     H,LINE
01C0 7E                 MOV     A,M
01C1 C603               ADI     3       ;BUMP LINE COUNT FOR HEADER & SPACES
01C3 77                 MOV     M,A
01C4 E1                 POP     H
01C5 C9                 RET


01C6 E5C5       PBYT:   PUSH H ! PUSH B
01C8 47                 MOV     B,A     ;SAVE THE CHARACTER
01C9 3AC103             LDA     PFLAG   ;CHECK TO SEE IF THIS PAGE
01CC B7                 ORA     A       ;IS TO BE PRINTED (FLAG=1);
01CD CAE401             JZ      PBY2    ;IF NOT, SKIP THE PRINTING,
                ;
01D0 C5                 PUSH    B       ;ELSE SAVE THE CHARACTER
01D1 0E05               MVI     C,WRLST ;PUT FUNCTION CODE IN C,
01D3 1600               MVI     D,0     ;CLEAR D,
01D5 58                 MOV     E,B     ;PUT CHAR IN E FOR BDOS,
01D6 CD0500             CALL    BDOS    ;AND DO THE PRINT.
01D9 C1                 POP     B       ;RESTORE THE CHARACTER.
                ;
01DA 78                 MOV     A,B     ;GET CHARACTER INTO A
01DB FE20               CPI     20H     ;& SEE IF IT'S PRINTABLE
01DD DAE401             JC      PBY2    ;IF NOT, DON'T BUMP COLUMN COUNT,
01E0 21BB03             LXI     H,COL   ;ELSE POINT TO COLUMN COUNT
01E3 34                 INR     M       ;AND INCREMENT IT.
                ;
01E4 0E0B       PBY2:   MVI     C,CSTAT ;GET CONSOLE STATUS
01E6 CD0500             CALL    BDOS    ;TO CHECK FOR AN ABORT COMMAND --
01E9 E601               ANI     1       ;LSB SET?
01EB C25E01             JNZ     EREXIT  ;YES, EXIT BUT WITH NO FORM FEED
01EE C1E1               POP B ! POP H
01F0 C9                 RET
```

```
                ;
                ;       ***PSTRNG is needed since CP/M does not have a
                ;       Print List Buffer function corresponding to the
                ;       Print Console Buffer function***
01F1 7E         PSTRNG: MOV     A,M     ;GET BYTE
01F2 FE24               CPI     '$'     ;STRING END?
01F4 C8                 RZ              ;YES, DONE
01F5 CDC601             CALL    PBYT    ;PRINT BYTE
01F8 23                 INX     H       ;BUMP POINTER
01F9 C3F101             JMP     PSTRNG  ;LOOP

                ;       ***PRINT N BYTES FROM BUFFER ADDRESSED BY HL***
01FC 7E         PCNT:   MOV     A,M     ;GET BYTE
01FD CDC601             CALL    PBYT    ;PRINT IT


0200 23                 INX     H       ;BUMP POINTER
0201 05                 DCR     B       ;DECREMENT COUNT
0202 C2FC01             JNZ     PCNT
0205 C9                 RET

                ;       ***CONVERT BINARY PAGE NUMBER TO ASCI DECIMAL***
0206 21C703     DEC:    LXI     H,DECWRK
0209 0E64               MVI     C,100
020B CD1902             CALL    DIGIT
020E 0E0A               MVI     C,10
0210 CD1902             CALL    DIGIT
0213 0E01               MVI     C,1
0215 CD1902             CALL    DIGIT
0218 C9                 RET

0219 3630       DIGIT:  MVI     M,'0'
021B 91         DI0:    SUB     C
021C FA2302             JM      DI1
021F 34                 INR     M
0220 C31B02             JMP     DI0
0223 81         DI1:    ADD     C
0224 23                 INX     H
0225 C9                 RET


                ;*********************************;
                ;       LINCHK                    ;
                ; Updates line count and checks   ;
                ; for page end. Carry set to      ;
                ; trigger a new page heading.     ;
                ;*********************************;

0226 E5C5       LINCHK: PUSH H ! PUSH B
0228 0604               MVI     B,CRNULLS

                ;       ***AFTER A CR, DELAY PRINTING***
022A AF         LNULLS: XRA     A
022B CDC601             CALL    PBYT
022E 05                 DCR     B
022F C22A02             JNZ     LNULLS
                ;
0232 21BD03             LXI     H,LINE
0235 34                 INR     M       ;BUMP LINE COUNT IN MEM,
0236 46                 MOV     B,M     ;AND GET UPDATED COUNT INTO B.
0237 2B                 DCX     H       ;POINT TO LNCNT
0238 7E                 MOV     A,M
0239 90                 SUB     B       ;SUBTRACT UPDATED COUNT
023A D24102             JNC     LINDON  ;NO CARRY, STILL ON-PAGE.
023D 23         PAGUP:  INX     H       ;CARRY=OFF PAGE, SO
023E 3600               MVI     M,0     ;RESET CURRENT LINE TO 0
0240 37                 STC             ;AND MAKE SURE CARRY IS SET.
0241 21BB03     LINDON: LXI     H,COL   ;RESET COLUMN COUNT TO 0
0244 3600               MVI     M,0
0246 C1E1               POP B! POP H
0248 C9                 RET             ;AND EXIT.
```

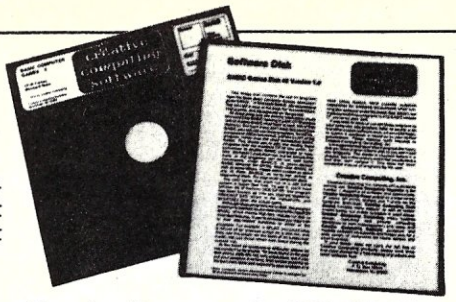
```
                ;*********************************;
                ;       PCHEK                     ;
                ; If LINCHK returns with Carry set;
                ; for new page, this routine      ;
                ; updates the page count and      ;
                ; checks to see if page is to be  ;
                ;         printed or not          ;
                ;*********************************;
0249 E5C5       PCHEK:  PUSH H ! PUSH B
024B 21BE03             LXI     H,PAGE  ;POINT TO CURRENT PAGE NUMBER
024E 34                 INR     M       ;AND UPDATE IT.
024F 23                 INX     H       ;POINT TO PAG1 (LOWER BOUND)
0250 46                 MOV     B,M     ;GET START PAGE NO.
0251 3ABE03             LDA     PAGE    ;GET CURRENT NO.
0254 B8                 CMP     B       ;CURRENT-LOWER
0255 D25C02             JNC     UPPER   ;LOWER BOUND OK, GO CHECK UPPER BOUND.
0258 AF         CLEAR:  XRA     A       ;NOT IN PRINT RANGE, SO CLEAR PRINT FLAG
0259 C36502             JMP     FSTOR   ;AND GO STORE IT.
                ;
025C 47         UPPER:  MOV     B,A     ;A STILL HAS CURRENT PAGE, SO SAVE IT.
025D 23                 INX     H       ;POINT TO PAG2 (UPPER BOUND);
025E 7E                 MOV     A,M     ;GET UPPER BOUND INTO A;
025F B8                 CMP     B       ;UPPER-CURRENT
0260 DA5E01             JC      EREXIT  ;IF CARRY, CURRENT IS ABOVE UPPER BOUND
                ;                       ;SO EXIT TO CP/M AT ONCE.  ELSE
0263 3E01               MVI     A,1     ;SET FLAG TO ENABLE PRINTING,
0265 32C103     FSTOR:  STA     PFLAG   ;AND STORE IT.
0268 C1E1               POP B ! POP H
026A C9                 RET



