

THE JOURNAL FOR ADVANCED MICROCOMPUTING

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# Microsystems

Volume 5/Number 3

March, 1984

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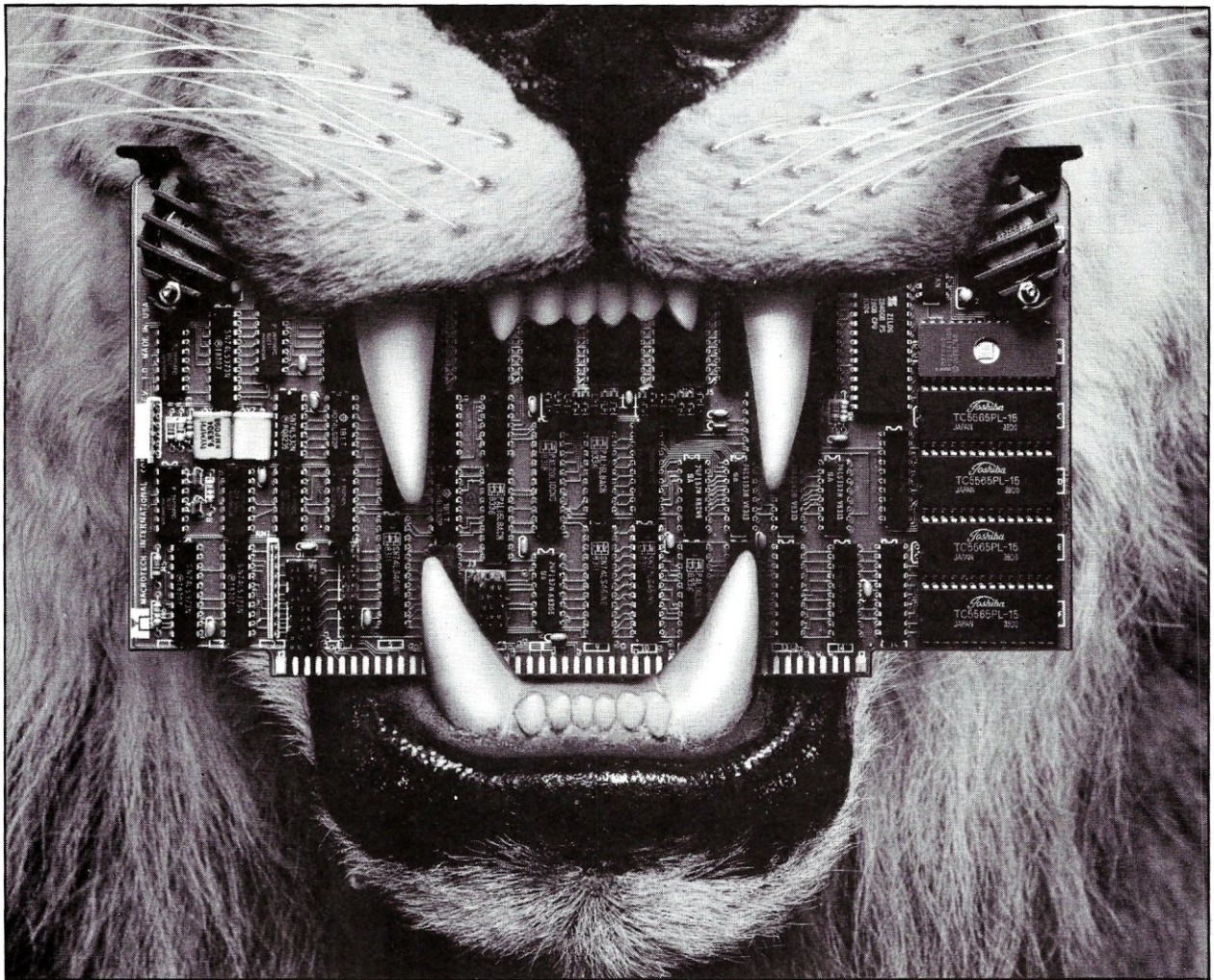
**MS-DOS-**  
**A new**  
**support**  
**for files**  
**and**  
**peripherals**

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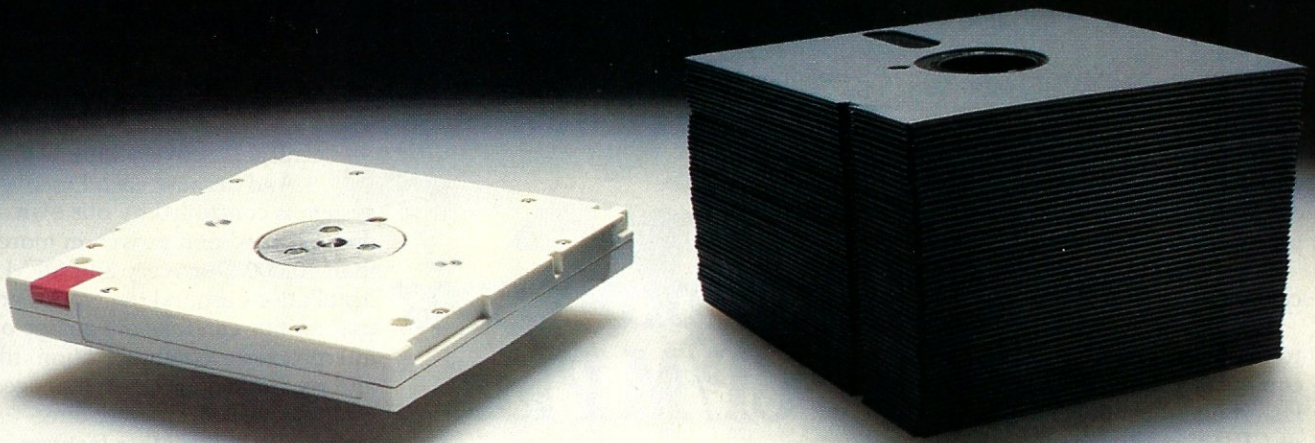
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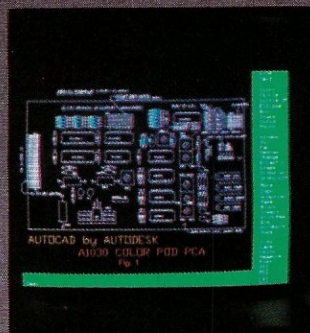


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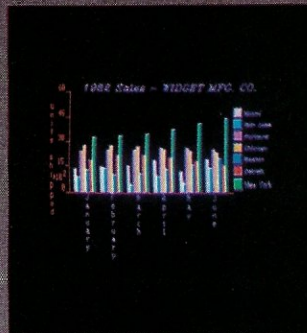
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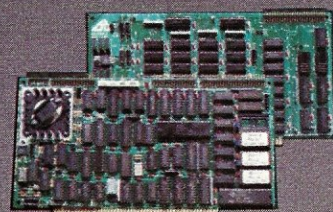
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S100/696 A1000

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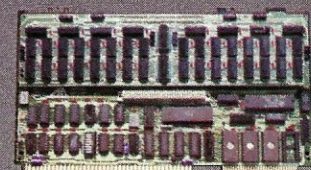
## Software Support

The A-1000 command set not only includes pixel and vector draws but also **Polygon Area Fills, 2D rotation, scaling, clipping, dither fills, terminal emulate mode, stroke and raster character sets, circles, windowing and viewporting.** A Microsoft compatible subroutine library and C driver are included with every A-1000, at no extra cost. A **PLOT 10** driver and **GIOS** driver for **GSX** are available.

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- GRAFTALK** Business graphics package.
- UGRAF** Business graphics software that interfaces to various spreadsheets, **DBASE II** and **Condor**.



Multibus A1000

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To find out more about the A-1000, call or write. **Dealer inquiries welcome.**

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Teletek 1984



# Microsystems

# March

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March 1984



## MS-DOS-

A new support for files and peripherals.

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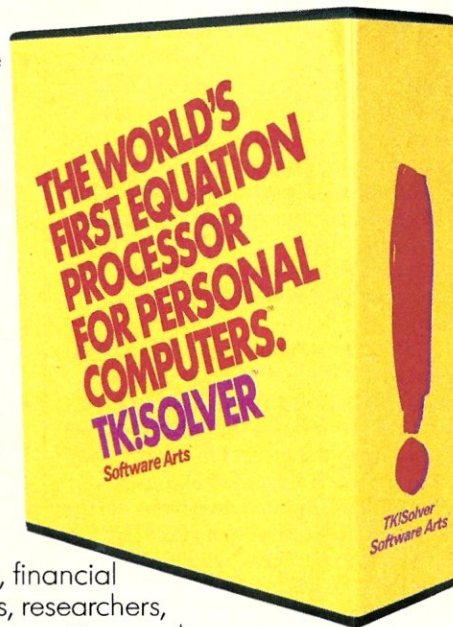
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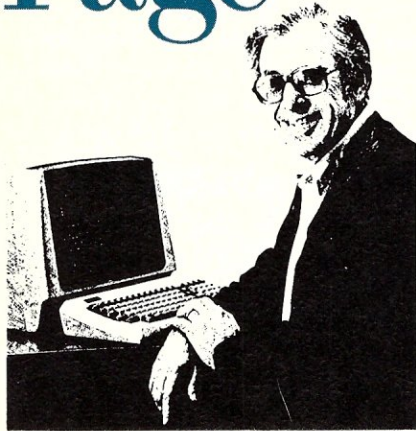
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**CIRCLE 9 ON READER SERVICE CARD**



# Editor's Page



## Digital Research takes on UNIX

by Sol Libes

At the recent Comdex show Intel and Digital Research announced that they have signed a contract under which DRI is to port UNIX System V to the Intel 80286 and also provide a line of related software to run under the operating system. This represents a radical departure for DRI, since all of their previous operating systems were derived from CP/M. Further, only a year ago DRI had stated they intended not to bring out a UNIX operating system.

It also represents a radical change for Intel, which had previously contracted Microsoft to port System V to the 286. Rumor has it that Microsoft decided to drop the project in favor of other, more profitable undertakings. Microsoft has invested heavily in the development and refining of XENIX, their version of UNIX, which is basically UNIX V7 with the Berkeley and System III enhancements, and they have done more to popularize UNIX on microcomputers than anyone else has. Under the terms of the contract, Western Electric will own the operating system, and both Intel and DRI will market and support the software.

It is reported that the XENIX project has been only marginally profitable for Microsoft, and that the System V implementation turned out to be much more work than they had anticipated. Further, it is likely that Microsoft was not happy with Western Electric's insistence that the port adhere strictly to the System V standard they had developed.

Thus Intel was left hanging and turned to DRI to get them out of the hole. With DRI's extensive line of languages and software development tools, they represented the best alternative to Microsoft. Both Intel and Western Electric scrutinized DRI's capabilities before the contract was signed.

Although DRI does its software development on a UNIX system, they lack any experience in the UNIX area, compared to several other software houses (e.g., UniSoft and Human Computing Resources) and it should therefore be very interesting to see how long it takes them to get this implementation out. There are rumors that DRI may acquire a small software house experienced in porting UNIX in order to get the expertise in-house quickly.

It is interesting to note that at the last NCC show in May, Western Elec-

tric, Intel, Motorola and National Semiconductor held a joint press conference to announce their commitment to port UNIX System V to the 286, 68000 and 16032 microprocessors. In the nine months that have gone by, no one has announced such a product, and we now learn that Intel has changed suppliers and is probably still more than six months away from releasing a product. Interestingly enough, UniSoft and Human Computing Resources have announced System V ports for the 68000, and HCR also has one for the 16032.

DRI has extensive experience with the C language, with implementations for 8086 and 68000 products. It is likely that after finishing the 286 System V implementation they will do a 68000 implementation. After all, Motorola has yet to bring out such an implementation, despite their contract with Western Electric.

DRI is apparently attempting to become *the* vendor for the standard System V UNIX for the 286 and possibly for other microprocessors such as the 68000. However, there are questions as to how successful this effort will be. After all, Microsoft and UniSoft have virtually all of the current OEM market sewed up, and there is little likelihood that these OEMs will change. Further, Microsoft introduced an improved performance version of XENIX for the 286 back in May, and Bill Gates has indicated that Microsoft will do their own implementation of System V. Microsoft has proved to be a very aggressive competitor. It is probable that their version will not be a strict Western Electric System implementation, but will most likely include the enhancements that Microsoft added to XENIX to make it more commercially marketable (e.g., improved user interface).

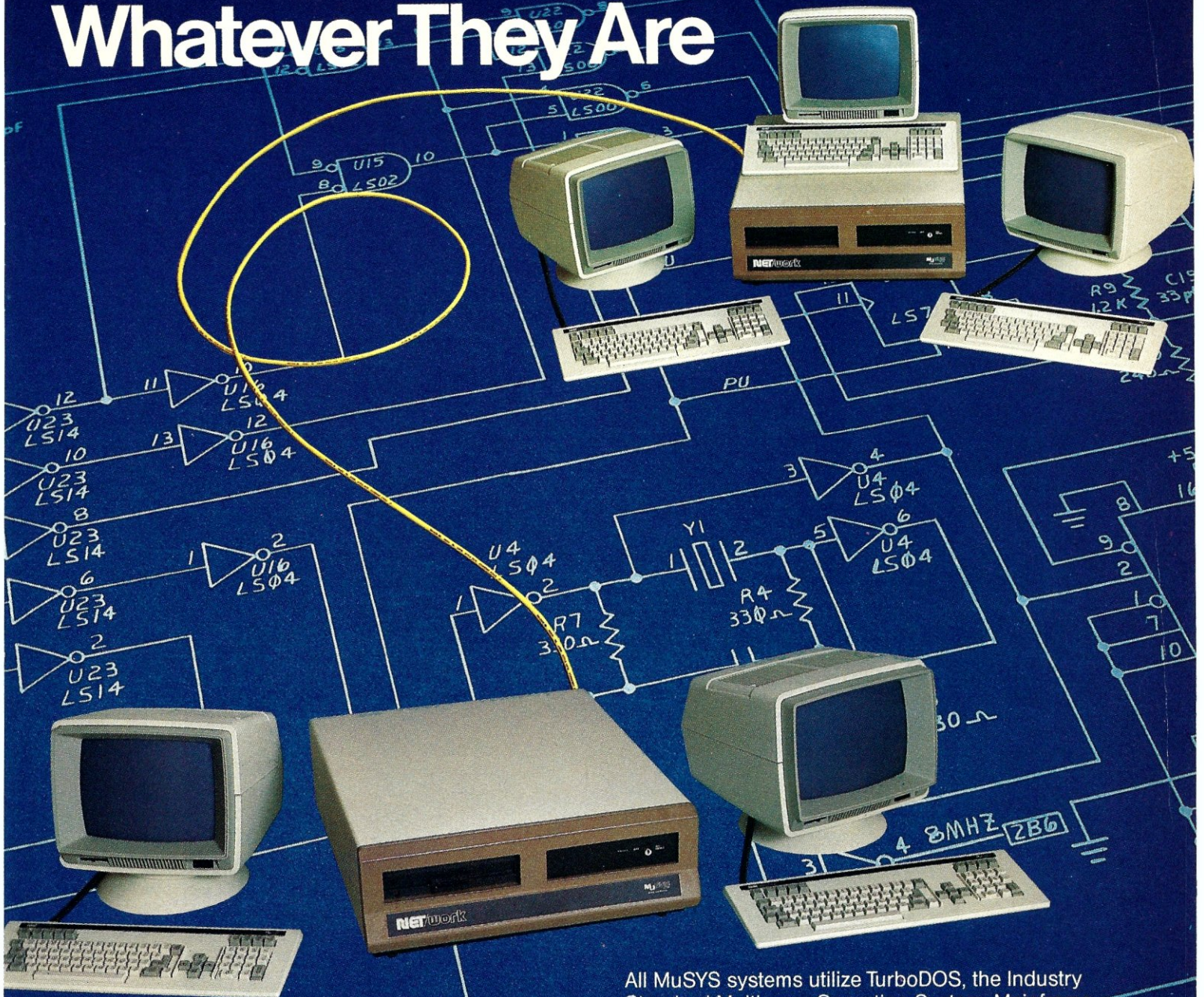
IBM is rumored to be developing their own operating system for their upcoming generation of 286-based workstations. Further, Western Electric's UNIX-based systems are due shortly, and they are not likely to use DRI's implementation. However, the market for languages and software development tools for these IBM and Western Electric systems could prove lucrative.

It is likely that DRI will offer a utility for their UNIX System V implementation that will allow the running or porting of standard CP/M software on these systems. Considering the wealth of CP/M software currently on the market and in the public domain, this would be a definite plus for DRI and for the UNIX community.

It is estimated that about 85,000 UNIX systems were sold last year (of which about two thirds were XENIX). This was the first year in which large



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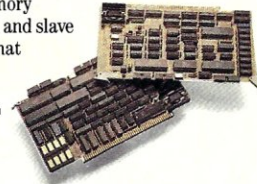
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Continued from page 8

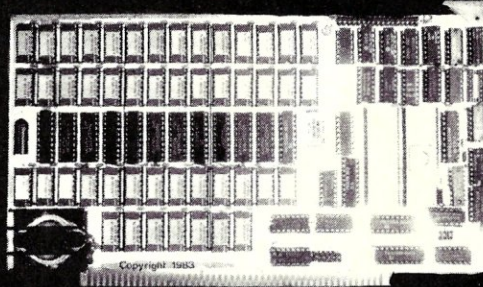
numbers of UNIX systems were sold. This certainly does not compare to the sizes of the CP/M and MS-DOS system markets, which are both about a million licenses each. It is estimated that the UNIX market will probably double this year and by the end of next year rise to well over 300,000 systems, particularly as IBM and Western Electric move into the marketplace.

The DRI version of UNIX now presents another area in which Microsoft and DRI are competing head-to-head. Considering Microsoft's previous successes in these battles, one can question the wisdom of DRI's decision to open up the war on yet another front. To a certain extent DRI may be forming an alliance with AT&T comparable to Microsoft's alliance with IBM.

For an in-depth discussion of Digital Research's entry into the UNIX marketplace and strategies being used by Microsoft, Intel, IBM and Western Electric, I refer the reader to an excellent monthly newsletter published by Yates Ventures, 4962 El Camino Real, Suite 111, Los Altos CA 94022, (415) 964-0130. The newsletter is titled *The Yates Perspective* and a yearly subscription is \$450.

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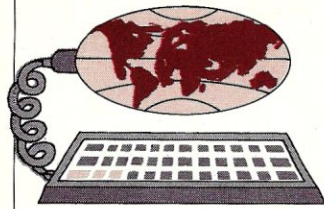
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# News & Views

Random rumors and gossip, plus a view of the industry's latest trends

by Sol Libes

Commodore is rumored to be negotiating with Mark Williams Company, Chicago IL to use the latter's UNIX-like Coherent operating system on Commodore's Z8000-based 16-bit microcomputer, now in development. The minimum system is expected to include 128K of RAM and a 320K disk drive and sell for under \$1,000. An 8088 plug-in card option is also expected, with versions of MS-DOS and CP/M-86 to run on it. . . . Commodore is also rumored to be readying a portable computer employing a 16-line by 80-character liquid crystal display and wafer-tape drive. . . . Texas Instruments is rumored to be working on a 68000 processor card for the desktop IBM PC-compatible system. TI is expected to include a UNIX-type operating system with the card.

## New public domain software

SIG/M (Special Interest Group for Microcomputers, Amateur Computer Group of New Jersey, Inc.) has issued one new volume of public domain software, bringing their total up to 152 volumes. The new volume contains a disk drive alignment program for the 1793 FDC; it does not require an oscilloscope, but you do have to purchase a \$30 test disk from Dysan. Also on the disk are updates for the DU, LDIR, SWEEP, TYPE and USQ utilities.

For complete information on SIG/M software, send \$2.50 (\$4 foreign) for printed catalog to: SIG/M, Box 97, Iselin, NJ 08830.

P/D Software, 4691 Dundas St. West, Islington, Ontario, Canada M9A 1A7 (416/239-2835) is distributing CPMUG and SIG/M software libraries in 25 different disk formats including 8", Apple, KayPro, Osborne, IBM and others. The software is available in prices ranging from \$10-\$20, depending on the disks required.

The New York Amateur Computer Club, Box 106, Church Street Station, NY, NY 10008, has released two new volumes of software for systems running MS-DOS and PC-DOS. The disks are \$6 postpaid (add \$3/order for foreign). A printed catalog is \$10 (\$15 foreign). The new volumes are:

- | Volume | Description  |
|--------|--|
| 43     | dBASE II order entry & inventory control system (converted from SIG/M library) |
| 44     | Demographics display system for IBM-PC   |

## DRI announces CP/M-86 version 3.1

Digital Research has announced that it expects to start shipping an enhanced version of CP/M-86 this month. The new version, designated 3.1, will add window-like structures to terminal screens. Further, it will be capable of running MS-DOS and IBM PC-DOS based software. The question now is: will Microsoft add the capability to run CP/M-86 software to MS-DOS and PC-DOS? The Microsoft MSX operating system for low-cost Z80-based home computers can run CP/M-80 software.

## 3M announces new magnetic medium

3M Corporation has announced a new, low-cost magnetic medium that they claim will allow "semi-rigid" 5.25" disks capable of storing 5 MB per side (10 MB total). The disks are expected to retail for about \$10 in quantity and, like floppies, do not require a sealed environment. Commercial availability is still expected to be a year away.

It should be pointed out that Kodak's Spin Physics Group had previously announced a product with similar capabilities. However, the cost is expected to be higher.

In any event, we can expect that 1985 will see systems with removable-media disk drives storing 5 and 10 MB.

## S-100 product directory in works

The annual *Microsystems* directory of IEEE-696/S-100 products is now being put together for publication in the May issue. In May of last year this directory listed 157 suppliers of approximately 500 IEEE-696/S-100 products. We have already discovered 33 new suppliers who have entered the marketplace and are not aware of any that have forsaken it. This is an increase of over 20% and it is likely that the number of products has increased by the same percentage, so that there are probably about 600 IEEE-696/S-100 products now being manufactured. This indicates that the S-100 marketplace is still active and growing.

If you are a supplier of such products and have not received a directory questionnaire form from us, please call us immediately and we will send one out to you.

## Intel announces improved iAPX432

Intel has announced an improved version of its 32-bit iAPX432 microcomputer chip set. The chip set, which represents a radical departure in CPU architecture from Intel's 16-bit devices, has never gained market acceptance. There have been reports of disappointing performance, and no major computer manufacturer has adopted the devices.



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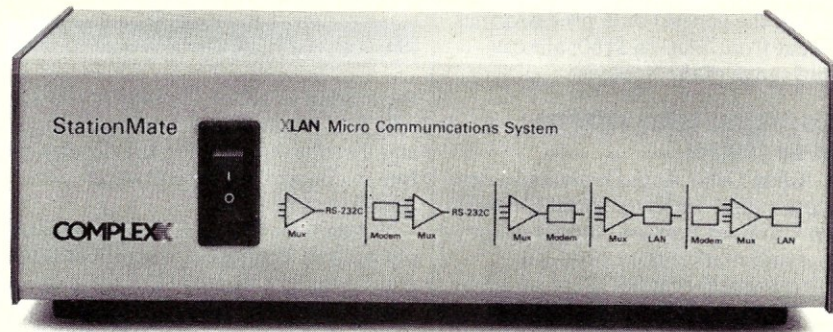
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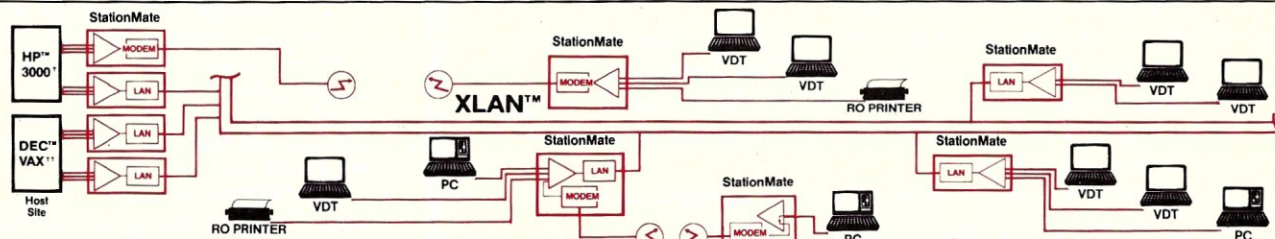
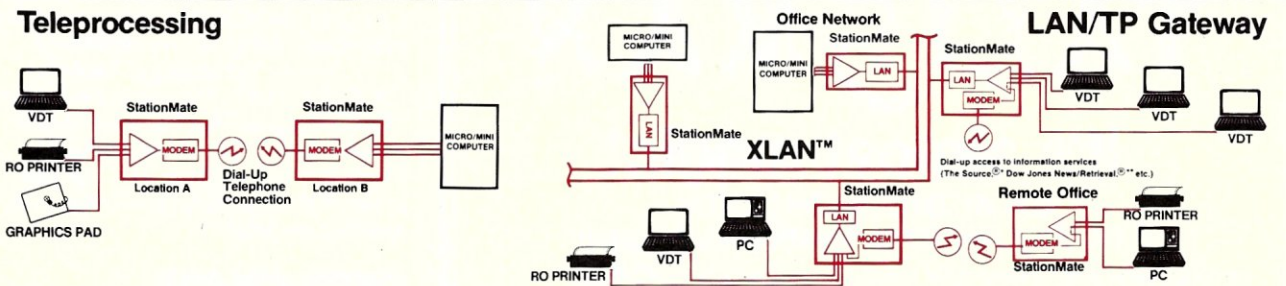
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## News & Views

Continued from page 12

But Intel has made a commitment to the 432 architecture, which they consider a major step forward for knowledge-based systems. The new release of the device operates at a higher speed and handles instructions more efficiently. Intel claims it is twice as fast as the previous version. Additional enhancements have been made to reduce I/O overhead, and a virtual operating system has been developed that anticipates memory usage and supports 1 trillion bytes of virtual memory. As an additional incentive Intel has reduced the prices of the chips. For example, the price for the general data processor has been cut from \$450 to \$160; almost within range of the hobbyist.

### Adam Osborne forms software start-up venture

Adam Osborne has launched a new venture called "Software Seed Capital Corp." to fund start-up software companies and market their products. Adam promises that SSCC, of which he is chairman and chief executive, will invest \$10 to \$15 million in these start-ups and hopes to have 50 to 60 programs on

**When you're a little guy you have to pay your own bills, but then you get more successful ...**

the market in about 12 months. SSCC will do the manufacturing, marketing and distribution, leaving the developers free to concentrate on software development.

Adam is still chairman of the board of Osborne Computer, which is still operating under Chapter 11 of the bankruptcy law. Adam claims that his day-to-day involvement in OC ended last February and "after that I really wasn't

certain of what was going on." Further, he has stated that "with the damage done from March to September there's really nothing left of the company I created." And that "there's not much point in me going in to pick up the pieces." He described the OC situation as "a tragedy" that was "totally unnecessary" and that OC "went down the tubes when I brought someone else in to run it." Here he was referring to Robert Jaunich, former president of Consolidated Foods, whom Adam hired to be president of OC.

OC is looking for someone to purchase the company. In the meantime, lawsuits have been filed against Adam Osborne, founder, and Robert Jaunich, president, charging misrepresentation of financial status when selling securities.

### Personal CP/M comes to Z80

As rumored previously in this column, a chip has been announced by American Microsystems, Santa Clara CA that places the kernel for the Personal CP/M operating system in the same chip with a Z80 processor. AMI has a second-source agreement with Zilog and expects to start sampling by the end of next month. The chip is expected to be used in low-cost home computer systems.

### Random news

Tandy has finally begun shipping CP/M for its Model IV computer, fully nine months after it first announced it. . . . Wayne Technology, Anaheim CA (714/772-5757) has introduced the "CoCo Coupler One" which makes it possible to run CP/M on the Radio Shack Color Computer. It is inserted between the computer's cartridge port and disk controller.

### Quotation of the month

"When you're a little guy, you have to pay all your own bills. But then you get a little more successful, you get a line of credit, and the bank starts paying your bills. Then you get a little more successful, and the bank won't pay anymore, so you pay your bills slower. . . . 30, 60, 120 days late. . . . and now your vendors are paying your bills. Now you're even more successful, you get venture capitalists, and they're paying your bills. And it used to be when you reached the highest level of success, you could go public and have the public paying your bills. But nowadays, when you finally reach the true pinnacle of financial success, like Chrysler, the government starts paying your bills."

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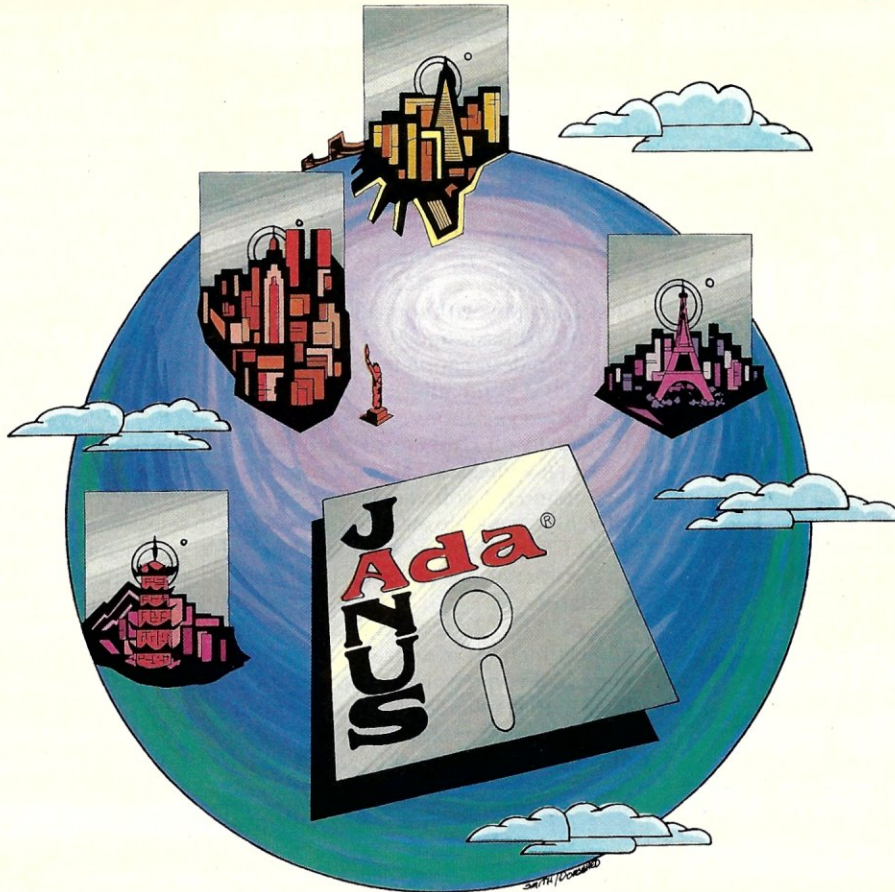
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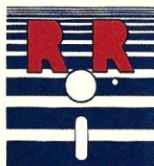
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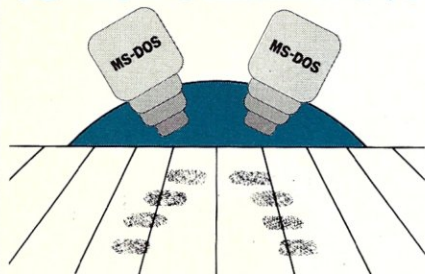
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# From the Sidelines



**Subtle differences among the new releases give you more possibilities to choose from**

by Hank Kee

The latest releases of PC-DOS are versions 1.10 and 2.1. PC-DOS 1.10 is essentially the same as version 1.1, but has the GRAPHICS option available in version 2.1, along with some differences between 1.10 Basic and 1.00 Basic. The change in designation is very subtle. Most IBM compatibles have only implemented variations of MS-DOS 2.0. Practically all IBM clones have version 1.1 or an equivalent. Most of the popular commodity software systems are currently available on either PC-DOS 1.10 or 2.1, albeit dependent on the IBM screen attributes. Version 2.1 requires greater RAM.

PC-DOS 2.1 is version 2.0 with the added functions of addressing the dynamic color video on the IBM PCjr. PC-DOS 1.10 is intended for systems with smaller memory sizes, whereas 2.1, with its requirement for over 24K of RAM, is

intended for systems that have larger memory. The paradox in all this is that the PCjr can only be used with version 2.1: its memory limit is 128K, the reason being the PCjr's dependence on the relocatable color video.

IBM PC-DOS 1.10 uses a 320K double-sided double-density format. Version 2.1 can reference either 320K or 360K of double-sided and double-density disk storage as well as fixed disks.

Like CP/M, MS-DOS/PC-DOS has implicit or internal commands as well as explicit or external commands. They are similar in function and format to CP/M in many respects. This month we will compare PC-DOS 1.10 to CP/M 2.2. This is strictly an arbitrary selection: they are similar in many respects, but different in others. In CP/M, destination-file is specified before source-file. To rename a file in CP/M, the proper command is:

```
REN (new-name)=(original-name)
```

In MS-DOS/PC-DOS it is just the reverse. An equivalent example is:

**Table 1. Internal commands**

PC-DOS	CP/M 2.2 equivalent	
COPY	PIP	copies one or more files (*)
DATE	—	displays and/or resets date
DEL	ERA	same as ERASE
DIR	DIR	lists directory
ERASE	ERA	deletes file
PAUSE	—	suspends system processing
REM	—	displays remarks within a batch file
REN(AME)	REN	changes the name of a file
TIME	—	displays and/or resets time
TYPE	TYPE	displays the contents of a file
—	SAVE	memory save

(\*) PIP is an external CP/M command.

**Table 2. External commands**

PC-DOS	CP/M 2.2 equivalent	
CHKDSK	STAT	check disk
COMP	—	compare files
DISKCOMP	—	compare disk
DISKCOPY	—	copy disk
EXE2BIN	—	converts .EXE files to .COM (*)
FORMAT	—	initializes disk
GRAPHICS	—	screen print
MODE	STAT	sets mode of operation
SYS	SYSGEN	transfers operating system
.BAT	SUBMIT	batch file processing
.BAT	XSUB	extended batch processing
—	DUMP	file dump

(\*) EXE2BIN converts relocatable binary to absolute binary code.



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## SIDELINES

Continued from page 16

RENAME (original-name) (new-name)

Switching between similar systems can cause confusion in syntax. It is probably easier to work with two completely different systems.

A comparison of the available commands is given in Tables 1-3.

## MS-DOS/PC-DOS 1.0 has a richer total command set than CP/M 2.2.

Hardware-specific CP/M support programs are normally provided on the system distribution disk. These normally include programs to format disks and to do fast disk copying. Some manufacturers include selected commodity software systems in their packages.

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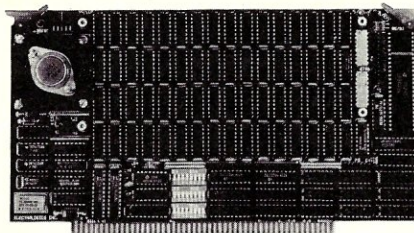
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# SIDELINES

Continued from page 19

The total command set of MS-DOS/PC-DOS 1.10 is richer than that of CP/M 2.2. However, MS-DOS/PC-DOS 1.10 and CP/M 2.2 require the lay person to understand the primitive structures of an operating system. MS-DOS/PC-DOS 2.1 and CP/M Plus provide for icon-driven formats, which in turn make them far easier to use. This will be discussed in future issues.

MS-DOS/PC-DOS, as offered, has file attributes different from those of CP/M. Each file under MS-DOS/PC-DOS has associated information in byte size, and date and time stamp of

Table 3. Supplied systems

PC-DOS	CP/M 2.2 equivalent	
DEBUG	DDT	dynamic debugger
EDLIN	ED	line editor
—	ASM	assembler
—	LOAD	converts .HEX to .COM
—	MOVCPM	generates CP/M sizing
BASIC	—	Basic interpreter
BASICA	—	advanced Basic interpreter
LINK	—	link editor

(\* ) LINK binds .EXE files.

creation or last modification. An example of this is as follows:

```

FORMAT COM 3816 5-07-82 12:00p
CHKDSK COM 1720 5-07-82 12:00p
DISKCOPY COM 2008 5-07-82 12:00p
BASICA COM 16768 5-07-82 12:00p
    
```

Under CP/M, a STAT command can be used to display information relevant to the number of blocks, size of file, number of extents and file attributes. With CP/M it is possible to display as well as alter information on file status, such as system or directory file, and read/write or read-only file status.

Recls	K	Ext	Acc
14	2K	1	R/O A:BOOT.Z80
38	6K	1	R/O A:(DDT.COM)
33	6K	1	R/W A:DUMP.ASM
4	2K	1	R/W A:(DUMP.COM)

If only it were possible to have the file attribute options of CP/M with the full complement of MS-DOS/PC-DOS commands, including date and time stamp as part of the standard operating system!

Two Basic interpreters are supplied with PC-DOS, as well as demonstration programs written in Basic. These programs do make a good foundation for a better understanding of the Basic functions, and most people prefer them over the availability of an assembler as part of the distribution of system software. CP/M, on the other hand, supplies an assembler along with the sample source programs (.ASM) on their distribution disk.

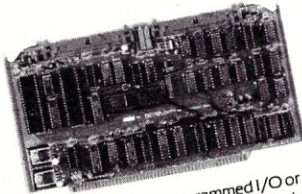
However, under CP/M, one will find that there is not 100% portability of code between the interpretive MBasic and the BASiC COMpiler. Microsoft did not discriminate between systems. This inconsistency exists under MS-DOS/PC-DOS as well. What makes it more difficult to understand is that the Basic compilers for MS-DOS are not compatible with those available under PC-DOS.

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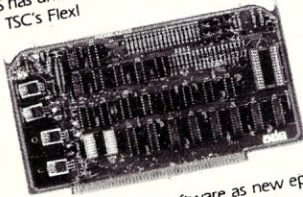
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### SOFTWARE:

ADS has drivers available for the following operating systems: Digital Research's CP/m, Microware's OS-9, and TSC's Flex!



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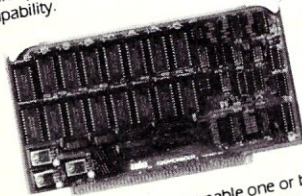
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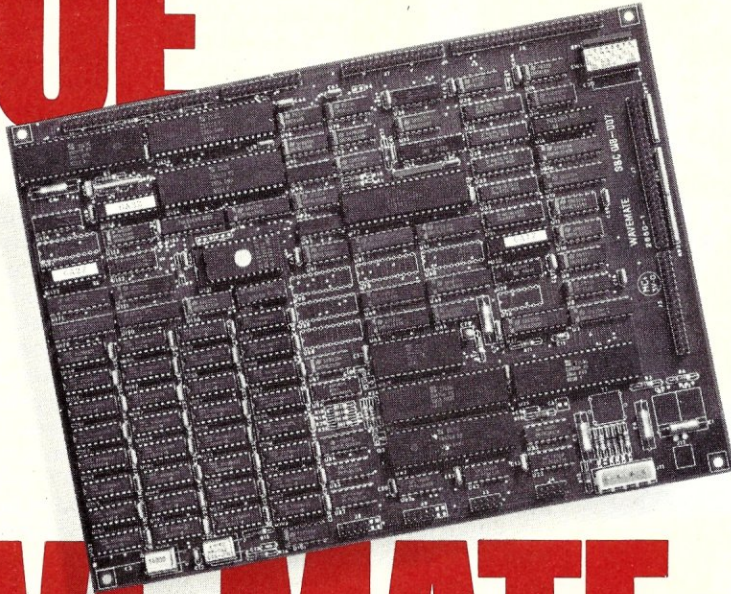
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Several BIOS enhancements—from the early, quite basic, to the more sophisticated

by Chris Terry

The BIOS source code provided on the Digital Research CP/M distribution disk is set up for the Intel MDS (Micro Development System), and is seldom of any use to the purchaser. This same BIOS is built into the MOVCPM utility that allows system relocation to suit the available memory size. Further, the standard BIOS "tolerates, but does not use" the IOBYTE at location 0003.

Thus, in the early volumes of the CPMUG and SIG/M libraries, at a time when CP/M 1.3 was still in use, we find quite a number of BIOS enhancements. Some of these are quite basic; others are more sophisticated and include hard disk support.

## Basic BIOS

CPMUG Vol. 1 contains VBIOS31, VBOOT31, and ASSIGN, all written by Jeff Kravitz for a system running an IMSAI disk controller, a ProTech VDM-1 memory-mapped video board, and an IMSAI SIO2-2 serial I/O board. Its main value is for study, particularly of a simple video driver and the routines that use the codes in the IOBYTE to attach different physical devices to the four logical devices of CP/M (CON:, RDR:, PUN:, and LST:). All character I/O routines inspect the corresponding bits of the IOBYTE and dispatch the character to the physical device currently specified. The ASSIGN transient program sets the codes in the IOBYTE according to keyboarded commands. These routines remain among the clearest and most effective for use of the IOBYTE under CP/M 1.3, 1.4 and 2.2, and well repay close study. CP/M Plus, of course, has built-in provision for far more elaborate I/O control.

CPMUG Vol. 25 contains early CBIOS, BOOT, COPY and FORMAT programs written by Tarbell staff for their single-density disk controller with Shugart 800 or Persci Dual 8" drives. All of these programs have been superseded by later versions, but they are well commented and again are worth close study if you want to learn the basics of writing a disk driver. Note, however, that the BIOS does not include access to the disk parameter tables, which were not brought out into the BIOS until the advent of CP/M 2.0.

## Advanced BIOS

CPMUG Vol. 38 is interesting for

two items. The first of these is a set of routines, with instructions, on how to integrate your own BIOS into the MOVCPM utility. You need MAC and SID to do this—it's a complex procedure for versions 1.3 and 1.4, and may need modification if you are using 2.2. It probably could be done nowadays much more easily with RMAC, which can generate both Relocatable (.REL) and System Page Relocatable (.SPR) code.

The second item of interest is DFOCO, a disk formatting and copy program for Tarbell or Delta double-density disk controllers. It can format or copy individual tracks in many different formats. Well commented and worth close study.

Until recently, disk controller manufacturers who also made CPU boards had a nasty habit of supplying their own operating system and putting all I/O routines in PROM on the CPU board to lock you into their system. SDS was one of these; thus we find several BIOS entries to allow the VersaFloppy II (a good, reliable controller) to run standard CP/M 2.2. One of these, for 8" and 5.25" floppy disks only, is to be found in SIG/M Vol. 26. Another, with support for XComp and SEAGATE-compatible hard disk, is in SIG/M Vol. 42. A BIOS that supports the DTC hard disk is to be found in SIG/M Vol. 50.

Anyone with a North Star Horizon system should look at CPMUG Vol. 82, which contains two North Star BIOS files, one of which has built-in drivers for the PMMI modem. The volume also contains various utilities. Cromemco

## Integrating your BIOS into MOVCPM is a complex procedure.

users may be interested in SIG/M Vol. 41, which contains a BIOS for the Cromemco 16FDC and 4FDC disk controllers in a system running ACDOS, together with support utilities for CDOS.

Finally, an interesting BIOS submitted to SIG/M (but not released at the time of writing) implements Bob Lurie's scheme for increasing the capacity of a single-density disk from the nor-





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Sort & Print Labels	6:41 min.	4:18 min.
Totals	1:02:30 hrs.	13:50:08 hrs.

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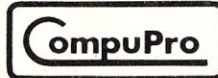


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**PUBLIC DOMAIN**

*Continued from page 22*

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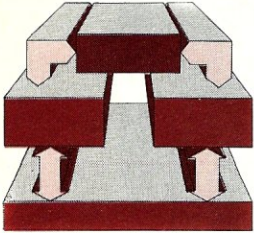
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# The UNIX File

**“UNIX is a well-designed, usable operating system, but it can’t protect users from ill-conceived attempts to produce enhancements.”**  
—*Banahan & Rutter*

by Ian F. Darwin

**T**his month The UNIX File reviews another in the non-terminating series of UNIbooks, looks at writing programs in the shell, and at using your small UNIX system for typesetting.

## The UNIX Book

*For want of a nail,  
the horse was lost.  
For want of a horse,  
the battle was lost.  
For want of a battle,  
the kingdom was lost.*

And so it has been, all through history. Alas, what we have here is another valiant entry in the UNIbook arena which will probably be lost for want of a seemingly minor detail. *The UNIX Book* by Mike Banahan and Andy Rutter (Wiley, 1983) is one of the few non-American books on UNIX, and its British flavor adds to, rather than detracts from, the book’s appeal. The authors seem to know the system quite well. They demonstrate use of the common system commands, the standard editor, shell programming, and the like. And this book conveys some sensible philosophy about UNIX.

“UNIX is a well-designed, usable operating system, but it can’t protect users from ill-conceived attempts to produce ‘enhancements.’ Some suppliers feel duty-bound to include their own souped-up editors with the UNIX systems they sell. Are they really doing you a favor?

“If you feel that you *must* use the flashy editor supplied with your particular system, give some careful thought to portability—both its and yours . . . [The UNIX portable software] means that you don’t have to worry nearly so much about details of hardware that differ from one installation to the next. If you start using nonstandard software and don’t have a copy of its source code, you could be in trouble when you move from one piece of hardware to another. Users who know only a nonportable editor (by ‘portable’ we mean one that *has* been ported, not one that vendors say *could* be) are at a big disadvantage.”

In this remark the authors convey much significant advice for anyone using UNIX or looking around the UNIX marketplace (or any computer market, for that matter). Portability has both a theoretical and a practical side; if the code could be ported, but won’t be because the software vendor has some stake in a particular hardware vendor or

system, then how portable is the program really? This points out the advantage of buying software that is known to be widely ported, not just portable.

The book is organized in a fairly natural manner. There is a brief introduction, a chapter on files, one on the standard editor, the filesystem, filters, text preparation, a chapter on C, one on UNIX processes, system libraries, and system administration. Their terminology will seem quaint; they call a filesystem a “filestore,” for example. And they use “SIO” for “stdio,” the standard I/O library. There is some advice which is interesting but not useful, such as “be wary of the UNIX ‘expert,’ who may have learned the system so long ago that his knowledge is out of date.” Fine advice, but how does a novice tell whose knowledge is out of date and whose is in? And, at odds with the spirit of the above advice, “devour the listings of as many real programs as you can” to learn more about C. Folks, many of the “real programs” are real crocks. What you want to do to learn C is to find *good* program source code examples to learn from. The same page contains the admonition to “read the other books,” which is probably good advice, since some of the chapters in this book do little more than whet the appetite.

One of the things that UNIX is about is not retyping manuscripts once they’ve been proofread. (Although my column gets retyped once at present, this is a temporary—I hope—imposition caused by a change in typesetting services). All the UNIX tools assume that their files are text, so that you can process most any kind of text with the same tools. The phototypesetter software is no exception, and most other UNIX books have been prepared under UNIX using either the **troff** program or some other package (see below). The Banahan and Rutter book, alas, was apparently not typeset under UNIX. Somebody seems to have laboriously retypeset the entire book from the printouts produced under UNIX. The result, predictable where technical text is concerned, is a typographical disaster.

In this book you are expected to infer a lot from the examples given. But many of the examples are typeset poorly or incorrectly. Spaces appear and disappear; command names change, wrong quotes are used, and so on. There is sloppy typesetting of examples throughout, which leads me to believe that the book was typeset by somebody with no real understanding of UNIX. This is, I hate to say, the worst typesetting job I have seen in any technical book. Ever.

The hand typesetting is reflected in other areas as well. *The UNIX Program-*



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## UNIX FILE

*Continued from page 26*  
*ming Environment*, which I reviewed last month, was prepared and typeset completely under UNIX, and has an excellent index (nine pages, three columns per page) although somebody renumbered the Roman numbers in the front matter after the index was done. *The UNIX Book* index is but two pages, two columns, large type. Many useful references are omitted from this index. But the appendices more than make up for the poor index. Tables of all the common commands, editor subcommands, shell syntax, a well-organized listing of the system calls and standard libraries, and so on—this is the reference material that you need when learning UNIX.

The authors claim that "very few UNIX sites have access to a typesetter," which is probably more accurate in Great Britain than in North America, where most large UNIX sites either own a typesetter or have access to one. So it's too bad that the authors of *The UNIX Book* were not able to make better arrangements for typesetting. Of course, a reputable publishing house such as Wiley should have come up with better arrangements. If they do so, and come out with a second edition that corrects the poor typesetting, then this book could serve as a good although slightly superficial introduction to UNIX. As it is, *The UNIX Book* has some very good points, but these are sunk by some very poor visual presentation.

### Shell programming considered beneficial

In previous columns I gave a few examples of "shell programming." This time I'd like to comment on the shell as a programming language comparable to Basic, C, or PL/1 in its utility. The shell provides an interactive programming environment like that of Basic, with program structuring comparable to C or PL/1, variables (not limited to two-character names!), immediate or stored-file execution, file access, etc.

As one example, I needed a prompter for some data entry I am doing on another editing project. It collects bibliographic data (citation, author, date, etc.) on magazine articles. I first wrote it as a C program. This worked, but took lots of time to write and debug. Fortunately, I had to do some of the entry on a UNIX system which (temporarily) did not have enough memory to run the C compiler. Being forced to replace my C program with a shell file made me think a lot about shell files as programs. I was able to replace more than a hundred lines of C with about 30 lines of shell command

file. It worked the first time (unlike the C program, which took several tries to get right). Not only that, but after running it for a while I decided to change some parameters. This involved simply editing the shell file; no recompilation step was needed to try out my changes.

I recommend this exercise for any aspiring UNIX programmer. Forego use of the C compiler for two weeks, and do everything as a series of shell files. During this time, learn some of the finer points of **make**, **awk**, **sh**, **pr**, **nroff** and **adb** (or **sdb**). During the time my home system was without C, I developed a (nonspooled) version of **lpr** which converted backspaces to overstrikes and did tab expansion (using only **awk** and **stty**), several versions of the bibliography

## The use of existing tools in new ways enriches UNIX without building up new mythologies.

prompter mentioned above, an **awk** file to generate another **awk** file to read in and check a database, and other programs.

As well, at work we have replaced several C programs by shell files. To some programmers, this sounds like a step backwards (although it inarguably results in fewer lines of code to maintain!). Part of the UNIX philosophy consists of using the right tool for the right purpose. To me, this includes *not* inventing a new tool for which a perfectly good one exists. Of course there are tradeoffs between building new tools and using existing ones. My **awk**-based **lpr** would not be used on an overloaded timesharing system (but overloaded timesharing systems are supposed to be the ebb tide of the past). Part of the problem with some currently available UNIXes is that their maintainers did not familiarize themselves fully with the existing UNIX tools. Instead, they built a bunch of new tools or disfigured existing ones, rather than building tools out

of combinations of standard utilities. The "new tools" approach complicates UNIX both for the end user and for subsequent developers; the use of existing tools in new ways enriches UNIX without building up new mythologies.