                ;*********************************;
                ;       SETUP                     ;
                ; Prompts for top and bottom line ;
                ; numbers, gets them from ABUF and ;
                ; stores ;them in TOPM and BOTM.   ;
                ; Then gets and stores page numbers;
                ; for printing range.             ;
                ;*********************************;
026B CD8303     SETUP:  CALL    ZBUF    ;CLEAR THE ABUF (ASCII BUFFER
                ;                       TO HOLD ANSWERS)
026E 0E09               MVI     C,WRMSG
0270 11F603             LXI     D,MARMSG ;PROMPT FOR 80-LINE DEFAULT
0273 CD0500             CALL    BDOS
                ;
0276 0E0A               MVI     C,RDCON ;NOW READ THE ANSWERS
0278 11B103             LXI     D,ABUF  ;INTO THE ABUF
027B CD0500             CALL    BDOS
                ;
027E 3AB303             LDA     ABUF+2  ;LOOK AT THE FIRST CHARACTER
0281 FE2F               CPI     '/'     ;IF ITS A SLASH
0283 CA9B02             JZ      SETUP3  ;GO SET DEFAULT LINES/PAGE,
                ;
0286 01B303             LXI     B,ABUF+2 ;ELSE POINT TO FIRST NUMBER
0289 CD9503             CALL    ADEC    ;CONVERT IT TO BINARY IN HL
028C 7D                 MOV     A,L
028D 32AF03             STA     TOPM    ;AND STORE IT.
                ;                       ;BC NOW POINT TO SEPARATOR SPACE.
0290 03                 INX     B       ;POINT TO 2ND NUMBER,
0291 CD9503             CALL    ADEC    ;CONVERT TO DECIMAL IN HL,
0294 7D                 MOV     A,L
0295 32B003             STA     BOTM    ;AND STORE IT.
0298 C3A502             JMP     LINSET  ;NOW GO COMPUTE PAGE DEPTH
                ;
029B 3E05       SETUP3: MVI     A,MINL  ;SET DEFAULT TOP AND
029D 32AF03             STA     TOPM
02A0 3E54               MVI     A,MAXL  ;BOTTOM LINES ON THE PAGE
02A2 32B003             STA     BOTM

                ;       ***Now compute no. of lines per page***
```

```
02A5 21AF03     LINSET: LXI     H,TOPM
02A8 46                 MOV     B,M
02A9 23                 INX     H       ;POINT TO BOTM
02AA 7E                 MOV     A,M
02AB 90                 SUB     B       ;BOTM-TOPM
02AC 3C                 INR     A       ;LNCNT=BOTM-TOPM+1
02AD 32BC03             STA     LNCNT   ;AND STORE IT FOR FUTURE USE

                ;       ***NOW FALL INTO PAGE RANGE ROUTINE***
                ;
02B0 CD8303     SETUP4: CALL    ZBUF    ;CLEAR THE ABUF (ASCII BUFFER)
                ;
02B3 0E09               MVI     C,WRMSG
02B5 116704             LXI     D,PAGMSG
02B8 CD0500             CALL    BDOS    ;PROMPT FOR PAGE PRINTING RANGE
                ;
02BB 0E0A               MVI     C,RDCON ;NOW GET PAGE RANGE
02BD 11B103             LXI     D,ABUF  ;INTO THE ABUF
02C0 CD0500             CALL    BDOS
                ;
02C3 3AB303             LDA     ABUF+2  ;LOOK AT THE FIRST CHARACTER,
02C6 FE2F               CPI     '/'     ;IF ITS A SLASH
02C8 CADD02             JZ      SETUP6  ;GO SET MAX PAGE RANGE,
                ;
02CB 01B303     SETUP5: LXI     B,ABUF+2 ;ELSE POINT TO LOWER PAGE NUMBER
02CE CD9503             CALL    ADEC    ;CONVERT IT TO BINARY IN HL
02D1 7D                 MOV     A,L
02D2 32BF03             STA     PAG1    ;AND STORE IT. B POINTS TO THE SPACE.
02D5 03                 INX     B       ;POINT TO UPPER PAGE NUMBER,
02D6 CD9503             CALL    ADEC    ;CONVERT IT TO BINARY IN HL,
02D9 7D                 MOV     A,L
02DA C3E402             JMP     SETUP7  ;AND STORE IT.

                SETUP6:                 ;SET MAXIMUM PAGE RANGE FOR PRINTING
02DD 3E01               MVI     A,MINP  ;FIRST PAGE
02DF 32BF03             STA     PAG1    ;TO
02E2 3EFF               MVI     A,MAXP  ;LAST POSSIBLE PAGE
02E4 32C003     SETUP7: STA     PAG2
02E7 C9                 RET



                ;*********************************;
                ;          F O P E N              ;
                ;  ROUTINE TO OPEN A DISK FILE    ;
                ;                                 ;
                ;  INPUT:  Set DE to address of   ;
                ;    the FCB. On open error, exit;
                ;    with message.                ;
                ;*********************************;
02E8 0E0F       FOPEN:  MVI     C,OPEN  ;OPEN CODE
02EA 115C00             LXI     D,TFCB
02ED CD0500             CALL    BDOS    ;ISSUE OPEN
02F0 FEFF               CPI     0FFH    ;ERROR?
02F2 CAF702             JZ      NOFILE  ;YES
02F5 AF                 XRA     A       ;CLEAR CARRY
02F6 C9                 RET
                ;
02F7 CD6501     NOFILE: CALL    ERR     ;THE CALL PUTS ADDRESS OF MSG ON STACK.
02FA 0D0A43414E         DB      0DH,0AH,'CANNOT OPEN FILE ',0DH,0AH,'$'


                ;*********************************;
                ;          G E T B T              ;
                ; Routine to read a byte from     ;
                ; IBUF; replenish from disk when  ;
                ; the buffer is empty.            ;
                ; OUTPUT:A =BYTE from disk buffer;
                ;*********************************;
0310 21BC09     GETBT:  LXI     H,IBUF+BUFLEN
0313 EB                 XCHG            ;BUFFER END ADDR. IN DE
0314 2AC303             LHLD    INPTR   ;CURRENT POINTER IN HL
0317 CD7D03             CALL    CPHL    ;TEST FOR END OF BUFFER
```

```
031A CA2D03            JZ      FILBUF  ;YES, READ
031D 7E        GETB1:  MOV     A,M     ;GET BYTE
031E 23                INX     H       ;BUMP POINTER
031F 22C303            SHLD    INPTR   ;SAVE POINTER
0322 B7                ORA     A       ;RESET CARRY
0323 C9                RET
               ;
0324 21BC05    GETB2:  LXI     H,IBUF  ;RESET BUFFER POINTER