### Typesetting from UNIX

UNIX has traditionally been used for preparing material to be typeset directly from computer-readable copy. This text can be checked by various spelling checkers, processed by equation, table, bibliographic, diagram and other preprocessors, formatted for a character printer with **nroff**, and finally typeset with a similar program called **troff**. But the **troff** program assumes that you have a particular typesetting machine, a Graphic Systems (WANG) C/A/T. They're not made anymore, and most people don't have one. However, if you have a small UNIX system you probably wish to get the benefits of the typesetting software. Here's how you can.

First decide if you need real phototypesetting, or if *good* proportionally spaced daisywheel printer output will do. Before you reject the latter, look at some printouts. Remember that this is what most micro-based word processors use. If the former, decide if you want to do the typesetting yourself or send it out to a professional typesetting firm.

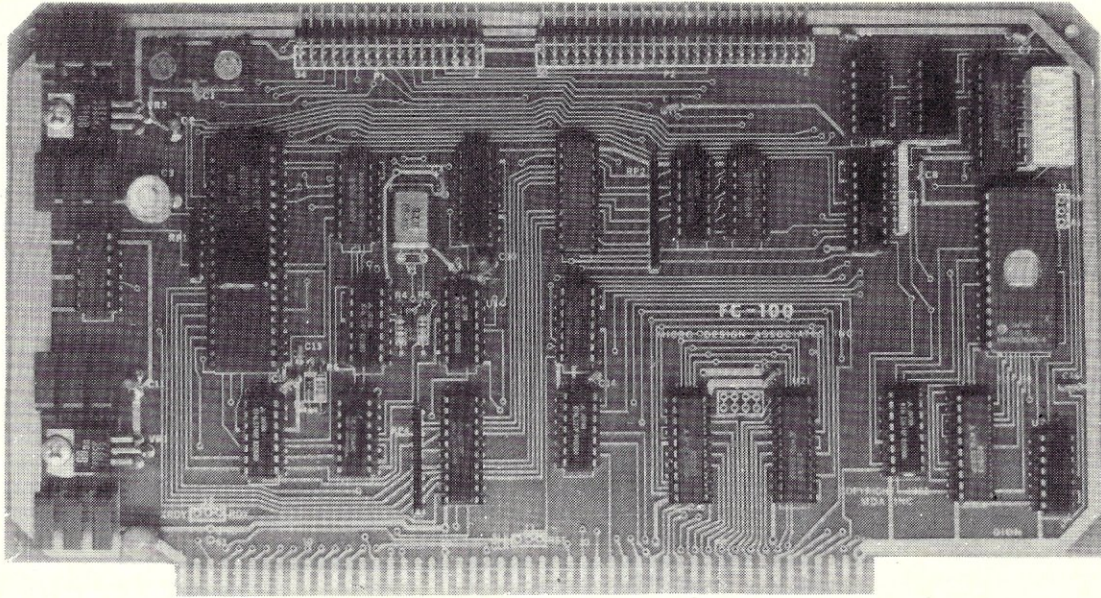
If you want to buy a typesetter, you might consider buying a used C/A/T. They are sometimes available on the used equipment market. There also exists a serial interface which you'll probably need unless you have a Unibus VAX-11 or PDP-11 system. You'll be investing in really obsolete technology, but the **troff** which comes with your UNIX will know how to talk to it. You'll also need a photochemical processor to develop and fix the paper output—this will probably cost a few thousand more. And you'll need to develop a whole new realm of expertise to get good results.

Instead of a C/A/T, you might buy a more modern typesetter. Brent Byer of Textware in Cambridge, MA, sells a couple of packages for small UNIX systems. Both take the output from the standard **troff** and recast it for particular devices. **Tpost** transforms the CAT files into a format suitable for newer machines such as the Compugraphic MCS8400 with a serial interface. One of our customers at work has **Tpost** and an 8400. While it was not simple to set up, the results have seemed satisfactory to date. Textware also sells **Tplus**, which makes **troff** drive a daisywheel printer such as a Diablo, NEC Spinwriter, or the like. **Tplus** represents the output as best it can on a device with fixed type size but variable motion. For normal



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# UNIX FILE

Continued from page 28

text such as letters, the sample outputs look quite good. For representing very large or very small-sized type, the quality drops off a little as the daisywheel letters get very far apart or very close together. But check it out yourself: **Textware International, Box 14, Harvard Square, Cambridge, MA 02238.** Their phone number is price: 716-UNI-TEXT.

Another approach involves Bell Lab's new **troff**, also called Typesetter Independent Troff or Device Independent Troff (the latter is pronounced "dit-roff"; the former is better not pronounced). This is a major revision of **troff** that can be adapted to many new devices, including both typesetters and daisywheel printers. Unfortunately for the small-system owner, AT&T (Bell, Western Electric) only licenses **ditroff** in source form, and it's several thousand dollars. They have a binary sublicense, which would allow OEMs to sell **ditroff** to end users in binary form for \$200 in royalties, but the major porters of UNIX have so far passed over this opportunity (hint, hint).

If you are not taken with **troff**, you

might look at a couple of other packages. Knuth's TeX package can be had for UNIX, as can the **SCRIBE** package from UniLogics. Both are rather newer designs than **troff**, and have about the power of **troff** with one of its standard macro packages. Both drive a range of devices, including daisywheel typewriters and phototypesetters, from the same input. However, they are much more verbose, and generally offer you much less freedom of action. They are difficult to write preprocessors for. And because they do not expect preprocessors, because they try to be all things to all people, they are quite large programs. I am familiar with all three, but have only used **troff** seriously. Perhaps I'll revisit the topic if and when I've made some real use of them. I doubt I shall use them, though, since **SCRIBE** babbles on so, while doing even the simplest thing, that it gives new overtones to the term "full-screen software."

There are thus several approaches if you want to do your own typesetting. And if you want somebody else to do it, you have a variety of other ways to proceed. Some typesetting shops will accept **troff** input files; others will accept output files. There are important issues regarding typefaces and different widths;

I suggest you talk these over with your local typesetting firm. Many large cities now have typesetting houses which know about **troff**, so look in the yellow pages for typesetting firms and phone around until you find somebody who knows what you're talking about. If you can't find anybody in your home town, drop me a line and I'll try to put you in touch with somebody nearby.

Watch for my comments on the UNIX conference in January in the next column, as well as more on "shell programming" and some information on networking. Also, next month's issue of *Microsystems* will have a directory of UNIX software. Watch for it! **U**

*The UNIX File looks at many aspects of the UNIX operating system. If you have comments or questions about UNIX or this column, feel free to write to me at the University of Toronto Computing Services (UTCS), 255 Huron St., Toronto, Ontario, Canada M5S 1A1. If you have UNIX mail access to the USENET network, you can contact me at "devvax!utcsstat!ian". The opinions presented here are my own, and not necessarily those of the University of Toronto or of UTCS.—Ian F. Darwin*

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### LOOKING FOR

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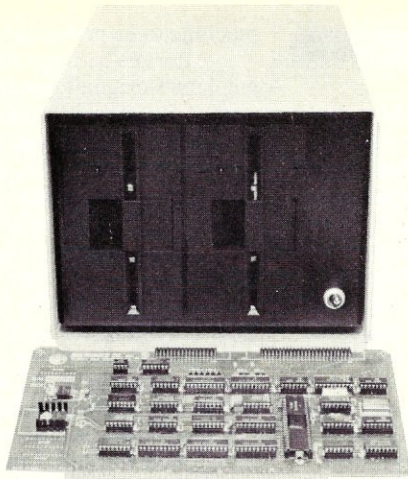
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Complete standalone Disk Maker II base unit includes one 8" DSDD disk drive, one 48 tpi 5¼" DSDD disk drive, 6 MHZ Z80B, 64K CP/M system with Disk Maker software. An additional 8" drive, a 96 tpi DSDD drive and a 10 M hard disk are available as options. Just plug in your terminal and make disks! Base unit: \$2995.00

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Disk Maker is a product which allows you to format, read and write over FIFTY popular 5¼" disk formats on your existing S-100 computer.

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- **An S-100 Floppy Disk Controller Board** — supports 4 drives, any combination of 5¼" or 8" — double-sided, double-density, 48 tpi or 96 tpi. And extendable to the new 3" drives in the near future!
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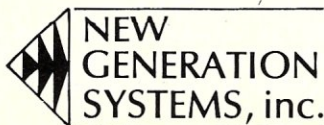
Any of over FIFTY formats. Osborne, Cromemco, DEC Rainbow and VT180, Epson, Sanyo, TI, Xerox, Eagle, Archives, KayPro, NEC, IBM PC (CP/M 86), SuperBrain, Otrona Attache, Zenith Z-100, Heath (Soft Sector) and TeleVideo to name just a few. And new formats as they are added.

### **How much does it cost?**

Disk Maker I, with S-100 controller board, one 48 tpi DSDD 5¼" disk drive, dual drive cabinet and power supply, cables and Disk Maker software is priced at \$1,500.00! (plus shipping.) Please notice: There is no per format charge. All formats currently available are provided at no extra charge. Future software updates are only \$25.00.

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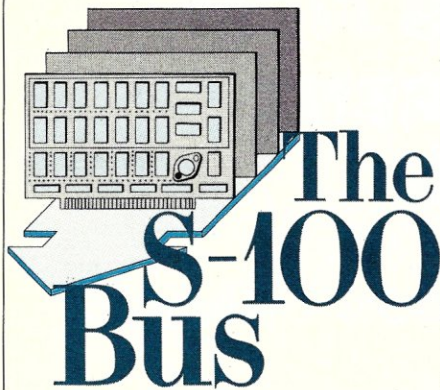
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## Simple power failure backup systems for the S-100

by Dave Hardy

**N**o matter how dependable your S-100 machine is, it is still susceptible to power failures and line dropouts. A well-designed power supply can save you if the dropout is short enough, but no filter can protect your system for more than a few seconds.

The best solution, of course, is an Uninterruptible Power Supply, but a UPS is also the most expensive. You could also use a good-sized DC-to-AC power converter, then buy a bunch of car batteries and then an AC-powered battery charger and hook them all up, but if you're like me, you'd probably have to sell your S100 frame to get enough money and make enough room for all that stuff. Plus, most "wet" batteries produce hazardous gasses when they are charged, and no one wants a room full of hydrogen gas and sulfuric acid fumes.

My own S-100 system runs 24 hours/day as an RCPM or RMPM, and suffers from line dropouts once or twice each week which, in the past, have caused a lot of grief. The worst problem was that the dropouts were often just long enough to cause the system to "glitch," but not quite long enough for the system to sense a power failure and automatically re-boot.

The solution, which has worked well for the past several months, was to replace the S-100 power supply with batteries. Surprisingly, it is easy to get inexpensive high-capacity sealed batteries in exactly the right voltages for an S-100 system. Five medium-sized "GEL-CELL" type 8-volt batteries, with a capacity of about 2 AMP/hours each, were used in my system: two batteries each for +16V and -16V, and one for the +8V line.

Because power regulation is performed on each individual circuit card in an S-100 system, the power supply voltages to the S-100 bus are not nearly as critical as they are in most other systems where the power supplies usually drive sensitive TTL devices directly. Therefore the battery voltages can vary significantly, as long as they are high enough to drive the S-100 cards' regulators.

Installing the batteries is easy, too, since they can just be attached to the S-100 bus power inputs. Because of their inherent low impedance, they also provide some additional filtering for the power supply. A three-pole power switch must also be added to allow the

machine to be powered on and off.

After the batteries are installed, the machine's original power supply is still needed, but now it functions both as a primary S-100 power source and as a battery charger. Should the AC power line fail or drop out for a short time, the batteries will continue to run the system for as long as they are capable.

Of course, there are some parts of the system that can't be run by batteries, such as cooling fans and AC floppy disk drive motors, but many systems (including mine) have DC drive motors and use convection cooling. If your system has to have AC power to run these things, and you still want it to be able to run during a power failure, then you can always use a UPS or try a DC-to-AC power converter, but they will cost a great deal more than simple batteries.

If you want to be able to run the system entirely on batteries instead of just having it stay "alive" during a power failure, you will probably have to add additional batteries to supply the +12V or +24V lines for the disk drives. All my system does during a blackout is interrupt to a power line test routine and stay there until line voltage is restored, so the disk drives don't need to operate until the AC comes back on.

## Replacing S-100 power supplies with batteries is surprisingly easy.

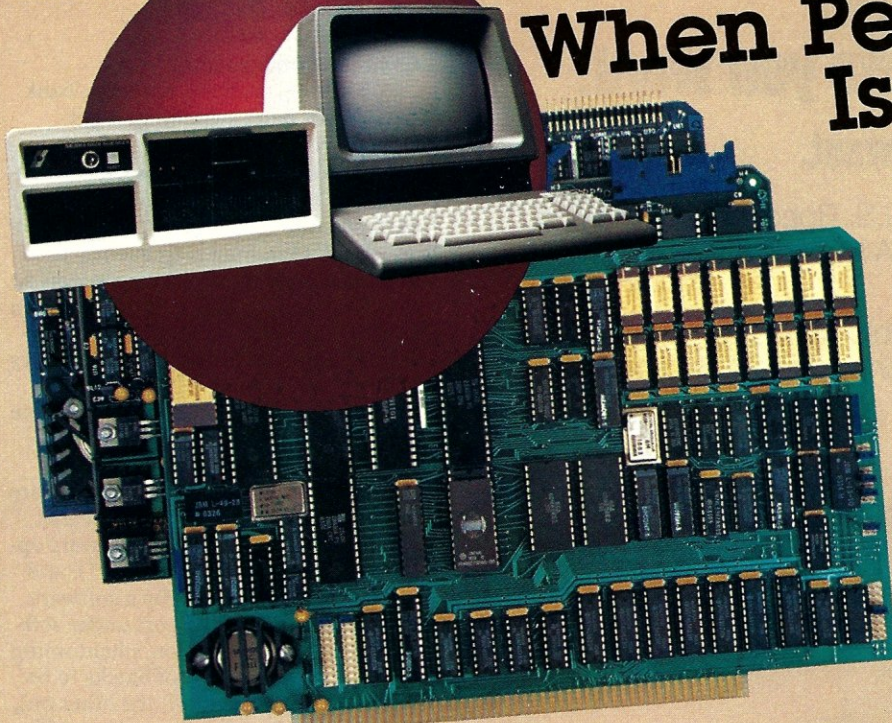
### Phantoming and banking

Several readers have written asking the difference between "phantoming" and "banking" memory. Next month's S-100 Bus will discuss these two S-100 phenomenon as they exist in the IEEE-696 standard, and will include some easy ways to add them to any S-100 system. But to quickly answer the readers' questions, phantoming, in terms of the S-100 bus, is performed by just asserting a bus line (called PHANTOM\*) that disables one memory block so that another may temporarily exist in that block's address space.

Many disk-based systems use phantoming to switch in a boot-up ROM to load an operating system, then switch the ROM back out so that the operating system can have 64K of RAM.



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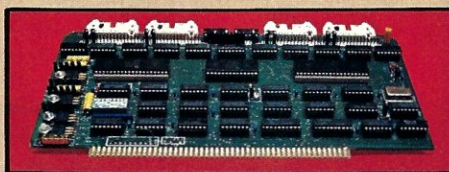
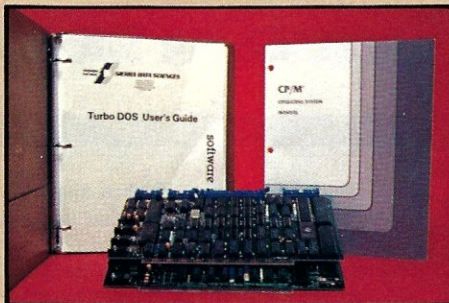
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## S-100 BUS

*Continued from page 32*

Banking, or, more properly, bank selecting or bank switching, is performed by (usually) writing a value to a control port to cause one block of memory to be disabled, and another to be switched into its address space.

Bank switching is frequently used in multiuser or multitasking systems so that each user, or task, can have its own large bank of RAM. MP/M II, for example, allows up to 16 banks of memory of up to 48K in size. CP/M Plus uses bank switching for buffering things like directories and disk files to greatly increase its processing speed.

Bank selecting and phantoming are similar in their functions, except that phantoming is caused by a hardware operation (asserting PHANTOM\*), and bank selecting is caused by a software operation (writing to a port under software control). In addition, phantoming allows only a single set of blocks to be switched (one turned off, the other on), while bank selecting allows up to 256 blocks to be selected.

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## CP/M Plus uses bank switching for buffering, which greatly increases processing speed.

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The IEEE-696 S-100 bus also allows extended addressing (that is, up to 24 bits of addressing) that could be used by an 8-bit processor like the Z80 only if it were treated as bank-selected memory. Unfortunately, because the Z80 can only directly control 16 address bits, extended addressing is of little use unless some nonstandard provision is made for a block of "common" memory—in other words, bank selecting. It is interesting to note that 8-bit operating systems like CP/M Plus and MP/M that require multiple banks of memory cannot operate with extended addressing for the very same reason.

Bank selecting, phantoming, and extended addressing can all live comfortably together in the same S-100 system, although it is unlikely that there



# QDP-300

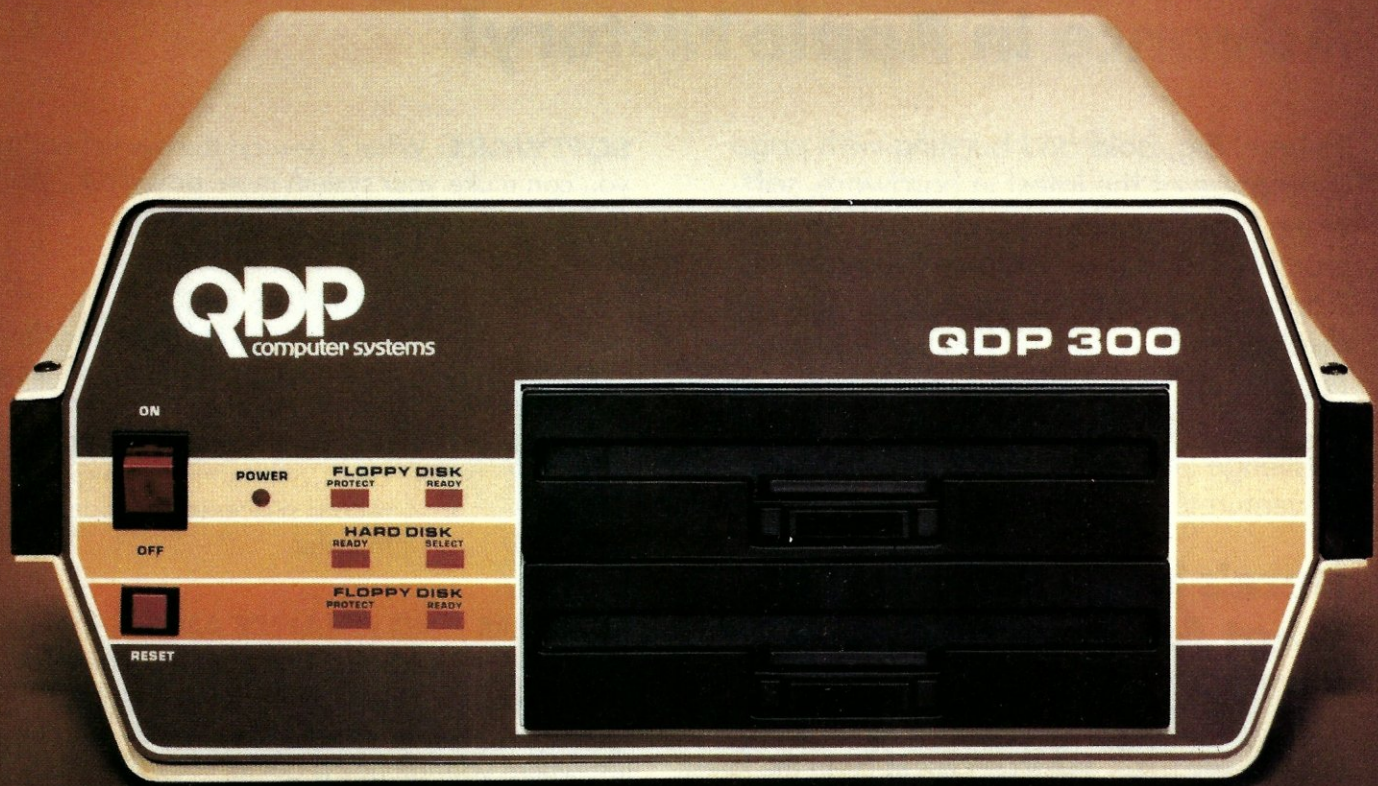
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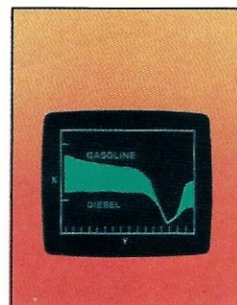
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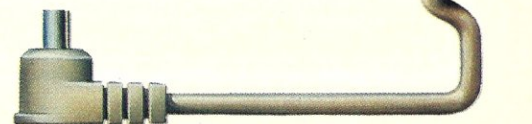
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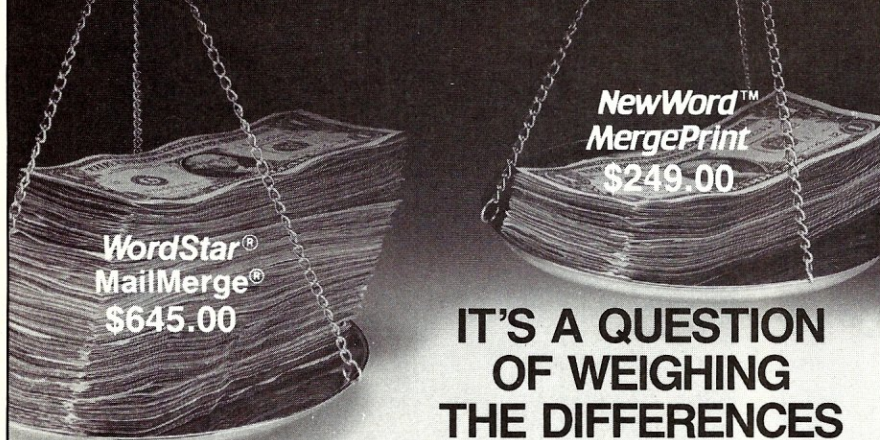
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**CIRCLE 20 ON READER SERVICE CARD**

## S-100 BUS

*Continued from page 34*

would ever be a need for both bank switching *and* extended addressing at the same time, since either method will allow more memory than any single S-100 frame could ever hold (at least until next year).

### Future topics

Along with next month's phantoming and bank selecting examples, future S-100 Bus columns will include the much promised North Star bus pin-out comparison, more IEEE-696 standard "tutorials," and simple S-100 interfaces, like an S-100 to SASI or SCSI controller interface. However, I depend on reader feedback to set the direction of this column. I encourage reader participation in "The S-100 Bus," and look forward to your mail and calls. If you would like to see any particular facet of the S-100 bus discussed here, please let me know. 

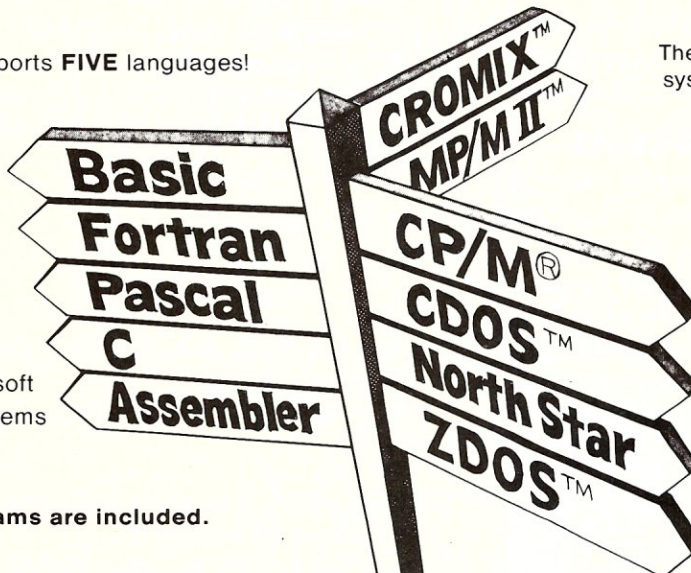
*This column is intended as a forum on S-100 bus topics. Readers are encouraged to send in questions on the S-100 bus, which I will attempt to answer. Please write to: Dave Hardy, 736 Notre Dame, Grosse Pointe, MI 48203.*

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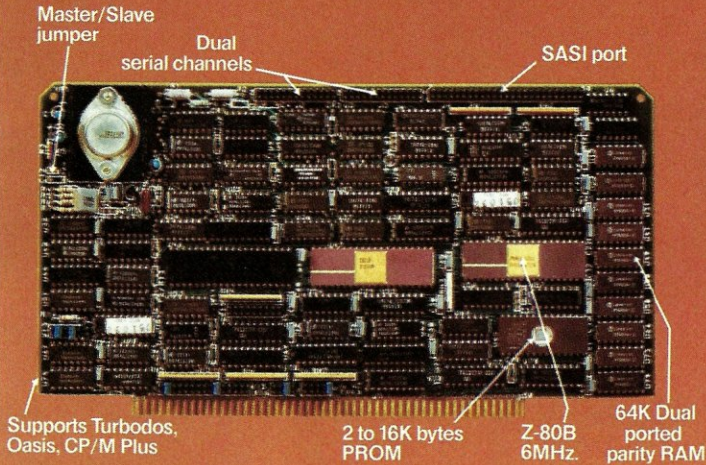


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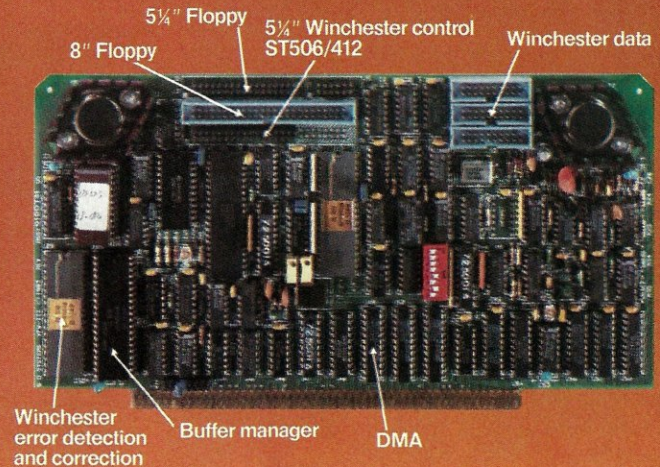


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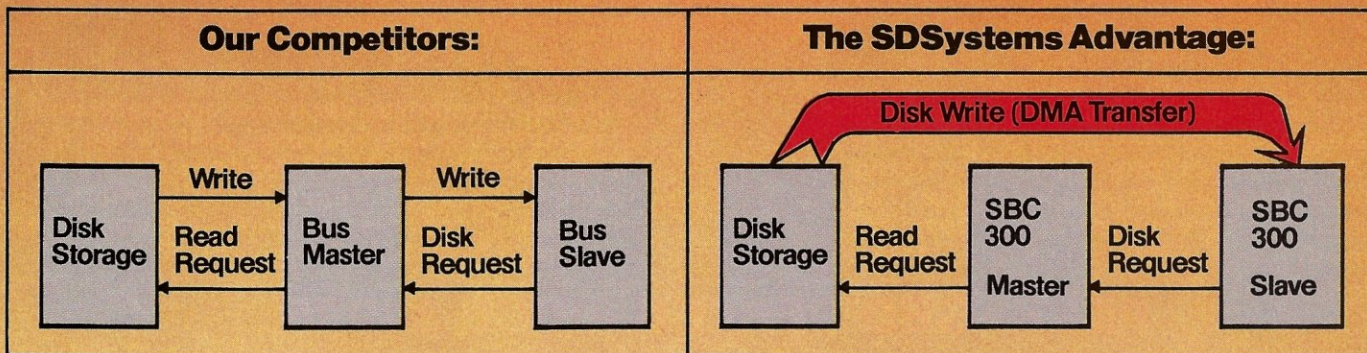
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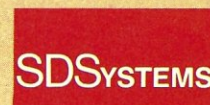
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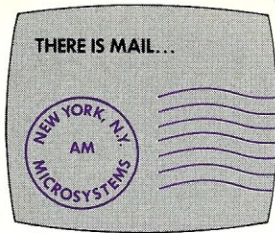
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# Letters to the Editor

**This month... problems plaguing the PIP utility, differing views on Nevada Fortran, and a closer look at memory management in older S-100 systems**

Dear Mr. Libes,

Steven Fisher's article "PIP Data Between Computers" (*Microsystems*, July 1983) performs a great service to CP/M users and provides insight into an important, but poorly documented, program. He indicates that his approach will work on machines whose CBIOS (Customized Basic Input/Output System) does not implement the reader or punch BDOS functions. Unfortunately, he does not fully describe the procedure for using the console port to transmit files. His suggestion to change BDOS function numbers 3 (reader) and 4 (punch) to 1 (console input) and 2 (console output), respectively, does not work properly. There are three major problems whose discussion may save other users many frustrating hours.

1. BDOS function 1 (console input) in CP/M version 2.2 echos the byte received from the "console" port. When this port is attached to a CRT, this echo permits the user to see what was typed. However, when this port is attached to a computer running a program with Mr. Fisher's sequential read/write handshaking protocol, the echo produces undesirable side effects. In a situation with a CompuPro/Godbout

Interfacer-4 board transmitting to a Teletek Systemaster, the side effect is for the first character of the original file to be propagated throughout the received file as every other character. This can be explained by the echo of BDOS function 1 and the I/O buffers in the Godbout and Teletek.

The easiest solution to this problem is to use BDOS function 6 (Direct Console I/O) for reading. This function does not echo and uses the value of register E to set reading, as is shown in Listing 1.

2. The second problem is more difficult to repair. When PIP completes its file manipulation, it performs a warm boot and returns control to the CCP. Under normal circumstances, this condition is conveyed to the user with the familiar CP/M prompt: A >. What could be more natural? However, when another computer running Mr. Fisher's handshaking protocol is attached to the "console" port, the prompt is transmitted and duly echoed by the receiving computer's CCP, or executing PIPIO program. The sending computer's CCP receives this, fails to find a program (COM file) by that name and sends a response intended for a CRT but which becomes more input to the receiving


#### LISTING 1

```
RCV:      MVI E,OFFH      ;LOAD FF TO READ
          MVI C,06       ;BDOS DIRECT I/O FUNCTION
          CALL BDOS
          STA 0109       ;A HAS CHAR, STORE IT FOR PIP
```

#### LISTING 2

LOCATION	INSTRUCTION	
0100H	JMP 0200	;JUMP TO TIME DELAY
0103H	JMP 010A	;JUMP TO RECEIVE
0106H	JMP 0150	;JUMP TO SEND
0109H	NOP	;CHAR FOR PIP.COM
:		
:		;READ AND WRITE
:		;ROUTINES
:		
0200H	LXI H,FFFF	;HL HAS # OF WAITS
0203H	DCX H	;16 BIT DECREMENT
:		
:		;READ
:		;COMPARE H AND L
:		
024DH	JNZ 0203	;LOOP UNTIL WAIT DONE
0250H	MVI A,0CE	;REPLACE PIP'S
0252H	STA 0101	;ORIGINAL JUMP LOCATION
0255H	MVI A,04	;
0257H	STA 0102	;
025AH	JMP 0100	;GO TO IT





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# LETTERS

Continued from page 41

computer. These transmissions of "A", ">", "?", etc., continue ad infinitum.

One solution is to disconnect the cables connecting the two computers, but, aside from the inelegance of this approach, we found that often the receiving computer had failed to close its file at that point and the transmitted file was lost. Our solution was to check every character sent for Control-Z (end of file) and, following its transmission, to alter the appropriate memory locations in the CBIOS of the sending computer so as to route subsequent console output to a harmless device such as a printer. Two problems with this are (a) the sending computer hangs, and (b) the memory locations to alter are specific to a particular CBIOS, and therefore the program cannot be used on other systems.

3. Using the console means changing cables, but the sending computer begins transmission as soon as PIP.COM and the ASCII file are loaded into memory. On disks with short directories, this requires a high degree of hand-eye coordination to complete the cable change in time. We used a time delay which, because of line noise due to cable changes, incorporated Direct I/O reads. Forcing PIP to perform an initial wait requires the code shown in Listing 2.

The problem of implementing PIP's INP: and OUT: functions using a console turned out to be much more difficult than we anticipated. Moreover, our solutions required system-specific manipulations that defeated our attempts to produce transportable code. Perhaps other users have produced better solutions to these problems; if so, we certainly hope they publicize them.

James W. Haefner and Scott E. Kelso  
Department of Biology  
George Mason University  
Fairfax, VA 22030

Dear Mr. Libes,

Having read the article on MP/M 8-16 in *Microsystems* (January 1984), I thought you might be privy to the solution for implementing WordStar 3.24 on the Altos 8600-12 under MP/M-86 2.11F0. Every 10 minutes or so the machine locks up—no error message or anything; more frequently with more users; sometimes with just *one!* I have sent away for updates to WordStar and MP/M-86. Meanwhile, Altos doesn't know how to fix it and MicroPro swears it works. I've had my hardware checked out and I've used new copies of my originals. I've tried making the memory partitions larger (and smaller). Among others, I've made the following GENSYS responses:

total character control works: 16  
enable compatability attributes: yes

```
(I then SET * .OVR & WS.CMD
[F1=ON,F2=ON,F3=0,F4=ON])
```

```
Temporary File drive B (my hard
disk)
Maximum locked records per
process = 14
Total locked records in system
= 40
Number of extra process
descriptions = 60
Maximum paragraphs per process
= FFFF
Number of Queue Control Blocks
= 60
Size of Queue Buffer Area in bytes
= 600
Number of extra memory description
= 60

2000 1800 3800 1800 4800 0800
5000 0800 5000 0800 6000 0800
6800 0800 7000 0800 7800 0800
```

With the exception of item #1 and the 0800 memory segments, the numbers above are all larger than the default numbers. Any help you can give me would be worthy of publication, for sure—I've heard similar complaints from other people.

Jeb Bonsteel  
Data Manager

Southern Maryland Health  
Systems Agency  
9131 Piscataway Rd., P.O. Box 85  
Clinton, MD 20735

Editor's note:

If any reader has encountered similar problems, or has suggestions for a solution, a letter would be very much appreciated.

Dear Mr. Libes,

I would like to take issue with the glowing review of Nevada Fortran, written by David L. Dupuy, which appeared in the November 1983 issue. My own experience with that compiler (I have version 2.2) is less than satisfactory. Besides its limitations, which the reviewer notes in passing, it has far more serious problems that were left unmentioned. The most glaring of these is the total lack of context in any error messages. A recent compilation of one of my programs produced this:

```
*** ERROR *** Unidentifiable
Statement
```

No context, no line number, nothing. In order to debug my programs, I have been forced to introduce *deliberate* er-

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rors in order to isolate the location of the real ones. Perhaps Mr. Dupuy is beyond the stage of writing code which contains errors; for me, this one problem makes the compiler essentially unusable.

There are other irritations in Nevada Fortran—for example, the fact that when reading in formatted data, input of characters which are inappropriate (i.e., letters when digits are expected) often causes the program to crash, spewing several lines of incoherent error messages to the screen before it dies. Also, Mr. Dupuy reports cheerfully that Nevada Fortran actually beats *interpretive* Microsoft Basic for speed. What a relief that should be to prospec-

tive buyers!

There are other annoyances, but of the kind I expect in a \$29.95 product. It is the major error-handling problems which are so devastating, especially given that many buyers may know no other language but Basic and may attempt to use this inexpensive opportunity to learn Fortran. Good luck to them.

Lastly, I found it distressing that the review, which ended with instructions on how to purchase Nevada Fortran, followed by Ellis Computing's response to the few criticisms Dupuy did mention (they sure respond quickly to a review), was then followed on the next page by a full-page ad for Nevada For-

tran and other compilers. While computer journals have traditionally tread the fine line between product promotion and fair criticism, this was too much for my stomach. *Microsystems* owes more to its readership than the gleeful pushing of mediocre products. Meanwhile, I am spending real money on a real compiler. It's worth it.

Rex E. Bradford  
3 Bush Hill Road  
Ipswich, MA 01938

*Dr. Dupuy replies:*

(1) Obscure error messages: *the error handling in the compiler could certainly be better. In retrospect, that would have been worth mentioning. I did not have significant problems tracking down errors, so I did not consider it a problem. But for \$29 I did not expect it to measure up to a DEC compiler. My usual technique for debugging is to write a "five-liner" if I am unsure of the effects of a given few lines of source code, and debug these small modules separately.*

(2) Reading formatted data: *as far as I am aware, any Fortran will have problems if a formatted read statement encounters inappropriate data. Some Fortrans (Microsoft?) assign zeros and keep going, and that's worse! You then have a problem and don't know it. I got two error messages with Nevada Fortran while entering alphabetic data on an F format: (a) Runtime error: ILL CHAR, and that seems like an informative error; (b) Program was executing line ??? in routine MAIN. In this error message, I presumed there was a provision in the set-up options that I overlooked to have the question marks replaced by the actual line number, but I didn't attempt to search this out. For most data input, the free form ACCEPT works well. In general, I found the error messages were adequate, especially with the details in the manual nearby.*

*I personally have no objections to an ad near a review article. That's a question that could be included on a questionnaire to subscribers, if Microsystems puts out another questionnaire.*

David L. DuPuy  
Assoc. Professor  
Virginia Military Institute  
Lexington, VA 24450

Dear Mr. Libes,

Andrew Eender's article on adapting older S-100 machines (November 1983) for extended memory was timely and well presented. However, he fell a little short by assuming that the Z80 is limited to a byte at a time when moving data between banks.

It is true that the Z80 cannot move data directly between banks without some extra hardware, but data can be

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moved more swiftly by than a single byte at a time. The method I used when implementing CP/M Plus was to set aside a 128-byte buffer in the common area of memory. This allows me to use the Z80 block move instruction to transfer blocks of data at a time, and since I needed exactly 128 bytes of memory for auto disk selection, its use wasn't wasted. Although, since CP/M Plus is relocated to 1K boundaries, the average system probably has at least this much memory wasted anyway.

The procedure necessary to transfer data between banks goes like this: *select the source bank, block move 128 bytes into the common buffer, select the destination bank, and finally move the 128-byte buffer to the destination.*

If a large amount of memory is to be transferred between banks, such as the CCP, using this method will greatly speed the operation.

Robert Blum  
5536 Colbert Trail  
Norcross, GA 30092

Dear Mr. Libes,

I am somewhat disturbed at the number of people who present, in a public fashion, an overly simplistic view of the memory management problem in an S-100 system, particularly in connection with CP/M Plus or MP/M. I was prompted to take action, in the form of this letter, by the last-straw effect when I read Andrew Bender's article, "Extended Memory Management for Older S-100 Computers," in the November 1983 issue of *Microsystems*. While the article is well written and well presented as far as it goes, it covers only the surface of the problem; and the solution presented, in the form of an actual circuit, is thereby inadequate except in the most advantageous of circumstances.

There are two problems which were not addressed in this particular article, and in others I have seen. The first is relatively simple and easily solved, but is nonetheless extremely important in all but the simplest of systems. This problem relates to the use of DMA (Direct Memory Access) devices.

When it has control of the bus, a DMA device must place the addresses it wishes to access onto the bus; this includes, for IEEE-696 compatible devices, the extended address lines. However, many extended addressing circuits presented do not take this into account and constantly assert the upper address lines. There will be no problem in systems with no DMA devices, but since there is a simple solution, it should be incorporated from the beginning to allow for the future addition of DMA devices. The S-100 bus provides a signal known as ADSB\* (Address Disable).

This signal is used in the transfer of control to a temporary master (DMA device) in order to disable the address lines of the permanent master (CPU). The output of an extended address latch should be gated by this signal. In Bender's Figure 1, the following changes should be made:

- 1) DS1 and MD should be tied to ground.
- 2) DS2 should be attached to ADSB\*.
- 3) OS6\* should go through an inverter then to STB.

The second, and more serious, problem is that of the "common memory" required by CP/M Plus and similar operating systems. The existence of this

problem was only implied by the Bender article.

It was also implied that the problem would be dealt with by the memory boards themselves. While this may sometimes be the case, it will not always be so, especially with 64K and larger boards. In any event, it needs to be considered, so that it may be dealt with *somewhere*.

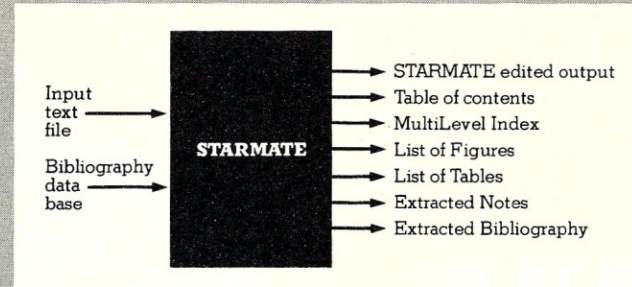
The problem is basically this: switching between banks of memory affects not only access of data, but access of program instructions as well. A solution to this problem is to have a section of the 64K address space refer to the same physical memory no matter which

(Continued on page 138)

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**Microsystems**

# MS-DOS: An Overview Part 1

**MS-DOS 2.0, the enhanced version of 1.1, brings significant improvements in speed and functionality.**

**It also corrects some problems...**

by William G. Wong





**M**S-DOS 2.0 is Microsoft's enhanced version of MS-DOS 1.1, which was made famous on the IBM PC as DOS 1.1. The new version is available on the IBM PC as DOS 2.0, along with a number of other 8088/8086 based machines. DOS 2.0 provides a significant number of improvements over its predecessor in terms of speed and functionality. It also corrects a number of problems encountered in 1.1.

This series on MS-DOS 2.0 will be divided into three articles in order to describe the inner workings in more detail. Part 1 is a general overview, discussing the major improvements and support programs. The new tree-structured file directory system is also explored. Part 2 will touch on the more intimate details of MS-DOS 2.0, including the programmer's interface and program file structure. Part 3 will cover field-installable device drivers.

Practically speaking, MS-DOS 2.0 is a superset of MS-DOS 1.x. For this reason, this review treats MS-DOS 2.0 as the set of enhancements added to the existing DOS 1.x. Some programs will run only under MS-DOS 1.x, and not under 2.0. This is usually because they access specific locations within the operating system that have changed or are eliminated in the new version. Copy-protected programs are typically in this class, since they bypass the normal system function call procedures.

PC-DOS 2.0 is IBM's rendition of MS-DOS 2.0. This article addresses the generic aspects of MS-DOS, but does not extend to a number of additional programs available with PC-DOS 2.0, such as GRAPHICS, which allows screen graphics to be sent to the printer, or CLS, which is used to clear the screen. These programs tend to be hardware specific.

This article is divided into three sections. The first section describes the new support programs supplied with DOS 2.0. The second section addresses the UNIX-style command line I/O redirection facility. The third section contains details on the multilevel file system also derived from UNIX, including the programs used to support it.

### New support programs

**VERSION.** When starting out it is always nice to know where the starting point is. To accomplish this, MS-DOS provides the version command, which simply prints out what version of MS-DOS is running. This will become more important as the number of revisions in-

## Batch files replace a lot of typing with a single command line.

creases. Right now it just prints out version 2.00.

**CONFIG.SYS.** Although the new configuration file is not really a program in the conventional sense, it is probably the most important new support feature in MS-DOS 2.0. The configuration file is named CONFIG.SYS and is read by MS-DOS when the system is first initialized. The following is a sample configuration file.

```
BREAK=OFF
BUFFERS=2
FILES=8
DEVICE=ANSI.SYS
SHELL=A:COMMAND.COM
```

The BREAK option tells MS-DOS whether to check from the control-break key only during console I/O calls (OFF, default) or during all MS-DOS calls (ON). The latter is useful in stopping programs such as compilers, which do little console I/O. The BUFFERS option sets the number of 512-byte disk buffers to be used by the system. Data which is read or written to a disk passes through these buffers. MS-DOS is intelligent enough to keep track of what is in the buffers so that it will not have to access a disk if the information already resides in one of these buffers. Dramatic speedups can occur when using more buffers, especially when database programs are used. Of course, each buffer added reduces the amount of program space by a corresponding amount.

The FILES option specifies the maximum number of file "handles" that can be used at one time. Handles are 16-bit binary values that refer to a file accessed using the new MS-DOS UNIX-style system calls. These will be described in more detail in Part 2. The FILES option has no effect on the number of files that can be accessed using the conventional file control block (FCB).

The DEVICE option is used to load device drivers as part of the operat-

ing system, thereby making them available to the user. The new drivers can be used to access new peripherals or enhance access to existing peripherals. ANSI.SYS is a sample device driver supplied with PC-DOS 2.0, the IBM version of MS-DOS 2.0, which replaces the standard console driver. It enhances the console support by adding ANSI-compatible control functions, but the biggest advantage of the DEVICE option is that hardware vendors can now supply (with their hardware such as hard disks or local area networks) device drivers that do not modify the operating system directly, as was done with 1.x. Also, changing device drivers is now simply a matter of changing the CONFIG.SYS file.

Finally, there is the SHELL option. This allows the default shell, COMMAND.COM, to be replaced with a new user interface. The new shell can be more or less powerful than the default shell, depending upon the designer. It is now possible to present a menu-driven system to the user, who may never know that the base system is MS-DOS.

**BACKUP.** Although hard disk support with tape or cartridge disk backup has been available for MS-DOS systems, floppy disks are still the backup method for most systems. MS-DOS 2.0 now includes two new programs to help standardize this backup process. These programs are appropriately called BACKUP and RESTORE. As with most 2.0 software, there are a host of options using cryptic switches. For example, the following command line:

```
BACKUP C:WORKFILE\SOURCE.*
A: /S /M /A /D:02-01-83
```

will use floppy drive A: to back up all files from drive C: in the directory WORKFILE with the filename SOURCE and any extension. All subdirectories (/S) will be included. Only files that have been modified (/M) will be copied, and the date associated with the file must be equal to or greater than February 1st, 1983 (/D:02-01-83). The new backup files will be added (/A) to any that already exist on the floppy. The syntax for RESTORE is similar.

**RECOVER.** Although directory corruption is rare when a system runs properly, there are always times when the system may crash—for example, when lightning strikes a nearby powerline. The RECOVER program gives some help in the event that the directory has been zapped. It will read the disk directory and try to reconstruct files. The resulting files are a multiple of the block size used with the disk, so there may be additional garbage at the



# MS-DOS

Continued from page 47

end of a file. Text files restored in this fashion can usually be fixed up with the aid of a word processor. The recovery process is not always complete, but at least there is now a prayer.

**ASSIGN.** Speaking of prayers, it has always been frustrating to use application programs that have been written to run only on specific disk configurations, and to find that these do not match the one on hand. The ASSIGN command has been added to alleviate some of these problems. ASSIGN allows logical drive names to be assigned to any physical drive. It is even possible to have multiple logical drives assigned to one physical drive. What use is this? Well, consider a home finance program that is written in assembler so it cannot be modified. It assumes that support programs will be on drive A: and data files on drive B:. This works great with two floppy drives, but we want to use drive E: which is a brand new hard disk. What to do? Enter:

```
ASSIGN A=E, B=E, C=A, D=B
```

and presto, the hard disk looks like drives A: and B: and the floppies can still be accessed as C: and D:. The application now runs fine, and the whole process was done without too much heartache.

**VERIFY.** The VERIFY is another command which helps to reduce the problems encountered with disk-based systems. Setting VERIFY ON makes MS-DOS read back all data which is written to a disk to make sure that the information really has been written. Although most disk systems are very reliable, many organizations require the more dependable operation provided by VERIFY. Most applications do not have this type of option, but, fortunately, MS-DOS 2.0 does. It can also be turned on and off at anytime as needed.

**CTTY.** Microsoft's enhancements are not confined to the disk area. The CTTY program has been added for those people who like to use more than one console—e.g., a CRT display for normal text processing and a printing terminal for recording the output of a particular program. It is even possible to communicate with a remote terminal through a modem, since CTTY accepts any character-oriented device as a parameter.

**PRINT.** The PRINT program is another nondisk enhancement that everyone has been waiting for. It provides a background print spooling facility to MS-DOS. Without it, you can watch your \$5,000 computer sit and print for

hours. Now it is possible to let it print and still use the machine for other purposes. The current incarnation allows up to 10 files to be placed into the print queue. Just make sure that you do not delete, rename or alter any files to be printed, remove the disk containing the files, or use the printer via a program—but what did you expect out of a single-tasking system? Even so, PRINT is an extremely useful option and probably the one which will get the most use.

**BATCH.** Finally, there is an enhanced batch processing facility, again akin to that of UNIX. Batch files are text files that can be created by most word processors. They are essentially programs with a limited vocabulary. The following batch program is an example of what the new batch file support can do.

```
REM This is a sample batch file
which will print on the
REM console each file on drive A:
with a designated
REM file type. The command line
may contain any number
REM of file types or the command
SWITCH. The latter
REM will allow you to change the
```

```
diskettes. The last
REM name in the list should be
DONE.
ECHO OFF
BREAK ON
:LOOP
IF %1==DONE GOTO END
IF NOT %1==SWITCH GOTO SKIP
REM Skip past SWITCH parameter
SHIFT
PAUSE Please put the next disk
into DriveA:
:SKIP
REM Print all files with the
appropriate file type
FOR %%F IN (*.*) DO TYPE A:%%F
REM Shift in next parameter
SHIFT
GOTO LOOP
:END
```

The example is contrived, but it does show the various batch commands in action. The REM command is used to add remarks or comments to the file. These will not be executed, and removing them will not change the way the batch file runs except to speed up the execution; however, it helps to know how and why a program works. The comments in this file should give some idea of what is going on.

The ECHO command controls the

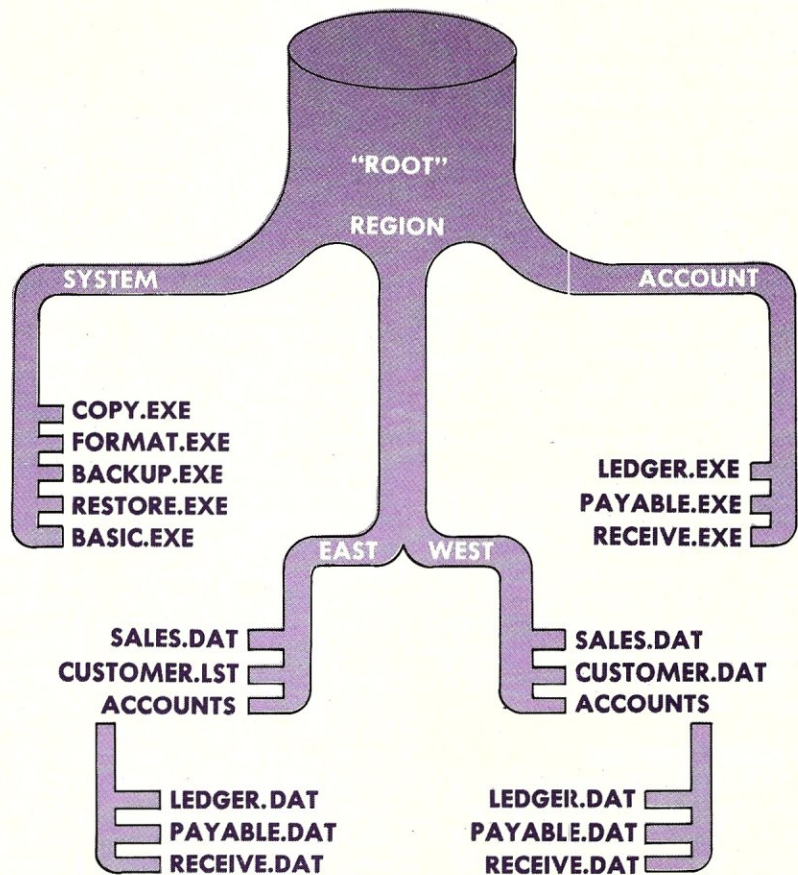


FIGURE 1.



display of the command file when it is run. In this case, turning ECHO off will let the system print all the lines up to and including the ECHO OFF line. The remaining portion of the batch file will not be printed; however, data printed by the PAUSE and TYPE programs will be displayed. ECHO can also be used to print any string (except ON or OFF) on the screen, too.