0327 22C303            SHLD    INPTR
032A C31D03            JMP     GETB1   ;CONTINUE
               ;
032D 3E08      FILBUF: MVI     A,NUMSEC ;SET NUMBER OF SECTORS TO READ
032F 32C203            STA     CURSEC  ;AND PUT IT IN CURRENT SECTOR COUNT
0332 21BC05            LXI     H,IBUF
0335 22C503            SHLD    LOADAD  ;INITIALIZE DISK READ ADDRESS
0338 EB                XCHG            ;PUT THIS IN DE
0339 C34703            JMP     FILBU3  ;AND GO SET INITIAL LOAD ADDRESS.
               ;
033C 2AC503    FILBU2: LHLD    LOADAD  ;GET LOAD POINT OF LAST READ,
033F 118000            LXI     D,SECLEN ;ADD THE SECTOR LENGTH
0342 19                DAD     D       ;TO THE PREVIOUS LOAD POINT,
0343 22C503            SHLD    LOADAD  ;STASH IT AWAY FOR NEXT TIME AROUND,
0346 EB                XCHG            ;AND PUT IN DE
               ;
0347 0E1A      FILBU3: MVI     C,DEFDMA ;FOR BDOS
0349 CD0500            CALL    BDOS    ;TO SET THE NEW LOAD ADDRESS.
034C 0E14              MVI     C,READ  ;FUNCTION CODE
034E 115C00            LXI     D,TFCB  ;PASS THE TFCB ADDRESS TO BDOS
0351 CD0500            CALL    BDOS    ;READ SECTOR,
0354 FE00              CPI     0       ;CHECK FOR GOOD READ
0356 C26603            JNZ     CKEOF   ;IF NOT, SEE IF EOF,
0359 3AC203            LDA     CURSEC  ;ELSE GET SECTOR READ COUNT,
035C 3D                DCR     A       ;DECREMENT IT,
035D CA2403            JZ      GETB2   ;IF 0, WE'RE DONE READING,
0360 32C203            STA     CURSEC  ;ELSE STASH UPDATED SECTOR COUNT,
0363 C33C03            JMP     FILBU2  ;AND GO READ SOME MORE.
               ;
0366 FE01      CKEOF:  CPI     1       ;IF 1 RETURNED, WE'RE PAST EOF
0368 CA2403            JZ      GETB2   ;SO GO PRINT WHAT WE GOT.
036B CD6501    RDERR:  CALL    ERR
036E 0D0A524541        DB      0DH,0AH,'READ ERROR',0DH,0AH,'$'


               ;*********************************;
               ;   MISCELLANEOUS SUBROUTINES     ;
               ;*********************************;

               ;*********************************;
               ;             C P H L             ;
               ;  ROUTINE TO COMPARE HL VS DE    ;
               ;*********************************;

037D 7C        CPHL:   MOV     A,H
037E BA                CMP     D
037F C0                RNZ
0380 7D                MOV     A,L
0381 BB                CMP     E
0382 C9                RET
               ;
               ;*****************************************************
               ;ZBUF fills the top bytes of ABUF with 00
               ;and puts the length in the 1st byte for BDOS.
               ;The ZBU1 portion can be used for other buffers if the
               ;top address and fill count are put in DE and B by caller.
               ;
0383 3E0A      ZBUF    MVI     A,ABUFLEN
0385 32B103            STA     ABUF
0388 AF                XRA     A
0389 11BB03            LXI     D,ABUF+ABUFLEN
038C 0609              MVI     B,ABUFLEN-1 ;So as not to clear length byte.
038E 1B        ZBU1    DCX     D
038F 12                STAX    D
0390 05                DCR     B
0391 C28E03            JNZ     ZBU1
0394 C9                RET
               ;
               ;*****************************************************
               ; ADEC fetches up to 5 ASCII decimal digits from the ABUF
               ;addressed by BC and converts them to a 16-bit binary value
               ;returned in HL. Scan stops on a space or 00.
               ;
0395 210000    ADEC:   LXI     H,0
0398 0A        ADE1:   LDAX    B
0399 FE30              CPI     30H
039B D8                RC              ;DONE IF CHAR < '0'
039C FE40              CPI     40H     ;OR > '9'
039E D0                RNC
039F 54                MOV     D,H
03A0 5D                MOV     E,L
03A1 29                DAD     H
03A2 29                DAD     H
03A3 19                DAD     D
03A4 29                DAD     H
03A5 D630              SUI     30H
03A7 5F                MOV     E,A
03A8 1600              MVI     D,0
03AA 19                DAD     D
03AB 03                INX     B
03AC C39803            JMP     ADE1