Moving down the program, the BREAK command performs the same operation as in the CONFIG.SYS file mentioned earlier. Next there are the IF and GOTO/label commands. These are the major additions to the batch file support. IF allows various conditions to be tested, the command following being executed only if the condition is true. The current conditions are limited to single string comparisons, checking to see if a file exists, and checking the result code from the previous program. In this case, the program is checking the first parameter (%1) to see if it is *not* the string SWITCH, in which case the GOTO command is executed. The GOTO command is followed by a "label" that must appear somewhere in the batch file preceded by a colon (: ) which

must be in the first column. Program execution will then shift to the line after the one containing the label. If the first parameter (%1) is SWITCH, the GOTO will not be executed and processing will continue on the line after the IF command; otherwise, the PROGRAM will GOTO label SKIP.

Next there is the PAUSE command, which prints the text following it and waits for a character. This allows the user to control the execution of the batch file. The PAUSE command in the example is used to let the user change disks before proceeding. The SHIFT command is used to logically move all the parameters on the initial command line one place to the left, throwing away the one initially on the left end. For example, assume the sample batch file is named LISTEXT and the following command line was used to start the batch file.

```
LISTEXT ASM LST SYM SWITCH BAK END
```

Table 1 shows the values of the parameters initially and after executing a number of SHIFT commands. Note that the name of the batch file is initially

parameter 0 (%0).

Note how the SHIFT function is used in this example. The first parameter (%0) is used through each iteration of the loop to hold either the filetype or one of the commands (SWITCH or DONE). The SHIFT function is used later to get the next command or filetype. The SHIFT function can also be used to access parameters in excess of the 10 (%0-%9) allowed by MS-DOS. For example, the sample batch program can take any number of arguments as long as they fit in one command line.

The FOR function is another very useful tool that is used in the sample program. The third parameter in parentheses can be a set of ambiguous filenames using the wildcard characters "\*" and "?" separated by commas. FOR assigns the batch file variable (%F), a matching unambiguous filename from the directory which matches a name in the set and then executes the command following DO, which usually contains the variable in one or more positions. This process is repeated until all matching names in the directory have been found and used. In this particular example, the batch file program will type all the files whose extension matches one of the parameters.

Batch files are extremely useful, and the MS-DOS implementation is very powerful. It can replace quite a bit of typing with one command line.

### Command line I/O redirection

Command line I/O redirection is a facility used in UNIX which has been moved to MS-DOS. It allows a user to specify the source or destination of character data from a program when it is started from a command line. By default the source is the keyboard and the destination is the display screen; however, MS-DOS now allows these to be any text file.

There are a number of things to keep in mind, because the scheme is not foolproof. For example, programs must use the standard system input and output routines and must examine the command line with care. Also, MS-DOS will hang if a program is waiting for input after the end of the file has been reached. However, these are not always major concerns. The programs supplied with MS-DOS support the I/O redirection, as will many others. Now we'll talk about how and why it works.

The redirection is specified in one of two ways. The first is to place in front of a filename one of three prefixes: "<", ">", or ">>". The first (<) indicates that the file is to be used as the standard input source. The other two indicate that the file is to be used as the standard output. These differ in the way that the

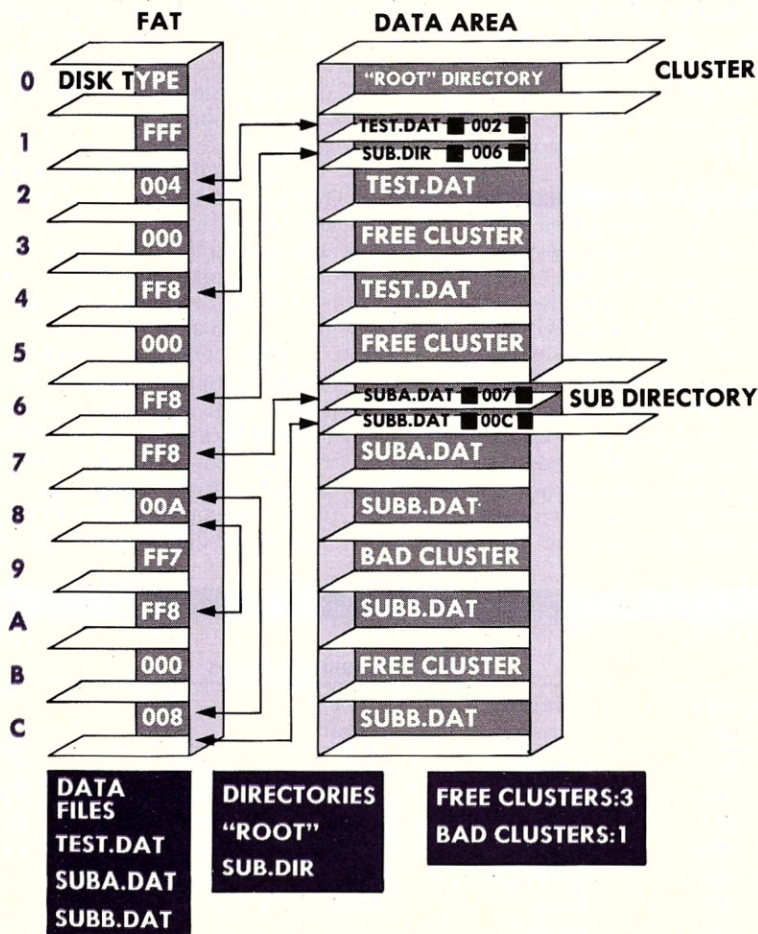


FIGURE 2. FILE ALLOCATION TABLE (FAT) EXAMPLE.



# MS-DOS

Continued from page 49

output file is manipulated. The ">" prefix will create a new file or overwrite an existing one. The ">>" prefix will append the new information to the end of an existing file; otherwise it creates a new file. The following are some examples using these prefixes. Note that, since MS-DOS allows devices as filenames, it is possible to say "direct output to the printer (PRN)."

```
DIR >PRN
DIR >DIRLIST
SORT >UNSORTED.TXT >SORTED.TXT
SORT >EXTRA.DAT >>SORTED.TXT
TYPE FOOTER.TXT >>SORTED.TXT
```

The second way to specify redirection is to use what has been called a "pipe." In this case, more than one program is started with one command line. UNIX does this in parallel, but MS-DOS does it sequentially. The character "|" is used to separate the commands. For example:

```
DIR | FIND '*.ASM' | SORT >
LIST.ASM
```

In this example the three programs are DIR, FIND, and SORT. This one command line is equivalent to the following five command lines, which are much more confusing:

```
DIR >%PIPE0. $$$
FIND '*.ASM' >%PIPE0. $$$
>%PIPE1. $$$
ERASE %PIPE0. $$$
SORT <%PIPE1. $$$ >LIST.ASM
ERASE %PIPE1. $$$
```

Essentially, "|" connects the standard output file of the program to its left to the standard input file of the program to its right. In MS-DOS, this file is an actual file placed on the default drive. In UNIX, the programs are connected directly together and no disk space is required. Even so, using pipes with MS-DOS can save a lot of typing and make commands much easier to understand.

Another thing to note is that MS-DOS does not support multipole designations for the standard input and output files. Therefore, the ">" and ">>" file prefixes should not be used to the left of a pipe ("|") and the "<" file prefix should not be used to the right. Also, there should not be multiple occurrences of any redirection characters within a command.

Programs written especially for use with pipes are called "filters." A filter program is one which uses the standard input to generate data for the standard output, using parameters on the command line. MS-DOS comes with three

## Command I/O redirection— a UNIX facility— has been moved to MS-DOS.

filters: FIND, SORT, and MORE. FIND takes a parameter string in double quotes. Any text line containing the string will be sent to the standard output file. SORT reads each input line and sends these lines to the standard output in ascending order. MORE reads the standard input file and prints out one screenfull at a time, waiting for keyboard input after typing "—MORE—" at the bottom of the screen.

I/O redirection and filters are tools that programmers will like to use. They can be applied to applications especially when coupled with the batch file facility. Most people using general applications will not need or understand the power of these features; however, they are nice to have around.

### MS-DOS 2.0 hierarchical file system

Although the idea behind the hierarchical file system has been around for quite some time, there have been a limited number of implementations on micro-based systems. MS-DOS now includes the support for all disk-based systems. Each disk drive has a "root" directory that has no name. This "root" directory can contain either data files or subdirectory files. Data files are those we have all come to know and love. The subdirectory files are the enhancement. Instead of containing data, these files

are directories just like the "root." They can contain data files as well as subdirectories.

Figure 1 shows a graphic view of a multilevel file system. Note that each logical disk drive has a "root," which means that a multidrive system does not have just one tree but a whole forest. In fact, hard disks which are partitioned into many logical disks have their own grove of trees.

Although there is no theoretical limit on the number of drives or the depth of a tree, MS-DOS 2.0 does place some practical limits on both. MS-DOS 2.0 limits the number of logical disk drives to 63, and it limits the "path" name to 63 characters. A path name is the list of directory names and the name of the file in the lowest subdirectory. The names are separated by a backslash (\). The following are examples of path names.

```
\SYSTEM\GRAPHIC\DEMOS
\COMPILER\PASCAL\PASCAL.EXE
\ACCOUNT.NEW\SUMMARY.LST
\SALES\REPORTS\REGION\EAST.BAK
```

All filenames have the same format as in MS-DOS 1.x—i.e., a filename of up to eight characters, followed by an optional period (.) and file extension up to three characters long, for a total of 12 characters. This means you almost get four levels of subdirectories if all the filenames are of maximum length. Since they are typically much shorter, you can count on about seven levels, which is usually more than anyone ever uses.

MS-DOS also allows the parent directory and the current directory to be used in path names. These directories are referred to using two periods (..) for the parent and one period (.) for the current directory. These names are used just as normal subdirectory names.

MS-DOS has a number of commands to support the hierarchical directory system. MKDIR is used to create subdirectories, while RMDIR is used to remove them. RMDIR can be used only if the subdirectory is empty. CHDIR is used to change the current default directory on the default drive. TREE is used

Table 1. Parameter values

Parameter name	Initial value	One shift	Two shift	Three shift
%0	LISTEXT	AMS	LST	SYM
%1	ASM	LST	SYM	SWITCH
%2	LST	SYM	SWITCH	BAK
%3	SYM	SWITCH	BAK	DONE
%4	SWITCH	BAK	DONE	
%5	BAK	DONE		
%6	DONE			



to display the directory at multiple levels, whereas DIR only displays one level.

The multilevel directory system does complicate matters slightly, since programs are often partitioned in a fashion other than by the way they are used. For example, all the compiler files may be in one subdirectory, while general programs are in another and linker programs in a third. Trying to use all three at the same time means that the default directory must be changed when accessing a different program, which can be quite tedious. MS-DOS supplies the PATH command to solve this problem. The parameters to PATH are a list of directories to search if a program is not found in the current directory. The following is an example to fix the aforementioned situation.

```
PATH A:\SYSTEM,B:\COMPILER\PASCAL,
      B:\LINKER
```

Note that drive names may be included with the PATH parameters, allowing programs to be split over a number of different drives. This is especially useful for floppy based systems, and it also comes in handy for hard disk based systems.

Although MS-DOS 1.x disks can be used with MS-DOS 2.0, the reverse is not true, because 1.x does not support the multilevel file structure. The remaining portion of this section deals with the new data structures on the disk used by MS-DOS 2.0 to support subdirectories and also partitioned hard disks. Note that the latter implementation is taken from the IBM PC-DOS 2.0 implementation, which may differ from other implementations. However, it is a good reference point to work from.

A physical disk may be partitioned into one or more logical disks. Each logical disk contains one logical multilevel directory system. This is implemented by partitioning the disk into the variable size sections, shown below.

MS-DOS disks are allocated in 512-byte blocks, and each section is

<b>Boot Section</b>
<b>File Allocation Table 1</b>
<b>File Allocation Table 0</b>
<b>"Root" Directory</b>
<b>Data Area</b>

## Implementing MS-DOS 2.0 on the IBM PC has made it a de facto standard.

made up of one or more of these blocks. All sections are a fixed size for a particular disk implementation and do not vary. Data files and subdirectories are located in the Data Area and allocated dynamically. This process is discussed later in more detail.

The Boot Section on the boot disk is used only when the system is first initialized, and is accessed by the boot program normally located in read-only memory (ROM). This section usually contains an extended boot program which knows the MS-DOS disk structure and how to load the main resident parts of MS-DOS contained in the files DOS.COM (Disk Operation System) and BIO.COM (Basic I/O system). These, in turn, check the configuration file, CONFIG.SYS, and load the shell program, which is usually COMMAND.COM. In theory, only one disk need have the Boot Section. However, in practice, all disks have the Boot Section allocated for the sake of consistency.

There are two File Allocation Tables (FATs) for redundancy. They are normally identical except when they are being updated or if they have been corrupted in some fashion. Keeping a redundant copy of this table allows the RECOVER program to be more efficient when trying to restore a corrupted disk. Only one copy of the FAT is kept in memory by MS-DOS for each disk, and the two copies on the physical disk are updated one after the other, as required.

The FAT is referenced by the "root" directory and its subdirectories. Each file has a directory entry in either the "root" directory or one of the subdirectories. This entry refers to the FAT, which has a one-to-one mapping between it and the data area. Each directory entry is 32 bytes in length and has the format shown in Table 2.

The status flag in the filename field

is used to indicate whether the directory entry can be used for a new file (00 and E5) or whether it is allocated as a directory entry (2E) or as a normal file entry. There are two indicators for unused entries for efficiency reasons. The directory is initially filled with zeros (00 is one of the flags) and the directory is always filled from the front to the back, making first use of entries flagged with E5 for new files. Therefore, directory searches can terminate whenever an entry with a zero flag is found, since no files can be allocated past this point. The references to the parent directory are used to support the "." path facility.

All files are dynamically allocated, and the FAT is used to keep track of the allocation. The FAT is organized as an array of 12-bit entries (1.5 bytes/entry). The first two entries (3 bytes) are reserved for the disk description. In these entries, the last two bytes are always OFFF hex; the first byte is described as shown in Table 3.

All remaining FAT entries are used to designate free space or allocation for a particular file. Actually, reserving the first two entries wastes no space, since this is used for the "root" directory area. Each FAT entry corresponds to one "cluster" in the Data Area. Ownership of an FAT entry by a file indicates that the matching "cluster" in the Data Area is part of that file. The FAT index in the directory entry for a file indexes the first FAT entry for the file. This entry contains the index of the next FAT entry for the file and so on. The last FAT entry in this chain contains a value from FF8 hex to FFF hex. Any data record in a file can be found by computing the "cluster" index containing the data and then searching the file's allocation chain in the FAT to find the appropriate "cluster." The data is contained in the sectors of the corresponding disk area.

MS-DOS keeps track of unallocated clusters by placing a 000 hex in the entry. Bad sectors that will generate hardware errors are flagged with an FF7 hex so they will not be used. Figure 2 shows a portion of a sample FAT with allocated, unallocated and bad sector entries.

The term "clusters" has been used in the previous discussion but not really defined. Essentially, a cluster is a fixed-size block of disk sectors. A cluster may be one or more disk sectors, depending upon the implementation. Hard disks tend to have larger clusters than floppy disks because of their greater storage capacity. The disk capacity comes into play because the maximum number of entries in an FAT is 4,096 (less reserved locations 000, 002 and FF0-FFF hex). The cluster size is therefore usually larg-



# MS-DOS

Continued from page 51

er than the disk capacity divided by 4,096. The maximum size of a FAT is 6,144 bytes, or 12 512-byte sectors assuming all 4,096 entries are needed.

Increasing the size of a file entails finding a free cluster and adding it to the end of the file's FAT chain. A file is deleted by changing each entry in its FAT chain to zero and placing an E5 hex in the directory entry.

Note that the cluster size is essentially the minimum file allocation size. Even if a file uses only one byte for its data, it is allocated one cluster, and the unused space cannot be accessed by another file. Even so, the ability to dynamically extend the size of a file greatly outweighs any possible waste of space.

One interesting point about the hierarchical file system under MS-DOS 2.0 is that there no longer seems to be any restriction on the number of files a disk may contain, assuming there is sufficient space. Although the "root" directory is a fixed size, all subdirectories are normal files whose length can be dynamically extended. Therefore there is no limit on the number of files a subdirectory can contain; however, a limit is imposed by the FAT structure; this limit is not always mentioned. Remember that the FAT is limited to 4,096 entries, and any file must use at least one FAT entry. Since 18 are reserved for various purposes, that leaves 4,078 entries. This means that you can have 4,078 files that each use one cluster, one file that uses all 4,078 clusters, or something in between. In any case, this limit will be encountered only on a hard disk with a large Data Area—but beware!

MS-DOS 2.0 can be told to use a number of buffers for disk caching by using parameters in the CONFIG.SYS file as mentioned before. It uses these buffers for data and directory information as well as the FAT tables. This means that a system with few buffers can still access a hard disk with a large directory and FAT. Increasing the number of buffers means that more of the directory and FAT can be resident. This makes MS-DOS 2.0 fast when accessing sequential files because the location of subsequent clusters can be found by looking at the memory-resident FAT. Unfortunately, the FAT access method falters under random access use, especially when a number of disk drives are in use at the same time and few buffers are available.


The random access mode means that subsequent file references can be made at any point in the file. Finding this point must always be done by se-

quentially searching the FAT. Since a large file usually requires a large FAT, randomly accessing the FAT means that a large number of buffers are needed or a number of additional disk accesses are needed to find the desired cluster. This time/space tradeoff can be critical in some large database applications. In these instances, it may be helpful to buy more memory and increase the number of buffers available to MS-DOS.

Overall, the new file system represents a major improvement over MS-DOS 1.x. It is more flexible and easier to use than its predecessor and offers a number of tradeoffs that can be made by the user. We will have to wait and see if

MS-DOS 3.0 removes some of the limitations in MS-DOS 2.0.

## Summary

MS-DOS 2.0 as a whole is a major improvement over 1.x. Its implementation on the IBM PC has made it a de facto standard to which most major manufacturers conform. Most of the enhancements will be exploited only by the designers and programmers, but users will benefit by the improvements in the applications provided by 2.0. Part 2 will discuss how to gain access to these enhancements at the program level. 

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Table 2. Directory entry formats

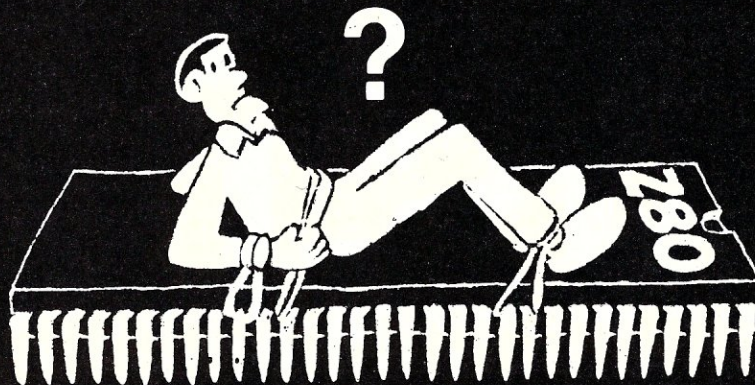
Offset	Size	Description
0	8	Filename, of which the first byte is a status flag
		<i>Byte 0</i>
		00 hex
		E5 hex
		2E hex
		<i>Description</i>
		Entry never used
		Entry erased
		Directory entry; if
		the next byte is also a
		2E hex, the FAT index points
		to the parent directory
		First character of the filename
8	3	File extension
11	1	File attribute
		<i>Bit</i>
		0
		1
		2
		3
		4
		5
6-7		
		<i>Description</i>
		Read only
		Hidden file
		System file
		Filename is volume label
		(only in "root" directory)
		Subdirectory
		Not archived
		Reserved
12	10	Reserved
22	2	Time of creation or last update
		<i>Bits</i>
		0-4
		5-10
		<i>Description</i>
		Two-second increments
		Minutes (0-59)
		Hours (0-23)
24	2	Date of creation or last update
		<i>Bits</i>
		0-3
		5-8
		<i>Description</i>
		Day (1-31)
		Month (1-12)
		Year offset from 1980
26	2	FAT index
28	4	File size in bytes (least significant byte first)

Table 3. Disk description byte

Hex value	Description
FF	Double-sided 8 sectors/track disk
FE	Single-sided 8 sectors/track disk
FD	Double-sided 9 sectors/track disk
FC	Single-sided 9 sectors/track disk
F8	Fixed hard disk



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# MSPRO: MS-DOS on the S-100 Bus

**MSPRO brings  
some UNIX-  
like features to  
the CompuPro  
8085/88 CPU**

by Andrew L. Bender

**R**ecently MS-DOS has been honored by Digital Research in an indirect fashion: they have made their software compatible with MS-DOS. This is not a bad idea because MS-DOS is to the 8086/88 what CP/M is to the 8080/85/Z80. Recently I had the opportunity to test the Godbout 8086/87 CPU board. I brought up CP/M-86 under that system and tested it. A few weeks later I got a review copy of MSPRO, an MS-DOS adapted for an S-100 system using the CompuPro 8085/88 CPU. The adaptation is by Computer House. It includes a new PROM for the Godbout Disk-1 Controller, a modified Lomas Data Products LDP-72 Disk Controller Board, a 5 $\frac{1}{4}$ " disk drive with a cable to connect it to the LDP-72, as well as Microsoft's MS-DOS and documentation. In case you don't already own one, the GO 86 PROM used to initiate operation of the 8085/88 board is also included.

#### **System considerations**

The Lomas disk controller board

(DP-72) can drive both 8" and 5 $\frac{1}{4}$ " disks at the same time. Thus it is possible to use only a Lomas LDP-72 in a system with mixed disk sizes. Computer House has modified the LDP-72 so that it works properly with MS-DOS. The modifications consist of some new wire jumpers on the board and a new IC in a spare socket. The new PROM for the Godbout Disk-1 board allows you to boot with either MS-DOS or CP/M. I could cross boot any system I wanted to without problems: CP/M-86, CP/M-80 and MS-DOS all came up properly with the new PROM.

You are expected to supply the CompuPro 8085/88 system with enough memory (at least 192K if you want to do anything serious with the system) a System Support Board for console I/O, and a clock as well as the address for the GO-86 PROM. If you want to use a printer—and who doesn't?—you will need an Interfacar 3 or 4 card, which I do not own.

That is a lot of hardware. I had done business with Computer House before and they sent all of this stuff to me for evaluation, which they expected me to do in three weeks. Alas, I make my living doing other things, so I couldn't possibly do an evaluation properly in that time.



I thought it would take me at least one week to get the hardware up and running but I was wrong—it took 20 minutes. One thin manual contained step-by-step instructions for getting the system up and running without a nervous breakdown. Not only did the system run after the steps were followed, but the manual didn't read like "Advanced Topics in Brain Surgery."

One thing you must do is set the switches on your Disk-1 controller card to indicate that you are using the System Support Board serial port as the console device. The manual doesn't say so, but the first thing you should do when your MSPRO system is up and running is to make a backup disk. I almost forgot this basic safety procedure and might have been left with a non-bootable system.

MS-DOS 2.0 has many features not present in the first 1.0 system. It offers multilevel named directories, a rudimentary system of pipes and filters, I/O redirection and what will probably be a very powerful queueing mechanism for I/O requests. None of the I/O dispatching routines are yet implemented—but they will be, and when they are MS-DOS will have the capability for multi-programming and concurrent operations. MS-DOS 2.0 is a bit like XENIX, Microsoft's version of UNIX.

The system did exactly what the manual said it would, and I had a running MSPRO/MS-DOS version 2.0, except I couldn't print anything. I looked for the assembly language driver routines and installation material which, according to the manual, were supposed to be included and—you're right—they were not there.

There was a file on the disk which described the device drivers and how they work under MS-DOS. There were instructions for writing the drivers, and I listed them out over and over on my CRT, reading them until I had an idea on how to write a printer driver for my Interfacer 1. I must admit there were some unclear areas which I resolved with Chris Cochrane, the person who wrote the MSPRO drivers. Once these areas were cleared up, the print driver was installed in several more marathon debugging sessions lasting at least nine hours.

I was glad to have this experience because suffering builds character! I had to read the manuals carefully. There are no instructions in any of the manuals as to how you are to interface with MS-DOS from a user program. I know that in MS-DOS 1.2 you use interrupt 21 and some other interrupts, but that is not even mentioned in the 2.0 manuals. Absent also are the necessary data structures to communicate with MS-DOS.

## MS-DOS is a bit like XENIX, Microsoft's version of UNIX.

Later, the folks at Computer House confided that this was the very first version 2.0 MSPRO system that they had shipped and that the manuals were not in "sync" with the system. This is not great, but if you want the latest working system, it is tolerable.

### The editor and assembler

EDLIN, a thinly disguised version of ED, was equally irritating. There are lofty descriptions of how EDLIN is powerful (translates to "almost unusable") and useful. I suppose that when it is the only editor you have, it is all of these things. There are better editors, but I didn't have any of them, so I did all my work with EDLIN and was not above the muttering of an occasional obscenity. EDLIN works with some mysterious function keys which are not described. The MS-DOS manual suggested trying the keys on the keyboard to find those keys that subserved the special functions. Lots of luck! Why didn't they just give the sequences so that I wouldn't have to waste my time? So much for EDLIN.

MASM is the 8086 version of M-80 and is well documented and implement-

ed. It works well and provides a wide range of useful directives (pseudo-operations). There is a macro facility that works like the Intel assembler macro generator in MAC and M-80, the 8080 assemblers. A wide range of listing directives allow for convenient debugging of not only macro-generated code but also the variable-length instructions that can cause problems if the operands are not defined properly. Strict adherence to the Intel mnemonics makes this assembler a proper development tool. Digital Research's assemblers (RASM86 and ASM86) do not support macros nor the complete set of Intel mnemonics—they cheat on FAR and NEAR calls and returns.

### Writing MS-DOS device drivers

I assembled my driver with MASM. I was surprised at the speed of MASM. It was running under MS-DOS and was at least 20% faster than ASM86 running under CP/M-86. It is *big!* A lot bigger than ASM86, but who buys a "small" 8086 system? The system requires that the I/O drivers be in .EXE format so you have to process them with MSLINK—the linkage editor. LINK converts relocatable .OBJ files into .EXE files. An .EXE file is an absolute memory image of a program with enough information to allow for some positioning in memory when it is loaded. This was fast, too, but then again there were no other relocatables being collected.

After creating my print drive in .EXE format, I just needed to link it into the device driver chain by mentioning it in the CONFIG.SYS file. I did this and to my surprise (and I am sure to yours, too) it didn't work. Because CONFIG.SYS is processed during booting, the system would not come up. Thanks to the miracle of backup copies I could boot my backup disk, rewrite my CONFIG.SYS and continue my development.

THE MICROSOFT MACRO ASSEMBLER  
INTERFACER 1 DRIVER

10-03-83 PAGE 1-1

```

1
2
3 ; TITLE INTERFACER 1 DRIVER
4 ; COMPU-PRO INTERFACER 1 DRIVER FOR
5 ; DIABLO 1643 PRINTER ON CHANNEL 2
6 PAGE 60,132
7
8 ;PROGRAMMED BY A. L. BENDER, M. D.
9 ;SEPTEMBER 27, 1983
10 ;RUNS UNDER MSDOS 2.0
11 ;DEVICE = PRT
12
13 0000 ASSUME CS:CSEG ;ALL SEG REG'S SET =
14 CSEG SEGMENT
15
16 ;THIS CODE IS ILLUSTRATIVE MORE THAN FUNCTIONAL
17 ;TO ALL YOU PURISTS, TAKE HEART-IT IS PROVIDED AS
18 ;A SKELETON SO THAT YOU CAN CODE YOUR OWN ROUTINES
19 ;BETTER AND IN LESS TIME THAN I DID THIS ONE.
20
21 ;SERIAL PORT ASSIGNMENTS
22 ;FOR INTERFACER-1 (WE USE THE SECOND PORT FOR THE PRINTER)
23 ;
24

```



# MSPRO

Continued from page 55

Adding any additional I/O drivers to MS-DOS 2.0 means that you will have a separate file for every additional driver or complex of drivers installed. This could mean a lot of driver files in a complex system. For example, if you add a hard disk, a semiconductor drive and another printer, you will need three more files. There is no BIOS as in CP/M, so that customizing your existing hardware is not trivial. As an example, I wanted to bring up my console on the Interfacer 1 rather than the System Support Board. Forget that, it's built into MS-DOS. Each nonresident I/O driver is installed during booting by the system initialization function. This program reads a configuration file and in-

## Set the switches on the Disk-1 controller card to indicate you are using the System Support Board serial port.

stalls each I/O device as specified in CONFIG.SYS, which is an ASCII directive file. If a device is installed from CONFIG.SYS that has the same name as a resident device, the device configured in CONFIG.SYS overrides the resident device.

Reading the instructions in DEVDRIV.DOC—a file of documentation on the disk—is supposed to impart sufficient knowledge to allow anyone to write a driver and install it. There is one drawback—if a driver is installed, it is hard to test. If it cannot be installed, the system either bypasses the driver or just hangs up. For those of you seeking sleepless nights, read no more; just try it on your own. If you want to save time, I have included a skeleton driver (Listing 1) and the following advice:

1. Code the entire driver in the code segment bank.
2. ASSUME CS:CSEG.
3. Pay little attention to the driver

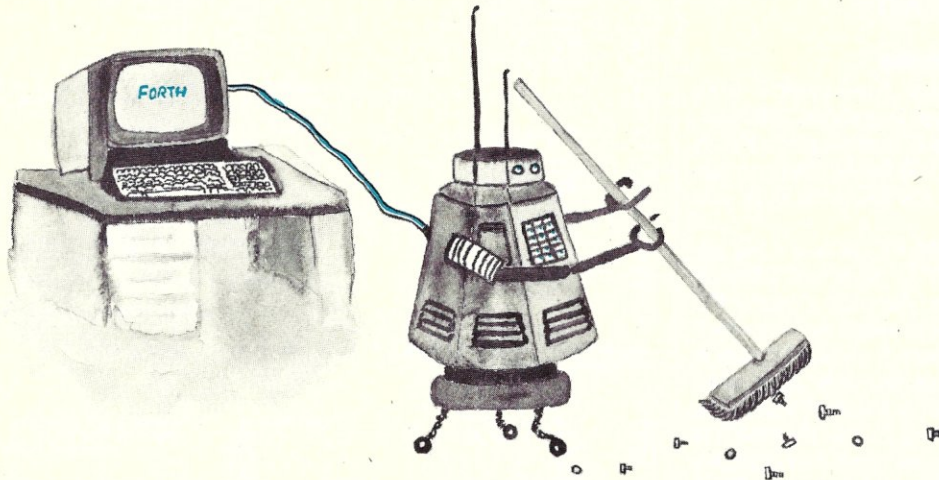
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25 = 0002 DATAPORT EQU 2 ;PORT 2=DATA PORT ON INTERFACER1
26 = 0003 SERSTAT EQU DATAPORT+1
27
28 ; DRIVER HEADER TABLE
29 DD -1 ;POINTER TO NEXT DEVICE IN CHAIN
30 0004 8000 DW 08000H ;CHARACTER DEVICE IOCTL BIT
31 0006 002F R DW CHREQ ;STRATEGY ROUTINE ENTRY
32 0008 003A R DW TRAP ;INTERRUPT ENTRY
33 000A 50 52 54 20 20 20 DB 'PRT ' ;DRIVER NAME
34 20 20
35
36
37 ;
38 = 0000 ;SRHBASE EQU 0 ;SRH PACKET BASE
39 = ;SRH EQU 0[BX] ;SR HEADER
40 = ;UNITCOD EQU 1[BX] ;UNIT CODE
41 = ;FUNC EQU 2[BX] ;FUNC CODE
42 = ;STATUS EQU 3[BX] ;16 BIT STATUS CODE
43 ;LOW SEVEN BITS OF STATUS CODE ERROR CODES:
44 ; 00=WRITE PROTECTION VIOLATION
45 ; 01=UNKNOWN UNIT
46 ; 02=DEVICE NOT READY
47 ; 03=UNKNOWN FUNC
48 ; 04=CRC CHECK
49 ; 05=BAD DRIVE STRUCTURE REQUEST LENGTH
50 ; 06=MEDIA SEEK ERROR
51 ; 07=UNKNOWN MEDIA
52 ; 08=SECTOR NOT FOUND
53 ; 09=PRINTER PAPER FAULT
54 ; 0A=WRITE FAULT
55 ; 0B=READ FAULT
56
57
58 ;
59 ; 0C=GENERAL FAILURE
60
61 MDESC EQU 13[BX] ;MEDIA DESCRIPTOR
62 XFRADR EQU 14[BX] ;TRANSFER ADDRESS
63 COUNT EQU 18[BX] ;COUNT OF BYTES TO TRANSMIT
64 NRUNITS EQU 13[BX] ;NUMBER OF UNITS RETURNED BY INIT
65 BRKADR EQU 14[BX] ;BREAK ADDRESS
66 SEGADR EQU 16[BX] ;SEGMENT ADDRESS
67
68 ;DATA STRUCTURES FOR DRIVER IN CONTROL SEGMENT
69
70 MEMLOC: DW ENDRVR ;LOCATION OF END OF DRIVER
71 DW ? ;SEGMENT INFORMATION
72 PACKET: DW ? ;STATIC REQUEST HEADER ADR
73 DW ? ;SET TO ES: ON ENTRY -> DS: ON TRAPPING
74
75 ;I/O WAIT (STATUS) SUBROUTINE
76
77 IOWAIT: MOV AH,AL ;SAVE AL FROM RUIN
78 IN AL,SERSTAT ;GET SERIAL PORT STATUS
79 XCHG AL,AH ;FLIP REGISTERS
80 RET ;RETRN (AH=STATUS BITS)
81
82 ;SUBROUTINE TO OUTPUT A CHARACTER TO THE PRINTER
83
84 OUTPUT: CALL IOWAIT
85 AND AH,041H ;CC BIT AND TBMT BIT
86 SUB AH,1 ;TBMT BIT
87 JNZ OUTPUT
88 OUT DATAPORT,AL
89 RET
90
91 ;CHAIN REQUEST FOR PRINTING (SOMEDAY)
92
93 ;ENTER WITH ES:[BX]->SRH STRUCTURE
94
95 CHREQ PROC FAR
96 MOV WORD PTR CS:PACKET,BX ;SAVE STATIC REQUEST HEADER
97 MOV WORD PTR CS:PACKET+2,ES ;SAVE SEGMENT TOO
98 RET ;RETURN TO MSDOS
99 CHREQ ENDP
100
101 ;INTERRUPT PROCEDURE FOR FUNCTIONS
102
103 TRAP PROC FAR ;FAR INTERRUPT PROCEDURE
104 PUSH AX ;SAVE EVERYTHING
105 PUSH BX
106 DS ;SAVE IT FROM RUIN (=ES:)
107 BX,DWORD PTR CS:PACKET ;RETRIEVE PACKET ADR
108 MOV AL,BYTE PTR FUNC ;GET FUNCTION BYTE FROM SRH
109 TEST AL,AL ;CHECK FOR INITIALIZATION
110 JZ ENDRVR ;INITIALIZATION CODE BEYOND DRIVER
111 PUSH CX ;PUSH FLAGS AND CX ONTO STACK
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# MSPRO

Continued from page 56

in the initialization section about returning the last address in the driver in DS:DX.

## System performance

I made some speed tests with MSPRO. It is fast. It is about 30% faster than MS-DOS 1.2 running on a PC. It is at least this much faster than concurrent CP/M for the PC with only one task.

Reading IBM PC disks is a big advantage of MSPRO. So what? Most of this software is so dependent on the PC that it won't run properly on any other machine. Yes, there is quite a bit that is not PC-dependent, but then again most of that is in multiple formats. I used the little disk only a few times. My MSPRO disk was only single sided, so I couldn't read any of my files from my office PC. I understand that Computer House offers a double-sided drive for a few bucks more.

## Conclusion

In summation I rate the implementation of MSPRO (MS-DOS by Computer House) as good. It would be much

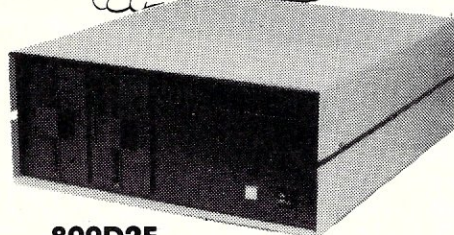
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139 007F 56          PUSH SI
140 0080 06          PUSH ES
141 0081 C4 77 0E    IOCOUT: L0DSB SI,DWORD PTR XFRADR
142 0084 AC          OUT SERSTAT,AL
143 0085 E6 03      LOOP IOCOUT
144 0087 E2 FB      POP ES
145 0089 07          POP SI
146 008A 5E          JMP SHORT WRRET
147 008B EB E0
148
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152 008D E4 03      ;OUTPUT STATUS ROUTINE - RETURNS 1 IF DEVICE BUSY, 0 IF READY
153 008F 24 41      ;USES BSY BIT IN SRH STATUS BYTE FOR THESE BITS. (BIT 9)
154 0091 2C 01      OUTSTAT: IN AL,SERSTAT
155 0093 74 05      AND AL,041H
156 0095 B8 0100    SUB AL,1
157 0098 EB 02      JZ RDY
158 009A 33 C0      MOV AX,100H
159
160
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167 009C 0C 80      RDY: XOR AX,AX
168 009E 89 47 03    ;GENERAL RETURN FROM TRANSMISSIVE OR STATUS OPERATIONS
169 00A1 9D          ;SETS COMPLETION BIT (BIT 8) IN STATUS WORD OF SRH
170 00A2 59          ;RESTORES ALL USED GENERAL REGISTERS
171 00A3 1F          ; DOES A FAR RETURN TO ROUTINE CALLING TRAP
172 00A4 5B          RETURN: OR AL,80H ;SET COMPLETION BIT
173 00A5 58          MOV WORD PTR STATUS,AX ;SET STATUS IN SRH
174 00A6 CB          POPF ;RESTORE FLAGS
175
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181 00A7            POP CX
182 00A7 2E: A1 0012 R ;RESTORE ALL
183 00AB C6 47 0D 00 ;RETURN TO USER CODE (FAR)
184 00AF 89 47 0E    ;THIS CODE IS NON RESIDENT (CODE BEYOND THE ABOVE RETURN FAR)
185 00B2 8C 4F 10    ;IT IS USED ONLY DURING INITIALIZATION AND IS THEN DESTROYED
186 00B5 C7 47 03 0080 ;BY THE CONFIG.COM INITIALIZATION AT BOOT TIME
187 00BA 1F          ;ANY NON-RESIDENT FUNCTIONS BELONG IN HERE
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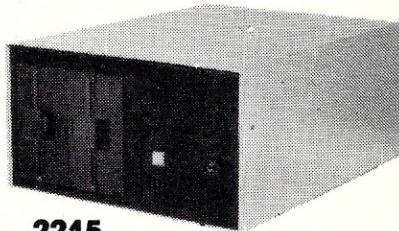
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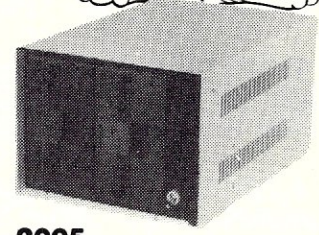
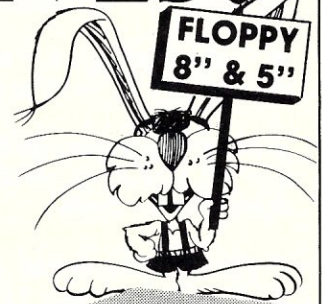
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# MSPRO

Continued from page 58

better if the user were not constrained by the hardware drivers, but that is *not* the fault of the Computer House implementation—just the way MS-DOS is put together. The documentation which I received was poor but was very preliminary. Performance was at least 30% better than under CP/M-85, and the disk allocation was less wasteful of space than in CP/M. The UNIX-like features are a nice touch. Frankly, the assembler and linker are worth the \$395 charged for the entire MSPRO package. Now that Digital Research has brought out its products for MS-DOS, there will be an acceleration in the availability of 8086 software.

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```

188      00BB 5B      POP      BX
189      00BC 58      POP      AX
190      00BD CB      RET
191      00BE      TRAP  ENDP ;RETURN FROM INITIALIZATION
192      00BE      CSEG  ENDS ;PROCEDURE
193      END        END ;END OF SEGMENT

THE MICROSOFT MACRO ASSEMBLER      10-03-83      PAGE      SYMBOLS-1
INTERFACER 1 DRIVER

SEGMENTS AND GROUPS:

                N A M E      SIZE  ALIGN  COMBINE CLASS
CSEG . . . . .      00BE  PARA  NONE

SYMBOLS:

                N A M E      TYPE  VALUE  ATTR
BRKADR . . . . .      TEXT   14[ BX]
CHREQ . . . . .      F PROC 002F  CSEG  LENGTH =000B
COUNT . . . . .      TEXT   18[ BX]
DATAPORT . . . . .     NUMBER 0002
ENDRVR . . . . .      L NEAR 00A7  CSEG
FUNC . . . . .        TEXT   2[ BX]
TOCOUT . . . . .     L NEAR 0084  CSEG
TOWAIT . . . . .     L NEAR 001A  CSEG
MDESC . . . . .      TEXT   13[ BX]
MEMLOC . . . . .     L NEAR 0012  CSEG
NEXT1 . . . . .      L NEAR 0072  CSEG
NRUNITS . . . . .     TEXT   13[ BX]
OUTPUT . . . . .     L NEAR 0021  CSEG
OUTSTAT . . . . .    L NEAR 008D  CSEG
PACKET . . . . .     L NEAR 0016  CSEG
RDY . . . . .        L NEAR 009A  CSEG
RETURN . . . . .     L NEAR 009C  CSEG
SEGAOR . . . . .     TEXT   16[ BX]
SERSTAT . . . . .    NUMBER 0003
SRH . . . . .        TEXT   0[ BX]
SRHBASE . . . . .    NUMBER 0000
STATUS . . . . .     TEXT   3[ BX]
TRAP . . . . .      F PROC 003A  CSEG  LENGTH =0084
UNITCOD . . . . .    TEXT   1[ BX]
UNKCOD . . . . .     L NEAR 0052  CSEG
WRITE . . . . .      L NEAR 0057  CSEG
WRITE1 . . . . .     L NEAR 0065  CSEG
WRRET . . . . .      L NEAR 006D  CSEG
XFRADR . . . . .     TEXT   14[ BX]

WARNING SEVERE
ERRORS   ERRORS
0         0

```

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Generate object code	<b>YES</b>	YES	YES
One pass native code compiler	<b>YES</b>	NO	NO
Locates RunTime errors directly in source code	<b>YES</b>	NO	NO

Benchmark data based on EightQueens in "Algorithms + Data Structures - Programs" by N. Wirth, run on an IBM PC.  
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# Enhancing MP/M II: A Batch Processor

**Your one-task  
system can let  
several programs  
run at once.**



by Tom Clodfelter

---

**I**n Part 1 of this series (January 1984), I discussed some of the features and faults of MP/M II as a multiuser system. Two of my major complaints were the fact that there was no multiuser login facility, and that MP/M II does not have a good batch processor. I will address these two points here.

The first project that I tackled under MP/M II was the problem of a user login and accounting system. My CP/M system had such a feature, since it had its own phone line. It was an RCPM-like system, but it was not public. MP/M is for a nonhostile environment, but a good multiuser system should still have a means to keep out unwanted users, yet allow those who have logged in to find out who else is on the system and communicate with them.

The password facility that does exist under MP/M II gives protection to disks and files. If password protection is enabled, you cannot access a file (or program) unless you know the password.

You can assign different passwords to each file. You can also set a default password for yourself that the system will attempt to use with any files that are password protected. There are many situations in which this type of file protection is good, but it is no substitute for keeping unwanted people out of the system entirely. Since you cannot password protect resident system processes, MP/M allows them to be run without any form of protection. There is also the danger that the default password will still be set to that of the previous user, leaving the system wide open. I desired a system that could keep all unwanted users from logging in. It would assign to the user the correct user number, on the correct disk drive, with the correct default password for his application. Finally, it would even have the ability to start an application program associated with the login.

For my first attempt at providing this service, I wrote a resident system process that attached to all consoles after system boot. Under normal circumstances the Terminal Message Process (TMP) is attached to each console when the system boots. The TMP is the pro-



cess that accepts your command line and sends it to the system. If you want a program to take control instead, it is only necessary to write a Resident System Process (RSP) that has a higher run priority than the TMP. This could then be made to detach from a console only after you logged into the system and to attach to your console when you logged out.

While this method works, it has several drawbacks. In the first place it takes up additional space in the common memory area. It also gives you no control over what the user does once he is logged in. I realized that the best place for this function was within the TMP itself. This way the TMP would have some control over the commands that the user issues, allowing different levels of privileged operation.

If you are not logged in, the TMP should accept only a login request. Once you are logged in, the TMP would have the first crack at checking your command line. If it saw something it did not like, it just wouldn't pass it on. This is a simple concept. That is, it is simple if you have the source to the TMP. Needless to say, I didn't have the source, so I wrote Digital Research to ask if I could buy it. Now, I won't say that they were rude (well, maybe close), but the answer was NO.

The MP/M II manual, although much better than that of 1.0, does not tell how to write a TMP. I had to know how the TMP was connected to the system. It took several months of investigation before I learned enough about how the TMP works to be able to write a replacement. My special TMP, soon to be a UNIX-like shell, is not the main topic of this installment. It is, however, important that you be aware of it when demonstrating BATCH. You are about to see MP/M do things that it is not supposed to do. If you are a MP/M user, you may not even recognize your operating system.

If you are familiar with CP/M's SUBMIT and XSUB, you may be surprised to find out that MP/M's submit facility is nowhere near as elaborate. There are several SUBMIT replacements available now, but most will not work correctly under MP/M. Even the ones that would work under MP/M fell short of what I wanted. I wanted a true batch facility with which I could run a job or series of jobs in background without tying up a terminal. I also wanted to be able to save the output from that job in a way that would show me when it ran, how long it took, and what it did.

The big secret of the solution to my problem came from a trick that I learned from several DEC operating systems. The cleverness lies in the con-

cept of a virtual console. A virtual console is a software console that the system cannot tell from a hardware one. It does not really exist, but there is a driver and a TMP supporting it just as if it were. Tie in the virtual console concept with MP/M's very nice message queue data structures, and you already have half of a background batch system.

The idea is that the system has a console driver that does I/O to and from queues instead of a physical device. A program can then read the desired input for the virtual console from a disk file, and it can record the consoles output to another file or device. There are a few catches, but that is the basic idea, and we will cover the problems as we get to them.

In order to provide virtual console

drivers, it is necessary for you to modify your XIOS. The XIOS is the BIOS equivalent for MP/M. The modifications are simple, so there is nothing to be afraid of. You should be able to accomplish them even if you have not done much assembly level programming. It is necessary, however, to have the source to your XIOS. I am working on a new method, that will allow virtual consoles even if you do not have the XIOS source. To modify your XIOS, just follow the examples.

Listing 1 shows an example of the MP/M console driver jump tables. Simply find the jump tables in your XIOS and add the additional data statements with the labels of your virtual consoles. Remember also to change the constant that is the maximum number of con-

This side of the diagram is a representation of BATCH reading and writing the virtual console queues. This side of the diagram is a representation of the virtual console driver.

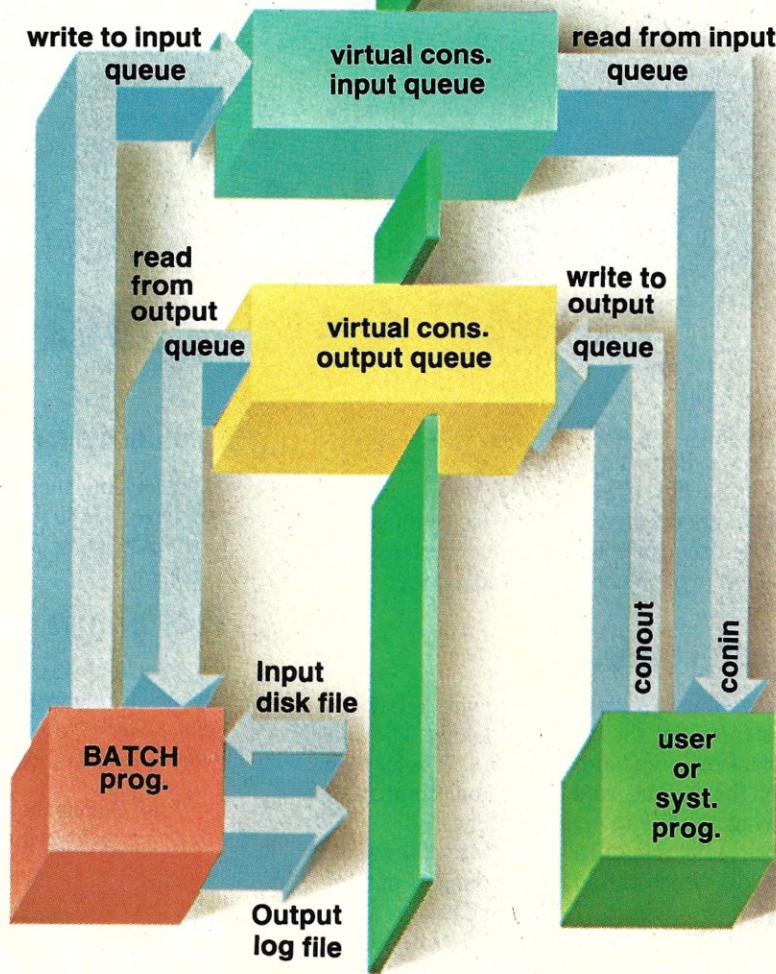
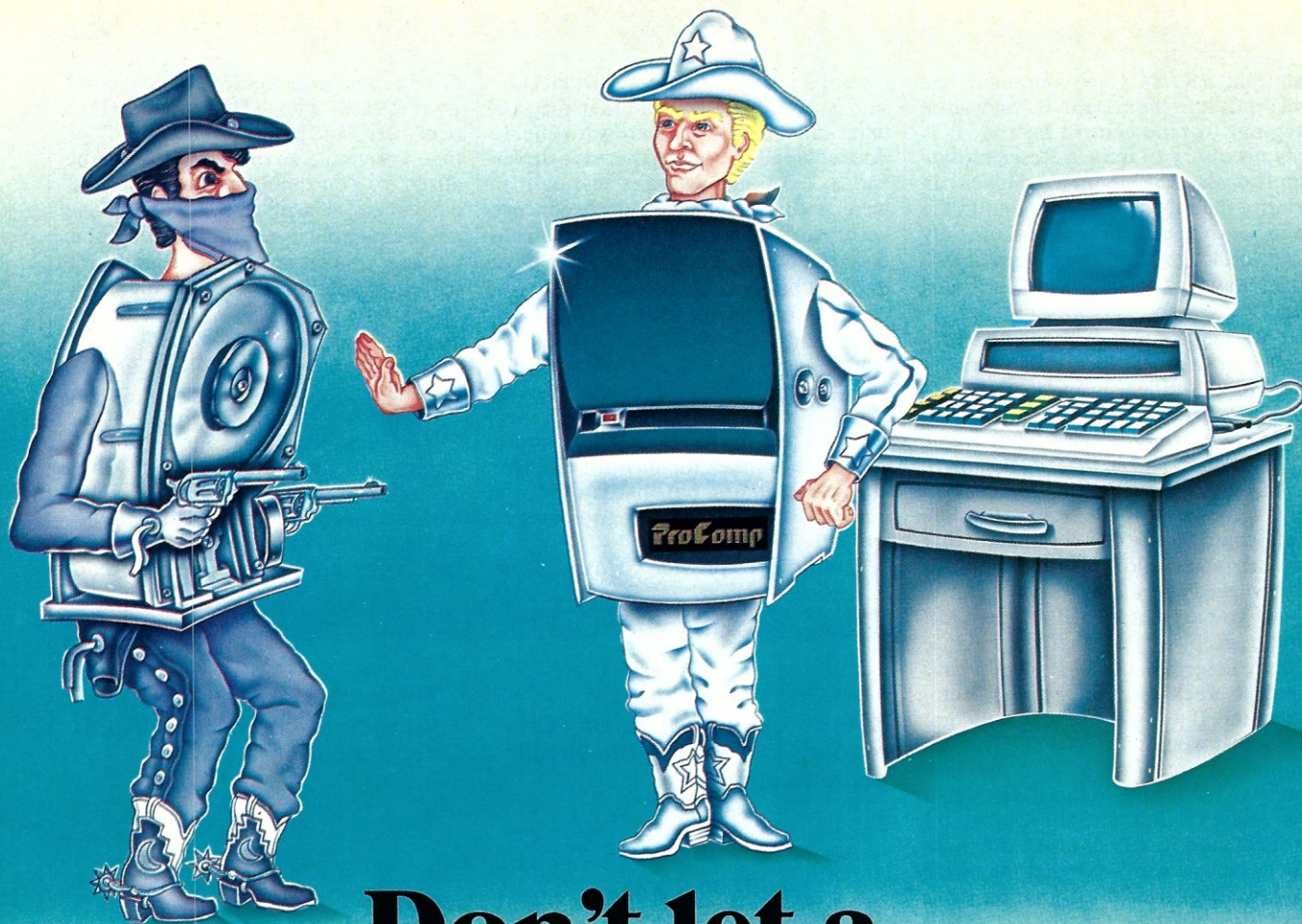


Diagram 1. Relationship of the virtual console queues during batch operation.





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# MP/M II

Continued from page 65

of a background process, however.

The modifications to this console driver make it much more powerful than the CP/M SUBMIT and XSUB method. Under CP/M you can feed input to a program run under SUBMIT, but there are severe limitations. With XSUB the program will only receive the input from the SUBMIT file if the program is doing line-buffered inputs through CP/M BDOS call #10. MP/M also has a SUBMIT program, but it has no XSUB facility at all.

The last modification to the XIOS is in the SYSTEMINIT routine. This simple modification, shown in Listing 3, ensures that the system will properly create the queues required. Now assemble your new XIOS and regenerate your system as per the MP/M II manual instructions. Remember that you have more consoles now. When all of this is done, a status display for your system should look something like Listing 4.

Now it is time to write a batch handler program to feed the virtual consoles. The listing with this article is a simple one written in C. Its only pur-

**If you want to pass control to a program instead of to the TMP, simply write an RSP with a higher run priority.**

pose is to demonstrate how the BATCH processor works. A similar batch processor could be written in almost any language. I chose C because I am familiar with it, and it relates very well to system data structures and pointers to structures.

This simple program does some translation of character sequences into