               ;*********************************;
               ;     W O R K  S P A C E         ;
               ;*********************************;
03AF 05        TOPM:   DB      MINL    ;1ST PRINT LINE
03B0 54        BOTM:   DB      MAXL    ;LAST PRINT LINE
03B1           ABUF:   DS      ABUFLEN ;ASCI BUFFER FOR RESPONSES
03BB 00        COL:    DB      0       ;CURRENT COLUMN COUNT
03BC 50        LNCNT:  DB      80      ;LINES PER PAGE
03BD 00        LINE:   DB      0       ;CURRENT LINE COUNT
03BE 00        PAGE:   DB      0       ;CURRENT PAGE NUMBER
03BF 01        PAG1:   DB      MINP    ;LOWER PRINT BOUND
03C0 FF        PAG2:   DB      MAXP    ;UPPER PRINT BOUND
03C1 01        PFLAG:  DB      1       ;PRINT FLAG, 1=PRINT, 0=NO PRINT
03C2 08        CURSEC: DB      NUMSEC  ;CURRENT READ SECTOR COUNT
03C3 BC09      INPTR:  DW      IBUF+BUFLEN ;INPUT POINTER INITIALIZED TO BUFFER END
03C5 BC05      LOADAD: DW      IBUF    ;DISK LOAD INITIALIZED TO START OF BUFFER
03C7 303030    DECWRK: DB      '000'   ;WORKSPACE FOR DECIMAL CONVERSION OF PAGE
               ;
               ;               ***MAIN MESSAGE AREA***
03CA 0D0A46494CFMSG:   DB      0DH,0AH,'FILE: $'
03D3 2020202020PMSG:   DB      '                    PAGE $'
03EE 4552524F52ERMSG:  DB      'ERROR',0DH,0AH,'$'
03F6 0D0A446566MARMSG: DB      0DH,0AH,'Default top & bottom lines are 5, 84, for elite
0428 0D0A              DB      0DH,0AH
042A 456E746572        DB      'Enter top line SPACE bottom line, or a / to keep default
0464 0D0A24            DB      0DH,0AH,'$'
0467 0D0A456E74PAGMSG: DB      0DH,0AH,'Enter 1st page SPACE last page, or a / to print
049D 0D0A202020        DB      0DH,0AH,'          ...WAIT...'
04B3 0D0A41646A        DB      0DH,0AH,'Adjust paper to 1st print line on new page,'
04E0 0D0A536574        DB      0DH,0AH,'Set printer switches for pica or elite,'
0509 0D0A747572        DB      0DH, 0AH,'turn OFF hardware line counting'
052A 0D0A627574        DB      0DH,0AH,'but initialize form-feed point.',0DH,0AH
054D 5468656E20        DB      'Then hit Return key to start printing.',0DH,0AH,'$'
               ;
               ;               ***STACK AREA***
0576           AREA:   DS      STAKLEN ;Local stack area
05B6 =         STACK:  EQU     $       ;Top of local stack
05B6 0000              DW      0
05B8 0000              DW      0
05BA 0000      OSTAK:  DW      0       ;CP/M Stack pointer storage
05BC           IBUF:   DS      BUFLEN
               ;
09BC                   END     PRINT
```

CP/M

All disks expect CS-9004 require 48K and Microsoft Basic. All 8" CP/M disks cost $24.95.



Basic Games-1, CS-9001

Includes the Following:

Acey Ducey	Civilwar
Amazing	Combat
Animal	Craps
Awari	Cube
Bagels	Depth Charge
Banner	Diamond
Basketball	Dice
Batnum	Digits
Battle	Even Wins I
Blackjack	Even Wins II
Bombardment	Flip Flop
Bombs Away	Football 1
Bounce	Football II
Bowling	Fur Trader
Boxing	Golf
Bug	Gomoko
Bullfight	Guess
Bullseye	Gunner
Bunny	Hammurabi
Buzzword	Hangman
Calendar	Hello
Change	Hexapawn
Checkers	Hi-Lo
Chemist	High I-Q
Chief	Hockey
Chomp	

Basic Games-2, CS-9002

Includes the Following:

Horserace	Rocket
Hurkle	Rock, Scissors, Paper
Kinema	Roulette
King	Russian Roulette
Letter	Salvo
Life	Sine Wave
Life For Two	Slalom
Literature Quiz	Slots
Love	Splat
Lunar LEM Rocket	Stars
Madlib	Stock Market
Mastermind	Super Star Trek
Math Dice	Synonym
Mugwump	Target
Name	Trek Instructions
Nicomachus	3-D Plot
Nim	3-D Tic Tac Toe
Number	Tic Tac Toe
One Check	Towers
Orbit	Train
Pizza	Trap
Poetry	23 Matches
Poker	War
Qubic	Weekday
Queen	Word
Reverse	

Basic Games-3, CS-9005

Includes the Following:

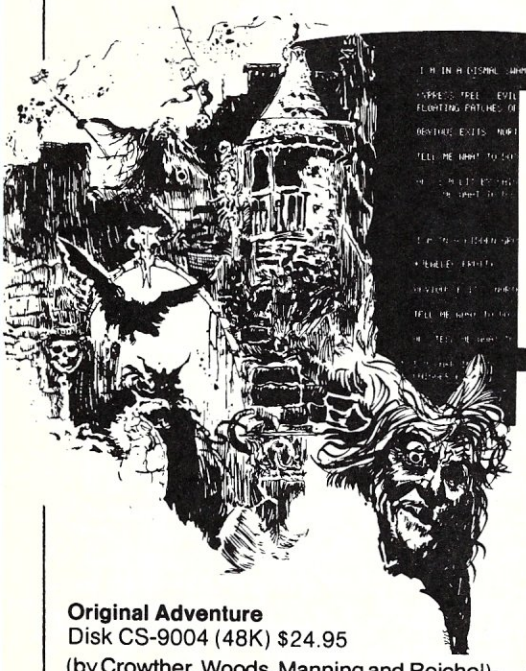
Artillery-3	Dodgem
Baccarat	Doors
Bible Quiz	Drag Race
Big 6	Dr. Z
Binary	Eliza
Blackbox	Father
Bobstones	Flip
Bocce	Geowar
Boga II	Grand Prix
Bombrun	Guess-It
Bridge-it	ICBM
Camel	Ink Blot
Chase	Joust
Chuck-A-Luck	Jumping Balls
Close Encounters	Keno
Column	L Game
Concentration	Life Expectancy
Condot	Lissajous
Convoy	Magic Square
Corral	Man-Eating Rabbit
Countdown	Maneuvers
Cup	Maze
Dealer's Choice	Millionaire
Deepspace	Motorcycle Jump
Defuse	Lewis

Basic Games-4, CS-9006

Includes the Following:

Mastermind	Seawar
Masterbagels	Shoot
Matpuzzle	Smash
Minotaur	Strike 9
Nomad	Tennis
Not One	Tickertape
Obstacle	TV Plot
Octrix	Twonky
Pasart I	Two-to-Ten
Pasart II	UFO
Patterns	Under & Over
Pinball	U.S. Population
Rabbit Chase	Van Gam
Roadrace	Warfish
Rotate	Word Search Puzzle
Safe	Wumpus I
Scales	Wumpus II
Schmoo	Yahtzee
Seabattle	4-In-A-Row

ADVENTURE



Original Adventure
Disk CS-9004 (48K) $24.95

(by Crowther, Woods, Manning and Roichel)-Somewhere nearby is a colossal cave where others have found fortunes in treasures and gold, but some who have entered have never been seen again. You start at a small brick building which is the wellhouse for a large spring. You must try to find your way into the underground caverns where you'll meet a giant clam, nasty little dwarves, and much more. **This Adventure is Bi-Lingual**—you may play in either **English or French**—a language learning tool beyond comparison. Runs in 32K CP/M system (48K required to SAVE GAME feature). Even includes SAM76 language in which to run the game. The troll says "Good Luck."

Two Adventures
Disk CS-9003 (48K) $24.95

Adventureland (by Scott Adams)-You wander through an enchanted world trying to recover the 13 lost treasures. You'll encounter WILD ANIMALS, BEINGS, and many other perils and puzzles. Can you rescue the BLUE OX from the quicksand? Or find your way out of the maze of pits? Happy Adventuring....

Pirate Adventure (by Scott Adams)-"Yo Ho Ho and a bottle of rum..." You'll meet up with the pirate and his daffy bird along with many strange sights as you attempt to go from your London flat to Treasure Island. Can you recover LONG JOHN SILVER's lost treasures? Happy sailing matey....

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SOFTWARE DIRECTORY

Program Name: ZDM
Hardware System: CP/M
Minimum Memory Size: Overlays CCP
Language: Z-80 Machine Language
Description: ZDM is a powerful Z-80 debugger and monitor designed to operate as a replacement for DDT on any CP/M system. All DDT commands (except A) are implemented. Additionally, ZDM features: a) customization to user terminal specifications, b) display and/or alteration of either set of Z-80 registers and flags, c) enable or disable interrupts when entering target program and d) read from an input port or write to an output port. ZDM uses extended 8080 mnemonics similar to those for the Digital Research macroassembler, MAC. Available on 8-inch single density IBM disk, 5-inch single density North Star, or double density Micropolis.
Release: August 1980
Price: $30; Manual $3