```
dw 0
dw 0
dw 0
dw 0
c4inent: ds 2 ; msgcnt
          ds 1 ; buffer
c4inuqcb: ; input user qcb
          dw c4inq ; pointer
          dw ch4in ; pointer to character
ch4in: db 0 ; input character
; Mutual Exclusion que for pc4.
mxvc4: dw 0 ; que link
        db MXVc4 ; name
        dw 2 ; msg length
        dw 1 ; number of msgs
        dw 0
        dw 0
        dw 0
pc4adr: ds 2 ; buffer
;
; output que structure
c4outq: dw 0 ; que link
        db Vc4out ; name
        dw 1 ; msg length
        dw 80 ; number of msgs
        dw 0
        dw 0
        dw 0
c4outent: ds 2 ; msgcnt
          ds 80 ; buffer
c4outuqcb: ; input user qcb
          dw c4outq ; pointer
          dw ch4out ; pointer to character
ch4out: db 0 ; output character
```

### Listing 3. SYSTEMINIT routine modification

```
;; You should insert this (or similar) code in at the tail end
;; of your system init routine in the XIOS. This is necessary
;; so that the system will create the Virtual Console I/O queues.
;; I have two Virtual consoles in my system (4 & 5).
```

```
mvi c,makeque ; create special queues
lxi d,c4inq ; Vc4:
call xdos

mvi c,makeque ; create special queues
lxi d,c4outq ; Vc4:
call xdos

mvi c,makeque ; create special queues
lxi d,mxvc4 ; MXVc4:
call xdos

mvi c,makeque ; create special queues
lxi d,c5inq ; Vc5:
call xdos

mvi c,makeque ; create special queues
lxi d,c5outq ; Vc5:
call xdos

mvi c,makeque ; create special queues
lxi d,mxvc5 ; MXVc5:
call xdos
```

### Listing 4. Status display

```
1C>MPMSTAT<cr>
```

```
***** MP/M II V2.0 Status Display *****
```

```
Top of memory = FFFFH
Number of consoles = 06
Debugger breakpoint restart # = 06
Stack is swapped on BDOS calls
Memory is bank switched
BDOS disk file management is bank switched
Z80 complementary registers managed by dispatcher
```

```
Ready Process(es):
MPMSTAT [1] Idle
Process(es) DQing:
[Sched] Sched [0]
[SPOOLQ] Spool [0]
[C110] c11
[ATTACH] ATTACH
[Vc5in] Tmp5 [5] <---- TMP for virtual console #5
[Vc4in] Tmp4 [4] <---- TMP for virtual console #4
Process(es) NQing:
Delayed Process(es):
Polling Process(es):
```



```

Tmp0      [0] Tmp2      [2] Tmp3      [3]
Process(es) Flag Waiting:
01 - Tick
02 - Clock
Flag(s) Set:
Queue(s):
MPMSTAT  Sched  STOPSPLR SPOOL0  C1i0  ATTACH  MXList
MXDisk   MXVc5  Vc5out  Vc5in  MXVc4  Vc4out  Vc4in <--- queues
MXProc
Process(es) Attached to Consoles:
[0] - Tmp0
[1] - MPMSTAT
[2] - Tmp2
[3] - Tmp3
[4] - Tmp4 <----- virtual console #4
[5] - Tmp5 <----- virtual console #5
Process(es) Waiting for Consoles:
[1] - Tmp1 [1]
Process(es) Attached to Printers:
[0] - Unattached
[1] - Unattached
Process(es) Waiting for Printers:
Memory Allocation:
Base = 5E00H Size = A200H Bank = 00H Allocated to MP/M-80 [0]
Base = 0000H Size = C000H Bank = 01H * Free *
Base = 0000H Size = C000H Bank = 02H * Free *
Base = 0000H Size = 5D00H Bank = 00H * Free *
Base = 0000H Size = 4000H Bank = 03H * Free *
1C>

```

### Listing 5a. Example of BATCH program

```

/*****
*
*   Background Batch Processor for MP/M II.
*
*   By Tom Clodfelter
*   The Arecibo Observatory
*   Arecibo, PR 00612
*   11-Feb-82
*
*   This program is to demonstrate how a batch
*   processor can work through virtual consoles
*   under MP/M II.
*
*****/

#include "a:stdio.h"
#include "mpm.h"

#define TRUE 1
#define FALSE 0

FILE *fi, *fo, *fopen();

main(argc, argv)
int argc;
char *argv[];
{
    register char *buffin, *buffout;
    register int k, c, ch, lstch;
    char *s;
    int flagl, llog, logit, pk;

    struct _uqcb inque; /* console input que control block */
    struct _uqcb outque; /* console output que control block */
    struct _tod time; /* time buffer */

    /* handle any value initialization */

    inque.msg = buffin;
    outque.msg = buffout;
    flagl=logit=llog=FALSE;
    c = 0;
    pk = 4;

    printf("\nMP/M II (+) Background Batch Processor V1.0");

    /* build the Queue control blocks and try to open the queues */

    strncpy(outque.name, "Vc4out ", 8);
    if (bdos(OPENQUE, &outque) != 0) {
        printf("\nbatch: Error can't open output.");
        exit(0);
    }
    strncpy(inque.name, "Vc4in ", 8);
    if (bdos(OPENQUE, &inque) != 0) {
        printf("\nbatch: Error can't open input.");
        exit(0);
    }
}

/* process option switches */

while (--argc > 0 && (++argv)[0] == '^')
    for (s = argv[0]+1; *s != '^0'; s++)
        switch(toupper(*s)) {
            case 'D':
                flagl = TRUE; /* detach Batch option */
                break;
            case 'L':
                llog = TRUE; /* log option set */
                break;

```

control codes. When it finds a tilde (^) in a control file, it will gobble it up and convert the next character into a control character. This was done to make it easier to edit the control file used to drive the batch stream. It does not yet have variables or flow control, but it still serves me well. By the time you read this I should have a batch language proces-

**I wanted  
a true  
batch facility  
to run jobs  
in background  
without tying up  
the terminal.**

sor in place of this demonstration program. Remember that the program in Listing 5a is only a simple example to show how BATCH works. Listing 5b shows the include file that contains the necessary system data structure for the BATCH program.

Now turn your attention to Listing 6 for an example of a batch control file. This one is named TEST.CTL—an original enough name to suit our present needs. The first part of the control file consists of the necessary character strings to log into my system. A ^G is necessary to get the system's attention; it then expects a user name and password. These steps would not be necessary in normal MP/M. Also note some of the other commands like WHO, TIME, DATE, etc. Many of these are new intrinsic commands. They reside in my own TMP. Some of my other MP/M systems works will also be briefly demonstrated during the course of the batch run.

The Basic shown is my own interpreter designed around MP/M realtime and multiuser capabilities. Though it is still a very simple interpreter at this point, it is developing well. My goal has been to make it compatible with DEC Basic Plus with added realtime features.

PS (Process Status) is another in-



# MP/M II

Continued from page 67

resting utility that I have written for MP/M II. It can serve as a replacement for MPMSTAT, although I continue to use them both. PS offers more information about running programs than MPMSTAT does.

Listing 7 is an example of how to run the BATCH program. I use a WHO command before and after the batch invocation in order to show you how the batch user gets logged into the system. You will note that the BATCH program itself still belongs to me, but the things it runs belong to the virtual console. Afterwards, I check my PS program to find that BATCH is no longer running. I may now check the output from the batch operation. It can be found in the file TEST.LOG. A listing of the output may be seen in Listing 8.

When a program wants service from the operating system it executes a system call. This system call causes the

**Tie in a virtual console with a message queue data structure, and you have half of a batch processor.**

system to dispatch the process. When a process is dispatched, this means that the operating system determines what type of system service the program requested and what resources it needs, then places it on a processing list for those resources. This has the effect of blocking the program from executing until the requested resource is available. The system then checks the status of all processes on its resource list to see if any are ready to be moved to the ready list. If any processes are due to be moved to the ready list, it does so and then picks the program with the greatest priority from the ready list and executes it.

For example, let's say that our program wants an input character. First it

```
default:
    printf("\nusage: batch -ld pname.ctl pname.log");
    printf("\n      -d detach and lower priority.");
    printf("\n      -l log output requested.");
    printf("\n      -? print this message.");
    exit(0);
}

/* Act on options requested */

if ((fi = fopen(*argv++, "r")) == NULL) {
    printf("\nbatch: can't open Ctl file.");
    exit(1);
}
if (llog == TRUE) {
    if ((fo = fopen(*argv, "w")) == NULL) {
        printf("\nbatch: can't open log file.");
        exit(1);
    }
    bdos(GETTOD, &time);
    fprintf(fo, "\n%02x:%02x:%02x $JOB %s\n", time.hour,
        time.minute, time.second, *argv);
}
if (flagl == TRUE) { /* detach */
    printf("\nbatch: Detaching....\n");
    bdos(SETPRI, 220); /* raise priority */
    bdos(DETACH, 0); /* detach from console */
}
while (TRUE) {
    ch = getc(fi); /* get from input */
    if (ch == '~') /* test for control character flag */
        ch = getc(fi) - '@'; /* convert next char to control */
    if (ch == 0x0a) ch = getc(fi);
    if (ch == '\n') ch = 0x0d;
    *buffin = ch;
    while (bdos(CONDRDOUE, &inque) == 0xff) {
        while (bdos(CONDRDOUE, &outque) == 0) {
            c = *buffout;
            if (c == 0x0a && lstch == 0x0d) logit = TRUE;
            if (llog == TRUE) putc(c, fo);
            if (logit == TRUE && llog == TRUE) {
                bdos(GETTOD, &time);
                fprintf(fo, "%02x:%02x:%02x ",
                    time.hour, time.minute, time.second);
            }
            logit = FALSE;
            lstch = c;
        }
    }
    if (ch == 0x1a) {
        while (bdos(CONDRDOUE, &outque) == 0) {
            c = *buffout;
            if (llog == TRUE) putc(c, fo);
            if (c == 0x0a && lstch == 0x0d) logit = TRUE;
            if (logit == TRUE && llog == TRUE) {
                bdos(GETTOD, &time);
                fprintf(fo, "%02x:%02x:%02x ",
                    time.hour, time.minute, time.second);
            }
            logit = FALSE;
            lstch = c;
        }
        fclose(fi); /* close input */
        if (llog == TRUE) {
            bdos(GETTOD, &time);
            fprintf(fo, "\n%02x:%02x:%02x $EOJ\n",
                time.hour, time.minute, time.second);
            fclose(fo); /* and output */
        }
        exit(0);
    }
}
}
```

Listing 5b. Include file for BATCH program

```
*****
*
* Special structures and defines for MP/M II system programs.
*
* By Tom Clodfelter
* The Arecibo Observatory
*
*****/

#define FLAG char

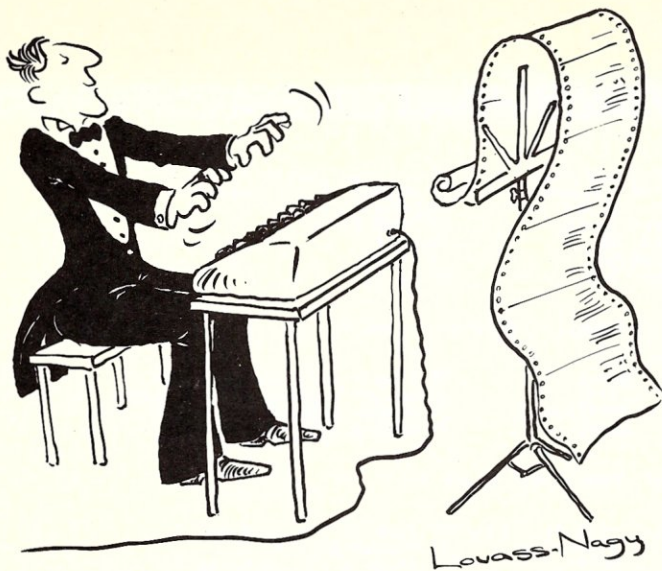
/* tod data block */

struct tod {
    unsigned date; /* 16 bit days since Jan. 1, 1978 */
    char hour; /* BCD hours */
    char minute; /* BCD minutes */
    char second; /* BCD seconds */
};

/* lqcb linked que control block */

struct lqcb {
    struct lqcb *nextque; /* pointer to next linked que */
    char name[8]; /* que name */
};
```





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XASM68	6800/01		
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# MP/M II

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will make an input character system call. At this point the operating system takes over. The program's state is saved in the process descriptor block. The system then scans various lists to determine which programs are due for a change of status, then chooses a program and executes. When that program makes a system call, or when a tick (system time interval interrupt) occurs, the system suspends the program and scans its lists to see what needs checking. When it is our program's turn to be first on the ready list again, the system will restore the process state of our program and allow it to continue from where it stopped. This will now cause the program to actually execute the system service routine for character input. Part of the character input routine is a system call to poll the I/O device. When this call is executed, the process will again be

**The system's console driver does I/O to and from queues instead of to and from a physical device.**

blocked from execution if no character is available. If a character is available, it will be returned to our program. Our program will now run until it makes another system call or a system tick occurs.

With our special virtual consoles there are a few more steps to go through, but the procedure is similar. As before, our program wants an input character, so it must make an operating system call for the system to dispatch it. When it is time for the system to execute the program call again, it will cause the program to execute the read queue call in the console input routine. This will again cause the system to dispatch our process and force it to wait for execution

```
    unsigned msglen;      /* message length */
    unsigned nmbmsgsg;    /* number of messages */
    unsigned dqph;        /* DOPH */
    unsigned nqph;        /* NOPH */
    unsigned mh;          /* MH */
    unsigned mt;          /* MT */
    unsigned bh;          /* BH */
};

/* memseg memory segment table structure */
struct memseg {
    char base;            /* memory segment base page */
    char size;            /* memory segment size in pages */
    char attributes;     /* memory segment attributes */
    char bank;           /* memory segment bank number */
};

/* pdb Process Descriptor Block */
struct pdb {
    struct _pdb *nextproc; /* link to next process */
    char status;           /* status byte */
    char priority;         /* process run priority */
    unsigned stack;        /* pointer to stack top */
    char name[8];          /* process name */
    char cons lst;         /* console and list numbers */
    char memseg;           /* memory segment */
    unsigned dparam;       /* dparam */
    unsigned thread;       /* process thread */
    unsigned dma;          /* dma address */
    char dsk usr;          /* disk and user number */
    unsigned dcnt;         /* dcnt */
    char searchl;          /* searchl */
    unsigned searcha;      /* searcha */
    unsigned pdextent;     /* extent */
    /* the register storage area follows */
    unsigned HL;           /* HL */
    unsigned DE;           /* DE */
    unsigned BC;           /* BC */
    unsigned AF;           /* AF */
    unsigned IY;           /* IY */
    unsigned IX;           /* IX */
    unsigned HL;           /* HL */
    unsigned DE;           /* DE */
    unsigned BC;           /* BC */
    unsigned AF;           /* AF */
    unsigned scratch;      /* scratch space reserved for MP/M II */
};

/* intdata XDOS internal data segment structure */
struct intdata {
    struct _tod time;      /* time of the day */
    struct _pdb *ready;    /* ready list root */
    struct _pdb *delay;    /* delay list root */
    struct _pdb *disp;     /* dispatched ready list */
    struct _pdb *poll;     /* poll list root */
    struct _pdb *swap;     /* swap list root */
    struct _lqcb *qroot;   /* que list root */
    unsigned Ethread;      /* thread root */
    char nmbcons;          /* number of consoles */
    unsigned attachtbl[16]; /* console attach table */
    unsigned consque[16];  /* console que */
    char nmbflags;         /* number of flags */
    unsigned sysflags[32]; /* system flags list */
    char numbsseg;         /* number of memory segments */
    struct memseg mem[8];  /* memory segment table */
    struct _pdb pdtable[8]; /* pdb table for memory segments */
    char nmbldpt;          /* number of list devices */
    unsigned lstattach[2]; /* list attach table */
    unsigned lstque[2];    /* list que */
};

/* sysdata System data page structure */
struct sysdata {
    char memtop;           /* top page of memory */
    char nmbcons;         /* number of consoles */
    char brkprst;          /* breakpoint restart number */
    FLAG systks;           /* add system call user stack boolean */
    FLAG bnked;            /* banked switched boolean */
    FLAG Z80;              /* z80 version boolean */
    FLAG bnkbdos;          /* banked bdos, boolean */
    char xiosjmp;          /* xios jump table page */
    char resbdos;          /* resbdos page */
    unsigned cpnetadr;     /* cp/net config table address */
    char xdospage;         /* xdos page address */
    char rspage;           /* RSP's (bnkxios top+1) base page */
    char bnkxiospg;        /* banked xios page address */
    char bnkbdospg;        /* banked bdos page address */
    char maxmemseg;        /* maximum memory segment number */
    struct memseg mem[8];  /* initial memory segment table */
    char bkpointvec[16];   /* breakpoint vector table */
    char reserved[16];     /* reserved for MP/M II */
    char stktbl[16];       /* stack pointer table */
    char reserved2[24];    /* reserved for MP/M II */
    unsigned numbrs;       /* number of records in MPM.SYS file */
    char nmbticks;         /* number of ticks per second */
    char systemdrive;      /* system default drive */
    char commonpage;       /* common memory base page */
    char numbrsps;         /* number of resident system processes */
    unsigned listcp;       /* listcp array address */
};
```



```

char    submitflg[16]; /* submit flag array */
char    reserved3[43]; /* reserved for MP/M II */
char    maxlocked;     /* max locked records/process */
char    maxopen;      /* max open files/process */
unsigned nmblocked;   /* number of locked list items */
char    *locktbl;     /* pointer to lock table free space */
char    totallocked; /* total system locked records */
char    totalopen;   /* total system open files */
FLAG    dayfile;     /* dayfile logging boolean */
char    tempdrive;   /* temporary file drive */
char    numblpt;     /* number of printers */
char    reserved4[44]; /* reserved for MP/M II */
char    bnkxdosp;    /* banked xdos page address */
char    tmpbase;     /* tmp pdb base */
char    cnsdatbase; /* console.dat base */
unsigned bdosentry; /* bdos/xdos entry point */
char    tmpsprbase; /* tmp.spr base */
char    nmbbnkrsp;  /* number of banked RSP's */
char    brspb;     /* BRSP base address */
char    brspb;     /* BRSP base address */
struct  _pdb *nonres; /* link to non-resident rsp */
struct  _intdata *internal; /* pointer to internal data segment */
struct  _pdb *resproc; /* link to resident system processes */
};

/* UQCB user que control block */
struct  uqcb {
    struct _lqcb *lnkque; /* pointer to actual que */
    struct _qmsg *msg;    /* pointer to message area */
    char    name[8];     /* que name */
};

/* apb Abort Parameter Block */
struct  _apb {
    struct  _pdb *pdb;    /* process descriptor address */
    unsigned code;      /* termination code */
    char    name[8];    /* process name */
    char    cons;       /* console number used by process */
};

/* dpb dph blocks from CP/M Interface Guide Sect 6.5 */
struct  _dpb {
    unsigned spt;       /* CP/M Version 2 Disk Parameter Block */
    char    bsh;        /* sectors per track */
    char    blm;        /* block shift factor */
    char    exm;        /* Extent Mask */
    unsigned dsm;      /* Highest block number on this disk */
    unsigned drn;      /* total number of directory entries -1 */
    unsigned al;       /* bit field corresponding to direc blocks */
    unsigned cks;      /* size of the directory check vector */
    unsigned off;      /* number of reserved tracks on this disk */
};

struct  _dph {
    char    **xlt;      /* MP/M Version 2 Disk Parameter Header */
    int     ooo;        /* logical to physical xlat vector */
    char    *dirbuf;   /* 128 byte scratchpad for directory use */
    struct  _dpb *dpb; /* disk param block for this type of disk */
    char    **csv;     /* scratch area for detecting changed disks */
    char    *alv;      /* pointer to bit vector alloc map for disk */
};

struct  _fcb {
    char    dr;        /* MP/M Version 2 fcb AS SEEN BY THE USER */
    char    fname[8]; /* drive number */
    char    ftype[3]; /* fname[1] used by TAG2 */
    char    ex;        /* ftype[1] 8th bit set for $SYS */
    char    sl;        /* file extent normally 0 */
    char    s2;        /* reserved for bdos's benefit */
    char    rc;        /* likewise, =0 on call to open,make,search */
    char    dmap[16]; /* record count for extent[ex] 0...128 */
    char    cr;        /* group pointers */
    unsigned recn;     /* current record, initialized to 0 by usr */
    char    recovf;    /* highest record number */
};

/* following are BIOS calls */
#define CONST 2        /* bios console char ready */
#define CONIN 3        /* bios cons char input */
#define CONOUT 4       /* bios cons char output */