Included with price: Disk, manual and copying instructions.
Where to purchase it:
RD Software
1290 Monument St.
Pacific Palisades, CA 90272

Program Name: COMMON
Hardware System : CPM 2.2 single density 8"
Language: ASM
Description: COMMON u:filex creates for the current USER a read-only virtual file pointing into filex of USER u. Now all users can have access to all the common utilities without using up the disk in redundant copies.
Release: January 1981
Price: $29.95
Included with price: 8" CP/M disk with ASM, COM and DOC files.
Where to purchase it:
microMethods
Box G
Warrenton, OR 97146

Program Name: VersaSort
Hardware System: CP/M
Minimum Memory Size: 32K
Language: 8080 machine code
Description: VersaSort will arrange any data files on the basis of key criteria; select up to 5 keys for each sort; and sort a file under the control of any CBasic program, quickly and easily.
Release: June 1980
Price: $195
Included with price: Documentation (75 pages) with many examples and samples.
Author: R. Murray
Where to purchase it:
MicroDaSys-Software
Box 36275
Los Angeles, CA 90036

Program Name: Inventory Control for Manufacturers (ICM)
Hardware System: CP/M Version 2.2, 2-8" disks
Minimum Memory Size: 56K
Language: PL/I-80
Description: ICM is a comprehensive inventory control system for a manufacturing environment. Standard inventory control functions are implemented. They include maintaining and reporting on the status of the inventory stock as well as maintaining records of all transactions made against part numbers in stock. In addition, ICM supports multi-level bills of material (BOM's), the creation of multiple part number transactions for jobs based on those BOM's, job-tracking, and generation of materials requirements reports.
Release: Available now
Price: $995
Included with price: Object code and user's manual
Author: Microcomputer Consultants
Where to purchase it:
Microcomputer Consultants
P.O. Box T
Davis, CA 95617

Program Name: PRGM/MAP
Hardware System: CP/M
Minimum Memory Size: 40K bytes
Language: Machine code
Description: Program Map is a cross-reference tool for Microsoft Basic programs. The system produces alphabetical lists of variables, commands functions, constants, quoted strings and line numbers. Use for documentation, conversion, or I/O modifications.
Release: June 1978
Price: $95; License Agreement Required
Included with price: Diskette, manual, examples, support
Author: The Software Store
Where to purchase it:
The Software Store
706 Chippewa Square
Marquette, MI 49855

Program Name: ACCOUNT81
Hardware System: Alpha Micro System
Language: AMOS operating system
Description: Provides accountants with a full inventory of reports and bookkeeping records: chart of accounts, balance sheets, income statements, income journal register, adjustment journal register, G/L, working trial balance, comparison reports, check register, master payroll report, general ledger, employee list, 941's, W-2's, cover letter, check writer and more. Has specially designed input routines that reduce operator fatigue through the use of formatted screens (menus), protected fields and automatic repetition of appropriate data. Smooth, error-free operation is insured by file verification routines that display all incorrectly entered transactions.
Release: February 1981
Price: $1995; updates $295/yr.
Author: Skill Services Inc. of Miami, Fla.
Where to purchase it:
Pony Express Services
100 West 57th St.
New York, NY 10019

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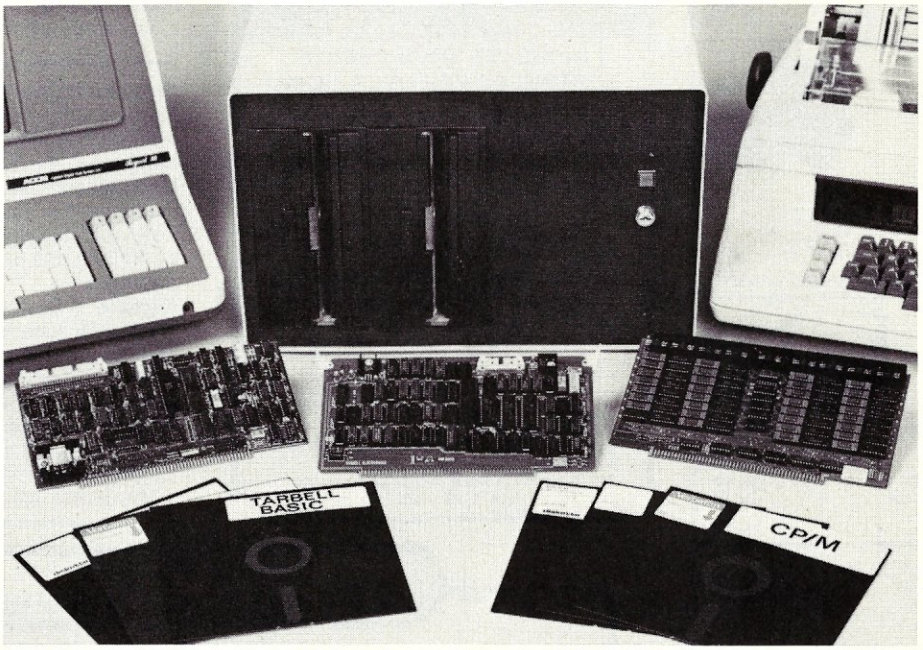

New CPU Card Completes the Package.

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One of the outstanding features of this new CPU board is memory-management hardware that allows dynamic mapping of logical to 1 Megabyte of physical memory in 4K blocks. Moreover, the CPU board is especially designed to make it easier to implement multi-user operating systems, such as MP/M™ from Digital Research. It can run at 2 or 4Mhz, jumper selectable. It has two RS-232 Serial Ports (one for printer and one for CRT), with full handshaking capability.

One of its additional important features is a crystal-controlled programmable timer, which can be used for time-of-day clock and multi-tasking operations. Programmable priority masked vectored interrupt hardware is another useful feature.

In addition to all the features of the new CPU card, the double density floppy interface has DMA which makes the multi-tasking operation quite efficient. Also, the 32K memory board is static, resulting in a reliable memory. The Tarbell System with all three cards can be expanded for more memory and thus provides the ultimate in flexiblity.

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MP/M is a trademark of Digital Research.

Program Name: Data Merge
Hardware System: CP/M Based or TRS-80 level I
Minimum Memory Size: 32K
Language: 8080 machine code
Description: Personalized form letters: names, addresses, etc. can be replaced by entries either from a mail list file or from the keyboard; reports and manuals: Table of contents and alphabetized index printed automatically eliminating the tedious task of manually changing page number; contracts and specifications: Standard or frequently used paragraphs or sections can be stored in disk files and inserted by name when a document is printed; and books and articles: Footnotes collected in the text and printed at the page bottom, chapters kept in separate files and chained together when printed.
Release: January 1979
Price: $195
Included with price: 100-page user manual.
Author: M. Posehn
Where to purchase it:
MicroDaSys—Software
Box 36275
Los Angeles, CA 90036

Program Name: EDIT
Hardware System: CP/M
Minimum Memory Size: 52K bytes
Language: Microsoft Basic
Description: Used with UDE ENTRY, provides fast and easy editing, insertion, deletion, and searchs for selected records. An optional audit printout of edit changes is provided.
Release: Available now
Price: $95; License Agreement Required
Included with price: Diskette, manual, examples, support.
Author: The Software Store
Where to purchase it:
The Software Store
706 Chippewa Square
Marquette, MI 49855

LDP88 CPU Board

The **LDP88 CPU** board offers the 16 bit processor of the future while maintaining compatibility with your present 8 bit boards. The **LDP88** offers the following features:

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- **8088 CPU**
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- 9 vectored interrupts
- 1K of RAM
- Up to 8K or ROM/EPROM
- **CP/M-86** support

LDP72 Advanced Floppy Disk Controller

- Meets all **IEEE 696** specifications
- Advanced Intel 8272 LSI controller
- Digital data recovery circuit requires no adjustment for reliable operations
- Supports up to 4 drives
- May mix 5" and 8" drives on the same board

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Don't buy an outdated RAM board, buy the **LOMAS DATA PRODUCTS'** 64K RAM board. The **LDP 64K RAM** is the only board that you can buy today and upgrade to a full 256K bytes on one board. The **LDP 64K RAM** offers the following advanced features:

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The **LDP1** is the only complete system available today using **CP/M-86** as its operating system. Why settle for an 8 bit system of the past when you can invest in the 16 bit system of the future. The **LDP1** includes the **LDP88, 8088 CPU,** the **LDP72** advanced floppy disk controller, and the **LDP 64K** dynamic RAM board. Included also are an 8" floppy drive, mainframe with 10 slots and room for two 8" drives and a choice of either **CP/M-86** or **86-DOS** as your operating system.

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86-DOS	195.00		
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	350.00		with LDP1 and 86-DOS
PASCAL/M	250.00		CP/M-86 required
Rev. A LDP88's while they last	275.00		
LDP1 with CP/M-86 or 86-DOS	3499.00		

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PASCAL/M is a trademark of Sorcim
CP/M-86 is a trademark of Digital Research
86-DOS is a trademark of Seattle Computer Products

Program Name : Order-Right
Hardware System: CP/M Based—CBasic
Minimum Memory Size: 48K
Language : CBasic-2
Description: Order-Right is an easy to use order entry system that can interact with Inventory, Accounts Receivable and General Ledger. It lets you enter orders using order codes; automatically calculates discounts for different customer types; allows you to specify special discounts; prints a complete invoice including tax and shipping information; prepares confirmation forms and feeds the Data Merge module for special reports and acknowledgements; prints shipping labels, charge card slips, acknowledgements; allows you to enter customer data from Accounts Receivable; and can interact with Inventory and Accounts Receivable.
Release: August 1980
Price: $800
Included with price: User manual and CBasic source code with sample multi-forms (invoice/statement/confirmation)
Author: J. Stuppy
Where to purchase it:
MicroDaSys—Software
Box 36275
Los Angeles, CA 90036

Program Name : Promer
Hardware System: Memory map PROM burning card such as Cromemco bytesaver
Minimum Memory Size: 16K CP/M System
Language: 8080 Assembler
Description: Allows user to build image to be burned in a memory buffer, without having to compute relocation factors, load files into alternate areas, transfer images, or append code sections. It will handle most standard size PROM (256, 512, 1024, 2048, and 4096 bytes per PROM), and verifies erasure at startup time. There may be any number of PROMS in use, and at whatever address the user specifies. Partially burned PROMS may be used, and over burns are possible (the user is notified before this occurs). The program builds the burn image in a stand alone buffer, and does all offsetting and relocating automatically. Data may be loaded from existing ROM, areas in RAM, or disk files (both direct image and hex files are supported), as well as keying directly into or patching the image in the burn buffer. Burning and verifying is automatic, with the user selecting the number of burn passes to execute. The entire program is menu driven, with extensive prompting and explanations on the screen during execution.
Release: Currently available
Price: $60 Source, $30 Object
Included with price: Self prompting software, Disk $7.50 extra
Author: Hawkeye Grafix
Where to purchase it:
Hawkeye Grafix
23914 Mobile Street
Canoga Park, CA 91307

Program Name: UDE-PRT
Hardware System: CP/M
Minimum Memory Size: 52K bytes
Language: Microsoft Basic
Description: Provides pagination and formatted file listings of Universal Data Entry (UDE) files. Batch and transaction totals are printed where defined. Optional date and report headings are provided.
Release: Dec. 1979
Price: $95; Licence Agreement Required
Included with price: Diskette, manual, examples, support
Author: The Software Store
Where to purchase it:
The Software Store
706 Chippewa Square
Marquette, MI 49855

Program Name: COMMX
Hardware System: CP/M
Minimum Memory Size: 16K
Language: 8080 Assembler
Description: Menu driven communication interface program provides links to time-share services, computer bulletin boards, or other CP/M systems. File transfer modes perform automatic disk accessing without data loss when available memory (determined at sign on) is exceeded. XON/XOFF protocol implemented, with full echoplex required from host using full- or half-duplex modem hardware. CRC16 error handling protocol is invoked between COMMX-to-COMMX user links guaranteeing precise data transfers of any data type. While remaining connected, a local mode provides disk directories, rename, delete, log in new disks, console echo control, control character display, and creation of a disk log file for terminal mode session recordings. On screen dialing and mode select are supported for those modem types.
Release: January 1981
Price: $250 Source, $75 Object
Included with price.: User manual, disk $47.50 extra
Author: Hawkeye Grafix
Where to purchase it:
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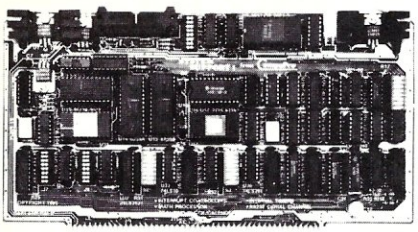
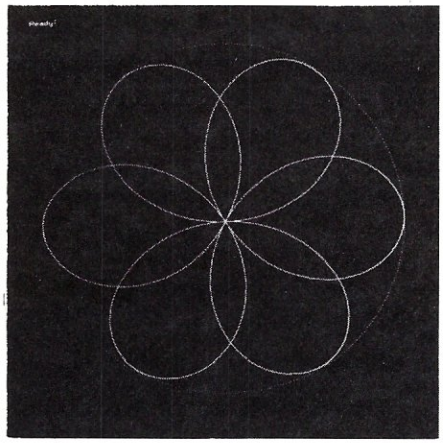


High Resolution S-100 Graphics Board Set

The Sigma 1042S high resolution S-100 memory-mapped precision graphics board brings professional graphics capability to the North Star S-100 market. Using video raster scan technology, the display provides a 640 x 800 dot matrix backed by a 64K display memory. The 64K display memory is divided into 16 4K blocks individually selectable for mapping onto a main memory window of only 4K. Each row, or scan line, is represented in the bit map display memory by 81 byte string. The first byte contains information while the subsequent eighty bytes carry the 640 bits of scan line information to be displayed on the screen. To access display memory the programmer first selects the appropriate 4K block using the high order hex address digit for the purpose of designation. He then accesses the block through the window as the top 4K of the user's main memory space.



The Sigma 1042S constructs graphic images and alphanumeric displays from a dot matrix of 800 row or scan lines, each 640 dots across. The rectangular matrix is 7 inches across by 9 inches high i.e., the full page sceen format. The horizontal resolution is 1 dot per .012 inch (.3 mm); vertical is 1 dot per .012 inch (.3 mm). The terminal can use shading for texture and depth effects.

The Sigma 1042S Terminal may also be used as a high performance, full page (860 lines of 80-character per line) word processing work station. In this application mode, its capabilities include variable spacing, multiple font, and scientific character capability. Also, reverse video, blinking, and intensification are offered as hardware features.

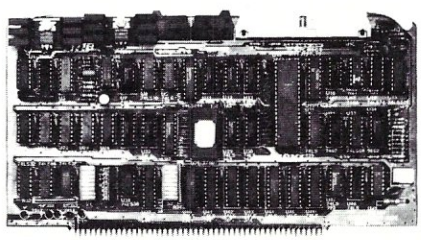
Sigma provides the user with BDOS interface routines, so that it may be used as a system console under CP/M. Driver software is provided with the graphics unit.

Video Monitor and keyboard are separately packaged as attractive desk-top units. In addition, there are two printed circuit boards which plug into the S-100 chassis and control the display unit. The keyboard is connected via cabling to an I/O port in the host system. Sigma provides each user with systems programming specifications, circuit diagrams of the PCB's, assembler listings of all Sigma systems software, and the manual for the monitor. Sigma Information Systems USA, Inc., 556 Trapelo Road, Belmont, MA 02178; (617) 484-2063.

CompuPro High-Speed S-100 Disk Controller Board

DISK 1 floppy disk controller board meets all IEEE 696/S-100 timing specifications including properly implemented DMA arbitration and 24 bit addressing, DISK 1 handles up to four 8" or 5.25" floppy disk drives (single or double density, single or double sided) and is compatible with MP/M, OASIS, CP/M-80 and CP/M-86 (supplied with BIOS for CP/M-80). High speed "cycle stealing" DMA interface gives processor independent data transfer to operation up to 10 MHz. DISK 1 also includes an on-board serial port for initial system booting, on-board Phantom boot EPROM for automatic startup, may be interrupt-driven in multi-user environments and requires no host CPU memory space.

Consult the factory or your local Compu Pro dealer for pricing and availability.



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8088 S-100 CPU Board

The LDP88 CPU card comes with an 8088 processor, a serial interface port controlled by an 8251A, two ROM/EPROM sockets (use either 2716's or 2732's) for a maximum of 8K bytes of program storage and 1K byte of RAM for data storage. The LDP88 is a complete processor and could be used in stand alone applications.

In order to maintain compatibility with boards designed to work with a 16-bit address bus, the LDP88 asserts PHANTOM when memory accesses are above the OFFFFH address range. Memory boards designed to utilize this signal for boot procedures may use this line to inhibit their operation when addresses above OFFFFH are used. This allows full address expansion of the system when the LDP88 is used. Although the 8088 has an I/O space of 65,000 ports, older boards that do not decode address bits 8 through 15 will limit the number of ports to 256. The price is $399 (A&T), $349.99 (full kit) and $199.95 (partial kit).

The following software is available: A serial monitor program, with 8 commands is available ($40) as well as the Seattle Computer Products' 86-DOS ($195) and CP/M-86 ($250). Lomas Data Products, 11 Cross Street, Westborough, MA 01581; (617) 366-4335.

S-100 Floppy Disk Controller

The LDP72 is an advanced floppy disk controller (FDC) based on the Intel 8272 floppy disk controller I.C. The LDP72 relieves the processor of functions normally done in software, thereby reducing software overhead. The FDC can transfer a complete track on both sides of a double-sided disk with only one command sequence. This allows the transfer of up to 16,384 bytes with only one command sequence. In order to synchronize data transfers, the READ line causes the processor to wait until data is available from the FDC. The FDC is IBM format compatible in both single and double sided density formats and will control both single and double sided disks. Selection between single and double density is accomplished by software selection allowing the same drive to be used in both modes. The FDC may also be configured through software commands to control either 5 1/4" or 8" floppy disk drives. This allows mini and standard floppies to be mixed on the same controller. Four disk drives may be attached to the controller in any mix of standard or mini drives. The FDC will do parallel seeks on up to four drives. Separation of data and clock are done by the LDP72 to insure maximum data reliability. The LDP72 complies with the IEEE 696 specification for the S-100 Bus, insuring compatibility with other complying manufacturer's boards.

List price for the LDP72 is $274.95 (A&T) with substantial discounts for OEM quantities. A partial kit is 129.95, full kit is $219.95. Software support is provided for 86-DOS, CP/M-86 and CP/M. Lomas Data Products, 11 Cross Street, Westborough, MA 01581; (617) 366-4335.

Microsystems — the CP/M* and S-100 User's Journal

CP/M is the software bus! S-100 is the hardware bus for sophisticated microcomputer users!

If you are a CP/M user, on any system—S-100, Apple, TRS-80, Heath, Ohio Scientific, Onyx, Durango, Intel MDS, Mostek MDX, etc—after all CP/M is the Disk Operating System that has been implemented on more computer systems than any other DOS—then *Microsystems* magazine is the "only" magazine published specifically for you!

Or, if you use an S-100/IEEE-696 based computer—and the most sophisticated microcomputer systems available use the S-100/IEEE-696 hardware bus—then *Microsystems* magazine is the "only" magazine published specifically for you!

We started publishing *Microsystems* almost two years ago to fill the void in the microcomputer field. There were magazines catering exclusively to the TRS-80, Apple, Pet, Heath, etc. system users. There were also broad based publications that cover the entire field but no one system in depth. But no magazine existed for CP/M users—nor did one exist for S-100 users.

The why and what of a software bus

First of all what is a "bus?" And why do we call CP/M "the software bus?"

A "bus" is a technique used to interface many different modules. Examples are the "S-100/IEEE-696 Bus" and the "IEEE-488 Bus." These are hardware buses that permit a user to plug a bus-compatible device into the bus without having to make any other hardware modifications and expect the device to operate with little or no monification.

CP/M is a Disk Operating System (DOS). It was first introduced in 1974 and is now the oldest and most mature DOS for microcomputer systems. CP/M has now been implemented on over 250 different computer systems. It has been implemented on hard disk systems as well as floppy disk systems. It is supported by two user groups (CP/M-UG and SIG/M-UG) that have released over sixty volumes containing over 1,600 public domain programs that can be loaded and run on systems using the CP/M DOS. Add to this another 1,500 commercially available CP/M software packages and you have the largest applications software base in existence.

CP/M is the only DOS for micros that has stood the test of time (seven years) with the highest level of compatibility from version to version. And over the years this compatibility has been maintained as new features have been added.

This is why we say "CP/M is the software bus" and why *Microsystems* magazine is vital to providing CP/M users with technical information on using CP/M, interfacing to CP/M, new CP/M compatible products and for CP/M users to exchange ideas.

Why support the S-100 bus?

S-100 is currently the most widely used microcomputer hardware bus. It offers advantages not available with any other microcomputer system. Here are a few of the advantages:

S-100 is processor independent. There are already thirty different S-100 CPU cards that can be plugged into an S-100 bus computer. Nine 8-bit microprocessors are available: 6502, 6800, 6802, 6809, 2650, F8, 8080, 8085 and Z80. Eight 16-bit microprocessors are available: 8086, 8088, 9900, Z8000, 68000, Pascal Microengine, Alpha Micro (similar to LSI-11) and even the AMD2901 bit slice processor. Take your pick from the incredible offerings.

S-100 has the greatest microcomputer power. What other microcomputer system has direct addressing of up to 16 megabytes of memory, up to 65,536 I/O ports, up to 10 vectored interrupts, up to 16 masters on the bus (with priority) and up to 10 Mhz data transfer rate? You will have to go a long way to use up that computing power.

S-100 is standardized. The S-100 bus has been standardized by the IEEE (Institute of Electrical and Electronic Engineers) assuring the highest degree of compatibility among plug-in boards from different manufacturers. And, *Microsystems* has published the complete IEEE S-100/696 standard (all 26 pages).

S-100 has the greatest hardware support. There are now over sixty different manufacturers of about 400 different plug-in S-100 boards. Far greater than any other microcomputer system.

With all these advantages is it any wonder that S-100 systems are so popular with microcomputer users who want to do more than just play games?

For the serious computer user.

Each issue of *Microsystems* brings you the latest in the CP/M and S-100 world. Articles on applications, tutorials, software development, product reviews, and lots more, to keep you on top of the ever changing microcomputer scene.

And if you are an S-100 system user using other operating systems (e.g. North Star) *Microsystems* also supports you.

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—California—

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(making complexity serve simplicity)

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Provar Inc.: Specialists in multi-user and networking systems. Currently marketing an MP/M utility package. Experienced in Assembler, Pascal, and Basic. We also design and build process control systems. Contact Mark Winkler, 6217 Kennedy Ave., Hammond, Ind. 46323. (219)844-0370.

—Massachusetts—

MICROFT INC.: Customization of CP/M-80, MP/M, CP/M-86 and other operating systems. Full range of consulting services in microsystems software (systems, utilities applications), product selection, hardware. Contact: Tom Campbell, Chief of Technical Staff, P.O. Box 128, E. Falmouth, MA 02536. Phone (617)563-3807.

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Systems And Services: Custom software in assembly language & Basic for S100 Z80/8080 CP/M systems. Contact Buz Koenig C/O Systems And Services, P.O.B. 961, Hurst, TX 76053.
Phone (817)268-2938 Eve & W.E.

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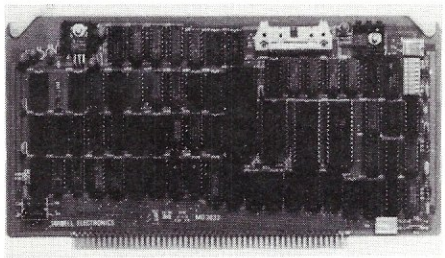
CHI ENERGY: Custom programs and package modification in Assembler, Basic & C languages; CP/M and real time systems. Contact: Mark A. Carlson, P.O. Box 55145, Seattle, WA 98155. (206)364-5463

New Products, cont'd...

S-100 CPU Board with Memory Manager

Tarbell Electronics has introduced a CPU/memory-management board that allows dynamic mapping of up to 1 Megabyte of physical memory in 4K blocks. It uses a fast on-board memory of 16 bytes, which holds a table. The 4-bit address of this memory comes from the upper four address lines of the Z-80. Four of the eight output lines go to the A12 and A15 bus address lines. The other four go to the A16 to A19 extended address lines of the S-100 bus. If no memory management is desired, a jumper block may be loaded by the programmer or system software with I/O commands.



The Tarbell Z-80 S-100 CPU board is especially designed to make it easier to implement multi-user operating systems, such as MP/M from Digital Research. It can run at 2 or 4Mhz, jumper selectable. It has two RS-232 Serial Ports, with full handshaking capability.

One of its additional important features is a crystal-controlled programmable timer (8253), which can be used for time-of-day clock and for time-slicing multi-tasking operations. Moreover, programmable priority masked vectored interrupt hardware is another useful feature.

Price is $450.00. For further information, contact Don Tarbell, Tarbell Electronics, 950 Dovlen Place, Suite B, Carson, CA 90746. Or call (213)538-4251.

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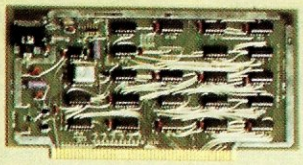
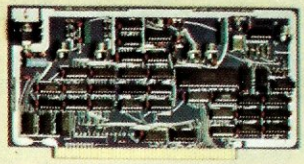
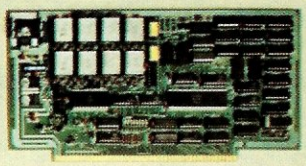


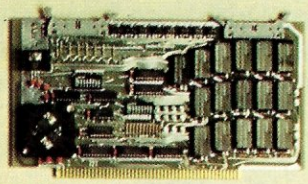
88-SPM Clock Module



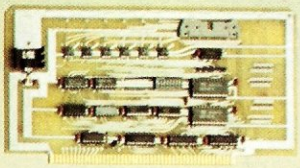
88-UFC 650 MHz Frequency Counter
Available with or without **TCXO**



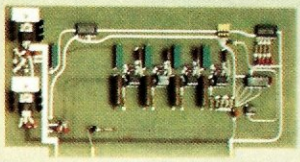
88-MODEM MODEM



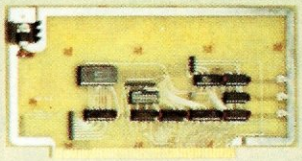
100-RCM Relay Control Module



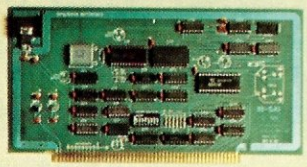
100-UEC Event Counter



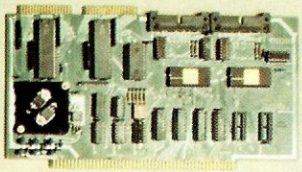
100-BBC Battery Back-Up Charger



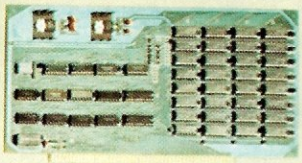
100-VIC Vectored Interrupt Controller



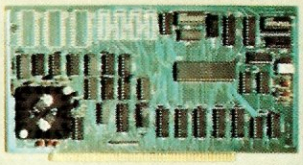
88-SAI SYN/ASYN I/O



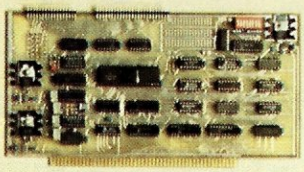
100-GPI Serial/Parallel



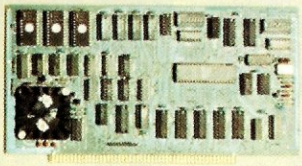
100-64K RAM Memory



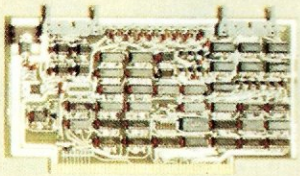
100-Z80 Z80 CPU



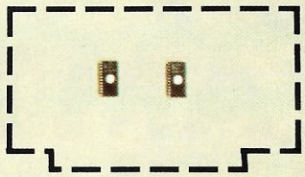
100-FDC Floppy Disk Controller



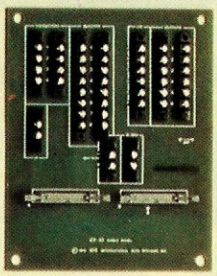
100-CPR CPU/PROM/RAM



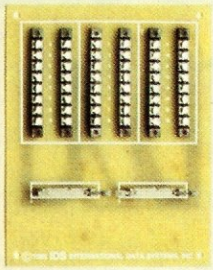
100-EMM Energy Management Module



ENERGY BASIC in PROM



CP-52 for 100-EMM



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