#define UFNSIZE 15     /* d:filename.typ\0 is 15 chars */

/* following are BDOS calls */
#define SELDSK 14      /* bdos select disk 0=default disk */
#define SRCH 17        /* bdos search for file pattern */
#define SRCHNXT 18     /* search for next occurrence */
#define GETDEFDISK 25 /* get current disk (0-15) */
#define SETDMA 26      /* set address for read, write, etc. */
#define GETALLOCP 27   /* get address of allocation vector */
#define SETATTRIB 30   /* update file attributes */
#define GETDPB 31      /* get DPB address for disk */
#define SETGETUSER 32 /* set or get user number */
#define COMPFILSIZ 35 /* compute file size into recn and recovf */

#define ABSMEMREQ 128 /* absolute memory seg request */
#define RELMEMREQ 129 /* relocatable memory seg request */
#define MEMORYFRE 130 /* memory free request */

```

until a message is available in the queue. At this point the system picks another program from the ready list and executes it. One of the programs on the ready list will eventually be BATCH. When it is time for BATCH to execute, it will make a system call that will write a character message to the queue. BATCH is then suspended, and the system finds out that our program now has the queue message it needs, so it again places it on the ready list. When it is our turn to run again, the system returns from the read queue routine, and then the I/O routine returns with the character it read from the queue. Our program

## Having the external status routine return a not ready status will allow most programs to run unchanged on the virtual console.

then gets to run until it makes another system call or a system tick occurs.

Simple? Fortunately the system keeps track of all of this, and you don't have to. All this was meant to give you an idea of how a system that allows only one task at a time to actually execute through time sharing lets two or more programs interact concurrently. Diagram 1 shows the relationship of the virtual console queues during batch operation.

Future versions of BATCH will contain many advanced features. For instance, with a few simple modifications to the XDOS, it will be possible to use program return codes to make decisions during a batch process.

There are many more interesting things to be done with MP/M. I hope that I have stimulated your interest in some of them. □

Tom Clodfelter, C/O Microsystems, One Park Ave., NY, NY 10016



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Z-80 XASM		500.00	\$99.50	\$99.50	\$99.50
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6502 XASM	99.50	500.00	\$99.50	\$99.50	\$99.50
6800,2,8 XASM	99.50	500.00	\$99.50	\$99.50	\$99.50
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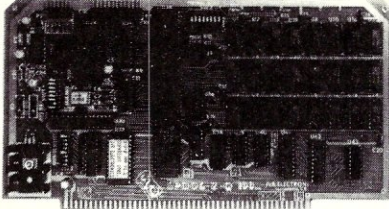
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**256K S-100  
PRINTER BUFFER**



**SPOOL-Z-Q 100 - \$119**

(BARE BOARD WITH EPROM AND MANUALS)

Spool-Z-Q 100 is now available as a BARE BOARD WITH EPROM AND MANUALS! In addition, all of the parts needed to build a Spool-Z-Q 100 are available in partial kits. Complete kits at significant savings are also available. If you choose to "roll your own" with just the bare board option, you will find that no impossible to find parts are used.

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**TECHNICAL DETAILS**

**SERIAL OUTPUT** — RS-232 compatible. Baud rates—Switch selectable 19.2K, 9600, 4800, 2400, 1200, 600, 300, & 150 baud.

**PROTOCOLS** — Switch selectable XON/XOFF, ETX-/ACK, ENQ/ACK, Reverse Channel (Busy/Ready) either polarity, or parallel.

**PARALLEL OUTPUT** — Standard Centronics interface signals, 8 Data, Busy & Strobe.

**S-100 (IEEE 696) INTERFACE** — No wait states required on any system. Switch selectable I/O address can be set to ANY one of the 256 possible addresses. Extremely simple to use. Simply monitor the Busy status bit and send data to Spool-Z-Q when not busy. All protocols, etc. are taken care of already.

**MEMORY TYPE AND EXPANSION** — Spool-Z-Q 100 uses industry standard 4164 type 64K RAM chips. Sizes available are 32, 64, 128, 192, and 256K characters. Every Spool-Z-Q 100 is fully socketed for 256K and may be expanded by just plugging in chips.

**AUTOMATIC SPACE CHARACTER COMPRESSION** — Although the maximum size is 256K (60-120 pages of print) the space compression feature allows Spool-Z-Q to effectively hold much more printing which contains many spaces (listings, reports, etc.).

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**DEALERS WANTED!**

**CIRCLE 28 ON READER SERVICE CARD**

**MP/M II**

Continued from page 71

```
#define POLLDEV      131      /* Poll device request */
#define FLAGWAIT    132      /* Flag wait request */
#define FLAGSET     133      /* Flag set request */
#define MAKEQUE     134      /* Make queue request */
#define OPENQUE     135      /* Open Que request */
#define DELETEQUE   136      /* Delete Que request */
#define READQUE     137      /* Read que request */
#define CONDRDOUE   138      /* conditional read que request */
#define WRITEQUE    139      /* Write que request */
#define CONDRDOUE   140      /* conditional write que request */
#define DELAY       141      /* delay system ticks */
#define DISPATCH    142      /* release time slice */
#define TERMINATE   143      /* terminate current process */
#define CREATEPROC  144      /* create process */
#define SETPRI      145      /* set process priority */
#define ATTACH      146      /* attach console */
#define DETACH      147      /* detach console */
#define SETCONS    148      /* set console device */
#define ASSIGN      149      /* assign console to program */
#define SENDCLI    150      /* send command line to cli */
#define CALLRSP    151      /* call resident system procedure */
#define PARSEFN    152      /* parse file name */
#define GETCONS    153      /* return console number */
#define GETSYSDATA 154      /* return system data page address */
#define GETTOD     155      /* get time and date */
#define GETPDA     156      /* get process descriptor address */
#define ATTACHLST  158      /* attach list device */
#define DETACHLST  159      /* detach list device */
#define SETLST     160      /* set list device */
#define CONDATLST  161      /* conditional attach list */
#define CONDATCNS  162      /* conditional attach console */
#define MPMVERS    163      /* return MP/M version number */
#define GETLST     164      /* return list number */

/* end of mpm.h */
```

**Listing 6. Example of a batch control file**

```
OC>type test.ct1<cr>
~CDEMO
SECRET
:
: Now we are logged into my system on a Virtual Console.
: Lets see who else is on the system.
: Also NOTE the Time Stamp to the left of every line.
: This is because we are running as a background job. What you
: are reading is the log file that the batch processor created.
: The batch processor stamps everything so that you will know
: when a job executed and how long it took.
:
who
:
: Now find out what time it is.
:
time
:
: So far all of the commands that I have used are handled
: in my special TMP.
:
: Lets take a look at PS, my status program.
:
ps
:
: Note: the default mode for PS was to only show processes
: that were associated with my console.
: Now I will do a PS for all processes.
:
ps -a
:
: And now for all processes in long format.
:
ps -al
:
: Now I will use PS to dump the Process Descriptor block of
: a specified process.
:
ps -p -n spool
:
: Now I will ask PS what options it has.
:
ps -?
:
: Lets try the Que option.
:
ps -q
:
: Thats enough of PS for Now.
: Now lets take a quick look at my Basic interpreter for MP/M.
:
basic
10 rem we will enter a short program into basic from batch.
20 detach : rem this will cause the program to run detached.
30 for x = 1 to 1000
40 next x
50 print "the answer is ";x;"."
60 end
list
run
```



# TURN-KEY, MULTI-USER BUSINESS SYSTEM

## Running the Turbo-Dos Operating System

This system is tailored to the needs of the individual customer and as such provides that touch of freedom desired by the business system buyer. **SYSTEM-1** is truly "TURN-KEY", just unpack the equipment, connect the cables, turn it on, and you are up and running. There are numerous **SYSTEM-1**'s meeting the requirements of the small to moderate size business currently in today's market.

**SYSTEM-1** can support up to fifteen users, a batch processor, and up to eight printers. Other options, such as "SEMIDISK", are available to the user when the need arises. The attractive all metal enclosure will complement any office decor, as will the **ADM-11** consoles, and the **MPI 150G PRINTMATE** printers.

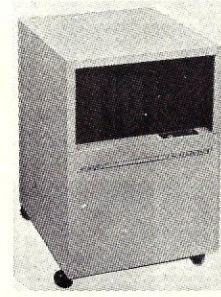
The system software is "TURBO-DOS", using the "TURBO-PLUS" extension. This package is compatible with "CP/M", and "MP/M", providing the user with a wealth of commercial software. **TURBO-PLUS** provides the user with several major advantages over other "CP/M" compatible systems, such as a **TWX** command for interconsole messages, a **MAIL** command to leave a message, special "LOGON" and "LOGOFF" commands for proper access and daily **BULLETINS**. If desired, the system will also maintain daily log entries including system access notations.

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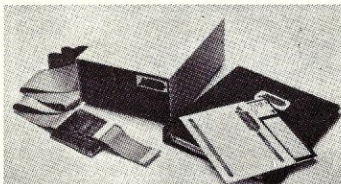
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# Technical Tools from SCS PART 1

**RAID** 8080 DEBUG/EMULATOR/SIMULATOR. RAID is the most advanced debugging aid available for CP/M environments, providing a level of user support surpassing even the expensive hardware-based "ICE" (In-Circuit-Emulator) systems. Although RAID was primarily intended for use as an assembly language debugging aid, it's numerous special functions have made it a favorite with both hardware technicians and applications programmers.

RAID's vast arsenal of commands, over seventy in all, includes several tracing modes. The user may trace program execution by: (1) prime path, (2) subroutines, (3) subroutine nesting, (4) breakpoints (with pass count capability), and (5) program-mable data dumps at selected locations. A subroutine histogram may be displayed at any time during processing, listing every currently nested subroutine and the location from which it was called, as well as the level of nesting!

Other features include:

- Up to seven breakpoints
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- Symbolic and/or numeric display/alteration of CPU registers
- Loading & saving named disk files
- Interpretive mode (emulation/simulation)
- Real-time mode
- Input/output directly to I/O ports

RAID comes complete with a sixty page type set & printed user's manual plus several copies of the RAID quick reference cards.

**RAID\* (CP/M version) . . . . . \$150.00**  
**RAID manual only . . . . . \$ 25.00**  
 \*Add \$50.00 for ISIS version

**ISIS** — CP/M UTILITIES. The ISIS to CP/M Utilities package gives the CP/M user fully bidirectional transferring capabilities with Intel Corporation's ISIS operating system. Two drives and a minimum CP/M system size of 16K are required. The utilities also include a program to display and to initialize the directory of an ISIS diskette.

The ISIS—CP/M UTILITIES permit the transfer of files from one system to the other, including ASCII and non-ASCII files. No attempt is made to "adapt" programs to run under the other operating system. The utilities are guaranteed to run all versions of CP/M.

**ISIS—CP/M utilities . . . . . \$250.00**  
**ISIS—CP/M manual only . . . . \$ 5.00**

**All products unconditionally guaranteed. Special OEM and dealer pricing available.**



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2304 12th Ave. North/Birmingham, AL 35234  
205/933-1659

CIRCLE 117 ON READER SERVICE CARD

## MP/M II

Continued from page 74

```

;
; Now we are detached from the basic program. Lets take
; a quick look with PS and then with MPMSTAT.
;
;
ps -1
;
mpmstat
;
; Now I will attach to the basic program and find out what
; the answer was.
;
attach basic
rem now i will exit basic
bye
;
; Now we are back in TMP mode.
;
logoff

```

OC>

### Listing 7. How the BATCH program runs

User-Name : TOM CLODFELTER  
Password :

Welcome to MP/M II V2.1 at 17:59:50 Tue 01-Mar-1983

```

OC>dir<cr>
Directory for User 0:
C: TEST CTL
System Files Exist
OC>time<cr>
Time: 18:00:30 Tue 01-Mar-1983
OC>who<cr>
***** MP/M II V2.1 Login Summary *****

```

```

Console [0] is logged in as [ OPERATOR ]
Console [1] is logged in as [ TOM CLODFELTER ]

```

OC>batch -dl test.ct1 test.log<cr>

MP/M II (+) Background Batch Processor V1.0  
batch: Detaching.....

```

OC>who<cr>
***** MP/M II V2.1 Login Summary *****

```

```

Console [0] is logged in as [ OPERATOR ]
Console [1] is logged in as [ TOM CLODFELTER ]
Console [4] is logged in as [ DEMO ]

```

OC>mpmstat<cr>

\*\*\*\*\* MP/M II V2.0 Status Display \*\*\*\*\*

```

Top of memory = FFFFH
Number of consoles = 06
Debugger breakpoint restart # = 06
Stack is swapped on BDOS calls
Memory is bank switched
BDOS disk file management is bank switched
Z80 complementary registers managed by dispatcher

```

```

Ready Process(es):
MPMSTAT [1] BATCH [1] Idle
Process(es) Doing:
[Sched(es) ] Sched [0]
[SPOOLQ ] Spool [0]
[CliQ ] cli
[ATTACH ] ATTACH
[Vc5in ] Tmp5 [5]
Process(es) NOing:
[Vc4out ]
Delayed Process(es):
Polling Process(es):
Tmp0 [0] Tmp2 [2] Tmp3 [3]
Process(es) Flag Waiting:
01 - Tick
02 - Clock
Flag(s) Set:
03

```

```

Queue(s):
MPMSTAT Sched STOPSPLR SPOOLQ CliQ ATTACH MXList
MKDisk MXVc5 Vc5out Vc5in MXVc4 Vc4out Vc4in
MXProc

```

Process(es) Attached to Consoles:

```

[0] - Tmp0
[1] - MPMSTAT
[2] - Tmp2
[3] - Tmp3
[4] - PS <---- BATCH is running PS on console #4
[5] - Tmp5

```

Process(es) Waiting for Consoles:

```

[1] - Tmp1 [1]
[4] - Tmp4 [4] <--- The TMP is waiting for PS to finish on #4

```

Process(es) Attached to Printers:

```

[0] - Unattached
[1] - Unattached

```



```

Process(es) Waiting for Printers:
Memory Allocation:
Base = 5E00H Size = A200H Bank = 00H Allocated to MP/M-80 [0]
Base = 0000H Size = C000H Bank = 01H * Free *
Base = 0000H Size = C000H Bank = 02H * Free *
Base = 0000H Size = 5D00H Bank = 00H Allocated to PS [4] <---
Base = 0000H Size = 4000H Bank = 03H Allocated to BATCH [1]

```

```

OC>time<cr>
Time: 18:02:24 Tue 01-Mar-1983
OC>ps<cr>
  PID  TTY    TIME  CMD
164615 tty1    0    PS
164701 tty1    0    BATCH <--- BATCH still running
177000 tty1    0    Tmp1
165704 tty1    0    cli

```

```

OC>
OC>time<cr>
Time: 18:03:10 Tue 01-Mar-1983
OC>ps<cr>
  PID  TTY    TIME  CMD
164615 tty1    0    PS
177000 tty1    0    Tmp1 <--- BATCH is gone now
165704 tty1    0    cli

```

```

OC>
OC>who<cr> <---- Check to see that BATCH logged off
***** MP/M II V2.1 Login Summary *****
Console [0] is logged in as [ OPERATOR ]
Console [1] is logged in as [ TOM CLODFELTER ] <--- DEMO is off
OC>
OC>dir<cr>
Directory for User 0:
C: TEST CTL TEST .LOG <--- The log file is now ready
System Files Exist
OC>

```

### Listing 8. Output of the batch operation

```

18:01:01 $JOB TEST.LOG
18:01:02 MP/M II V2.1
18:01:02 Copyright (C) 1981, Digital Research
18:01:02
18:01:02 User-Name : DEMO
18:01:02 Password :
18:01:02 Welcome to MP/M II V2.1 at 18:01:02 Tue 01-Mar-1983
18:01:03
18:01:03 4C>;
18:01:03 4C>; Now we are logged into my system on a Virtual Console.
18:01:03 4C>; Lets see who else is on the system.
18:01:04 4C>; Also NOTE the Time Stamp to the left of every line.
18:01:04 4C>; This is because we are running as a background job. What you
18:01:05 4C>; are reading is the log file that the batch processor created.
18:01:06 4C>; The batch processor stamps everything so that you will know
18:01:06 4C>; when a job executed and how long it took.
18:01:06 4C>;
18:01:06 4C>who
18:01:07 ***** MP/M II V2.1 Login Summary *****
18:01:07
18:01:07 Console [0] is logged in as [ OPERATOR ]
18:01:07 Console [1] is logged in as [ TOM CLODFELTER ]
18:01:07 Console [4] is logged in as [ DEMO ]
18:01:08
18:01:08 4C>;
18:01:08 4C>; Now find out what time it is.
18:01:08 4C>;
18:01:08 4C>time
18:01:08 Time: 18:01:08 Tue 01-Mar-1983
18:01:09 4C>;
18:01:09 4C>; So far all of the commands that I have used are handled
18:01:09 4C>; in my special TMP.
18:01:11 4C>;
18:01:12 4C>; Lets take a look at PS, my status program.
18:01:12 4C>;
18:01:12 4C>ps
18:01:12
  PID  TTY    TIME  CMD
18:01:13 164615 tty4    0    PS
18:01:13 176500 tty4    0    Tmp4
18:01:13 165704 tty4    0    cli
18:01:13 4C>;
18:01:15 4C>; Note: the default mode for PS was to only show processes
18:01:15 4C>; that were associated with my console.
18:01:16 4C>; Now I will do a PS for all processes.
18:01:16 4C>;
18:01:18 4C>ps -a
18:01:18
  PID  TTY    TIME  CMD
18:01:19 164615 tty4    0    PS
18:01:19 164701 tty1    0    BATCH
18:01:19 177100 console 0    Tmp0
18:01:20 177000 tty1    0    Tmp1
18:01:20 176700 tty2    0    Tmp2

```

# Technical Tools from SCS PART 2

**FPP** FLOATING POINT PROCESSOR. FPP is a floating point processor for machines capable of executing the 8080 instruction set, and was written in assembly language. FPP features a twelve digit mantissa with exponents ranging from -127 to +127. FPP uses BCD arithmetic so that there are no conversion errors and conversion time is close to zero.

Seven subroutines are included which provide the basic functions of addition, subtraction, multiplication, division, conversion to/from ASCII string (with scientific notation), and number movement.

The package is available in object code form (as an REL file) compatible with the Microsoft format, or in source code form. The program is supplied on an 8" single density CP/M or ISIS format diskette with manual.

**FPP relocatable object code module** ..... \$250.00  
**FPP source code (limited usage license)** ..... \$500.00  
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## MP/M II

Continued from page 77

```

18:01:20 176600 tty3 0 Tmp3
18:01:21 176500 tty4 0 Tmp4
18:01:21 176400 tty5 0 Tmp5
18:01:21 146002 tty1 0 MPMSTAT
18:01:22 145402 console 0 Sched
18:01:22 145002 console 0 Spool
18:01:22 166630 console 0 Tick
18:01:23 166740 console 0 Clock
18:01:23 165704 tty4 0 c11
18:01:23 167050 console 0 ATTACH
18:01:23 4C>;
18:01:25 4C>; And now for all processes in long format.
18:01:26 4C>;
18:01:26 4C>ps -al
18:01:26 F S UID PID PPID CPU PRF NICE ADDR SZ WCHAN TTY CMD
18:01:27 0 R 4 164615 0 0 310 24 0 135 0 tty4 PS
18:01:27 9 S 0 164701 164615 0 334 24 0 100 0 tty1 BATCH
18:01:28 3 P 0 177100 164701 0 306 24 57000 242 0 console Tmp0
18:01:29 3 P 0 177000 177100 0 306 24 57000 242 0 tty1 Tmp1
18:01:30 3 P 2 176700 177000 0 306 24 57000 242 0 tty2 Tmp2
18:01:31 3 P 3 176600 176700 0 306 24 57000 242 0 tty3 Tmp3
18:01:32 10 W 4 176500 176600 0 306 24 57000 242 0 tty4 Tmp4
18:01:32 1 Q 5 176400 176500 0 306 24 57000 242 0 tty5 Tmp5
18:01:33 1 Q 14 146002 176400 0 276 24 57000 242 0 tty1 MPMSTAT
18:01:34 1 Q 4 145402 146002 0 144 24 57000 242 0 console Sched
18:01:35 1 Q 14 145002 145402 0 311 24 57000 242 0 console Spool
18:01:36 4 W 0 166630 145002 0 12 24 140000 77 0 console Tick
18:01:37 4 W 0 166740 166630 0 24 24 140000 77 0 console Clock
18:01:37 1 Q 4 165704 166740 0 310 24 140000 77 0 tty4 c11
18:01:38 1 Q 0 167050 165704 0 24 24 140000 77 0 console ATTACH
18:01:39 4C>;
18:01:39 4C>; Now I will use PS to dump the Process Descriptor block of
18:01:39 4C>; a specified process.
18:01:42 4C>;
18:01:42 4C>ps -p -n spool
18:01:42 -----
18:01:42 Process Descriptor Block for : Spool PID 145002
18:01:44 Process link ... 0000H 0000000
18:01:44 Status Byte .... 01H 0010
18:01:45 Priority ..... 201 3110
18:01:45 Stack Top ..... 6a5cH 0651340
18:01:45 Process Name ... Spool
18:01:46 Console ..... tty0
18:01:46 Printer ..... lp0
18:01:46 Memory Seg ..... 00H 0000
18:01:46 Dparam ..... 0000H 0000000
18:01:47 Process Thread .. ed98H 1666300
18:01:47 DMA Address .... 0421H 0020410
18:01:47 Default Disk ... B:
18:01:48 User number .... 14
18:01:48 DCNT ..... 77b6H 0736660
18:01:48 SEARCHL ..... 3aH 00720
18:01:49 SEARCHA ..... 1ea8H 0172500
18:01:49 PDEXTENT ..... 3200H 0310000
18:01:49 Saved Register Values for : Spool
18:01:50 IY (0730H) HL (1ea4H) DE (a83aH) BC (fe1eH)AF (c213H)
18:01:50 IX (cfdH) HL (ca44H) DE (ca36H) BC (6a70H)AF (004cH)
18:01:51 SCRATCH ..... 0001H
18:01:51 4C>;
18:01:53 4C>; Now I will ask PS what options it has.
18:01:53 4C>;
18:01:53 4C>ps -?
18:01:53 usage: ps -hablpq? [-n] {pname}
18:01:54 -h show system data page header.
18:01:54 -a show all processes.
18:01:54 -b short (brief) display [default].
18:01:54 -l long display format.
18:01:55 -p show process descriptor block.
18:01:55 -n show processes matching {pname}.
18:01:55 -q shows que list and statistics.
18:01:55 -? print this message.
18:01:55 4C>;
18:01:57 4C>; Lets try the Que option.
18:01:58 4C>;
18:01:58 4C>ps -q
18:01:58
18:01:58 Qname Len Max Lqcb Llnk DOPH NOPH Type Cnt/lnk
18:01:59 MPMSTAT 2 1 c938H cb36H cc02H 0000H Circular Que 0
18:01:59 Sched 69 1 cb36H caceH cb02H 0000H Linked Que cb4eH
18:02:00 STOPSPLR 0 1 caceH ca36H 0000H 0000H Circular Que 0
18:02:01 SPOOLQ 62 2 ca36H ce2aH ca02H 0000H Linked Que ca4eH
18:02:01 C110 129 1 ec2aH ee78H ebc4H 0000H Linked Que ec42H
18:02:02 ATTACH 10 1 ee78H f050H ee28H 0000H Linked Que ee90H
18:02:02 MXList 0 1 f050H f034H 0000H 0000H Circular Que 1
18:02:03 MXDisk 0 1 f034H c4adH 0000H 0000H Circular Que 1
18:02:03 MXvc5 2 1 c4adH c440H 0000H 0000H Circular Que 0
18:02:04 Vc5out 1 80 c440H c422H 0000H 0000H Circular Que 55
18:02:05 Vc5in 1 1 c422H c379H fd00H 0000H Circular Que 0
18:02:05 MXvc4 2 1 c379H c391H 0000H 0000H Circular Que 0
18:02:06 Vc4out 1 80 c391H c35bH 0000H 0000H Circular Que 80
18:02:07 Vc4in 1 1 c35bH e76eH 0000H 0000H Circular Que 1
18:02:08 MXProc 0 1 e76eH 0000H 0000H 0000H Circular Que 1
18:02:08 4C>;
18:02:09 4C>; Thats enough of PS for Now.
18:02:09 4C>; Now lets take a quick look at my Basic interpreter for MP/M.
18:02:11 4C>;
18:02:12 4C>basic
18:02:12

```



```

18:02:12 MP/M II RealTime BASIC V1.5 Cons[4] User[4] Drive C: 23101 free.
18:02:12 Ready
18:02:12 10 rem we will enter a short program into basic from batch.
18:02:13 20 detach : rem this will cause the program to run detached.
18:02:13 30 for x = 1 to 1000
18:02:14 40 next x
18:02:14 50 print "the answer is ";x;"."
18:02:14 60 end
18:02:14 list
18:02:14 10 REM we will enter a short program into basic from batch.
18:02:15 20 DETACH : REM this will cause the program to run detached.
18:02:15 30 FOR X = 1 TO 1000
18:02:15 40 NEXT X
18:02:15 50 PRINT "the answer is ";X;"."
18:02:15 60 END
18:02:16 Ready
18:02:16 run
18:02:16 4C>;
18:02:16 4C>; Now we are detached from the basic program. Lets take
18:02:16 4C>; a quick look with PS and then with MPMSTAT.
18:02:19 4C>;
18:02:19 4C>ps -l
18:02:19
18:02:20 F S UID PID PPID CPU PRI NICE ADDR SZ WCHAN TTY CMD
18:02:20 0 R 4 164615 0 0 310 24 0 135 0 tty4 PS
18:02:21 10 W 4 164445 164615 0 310 24 0 300 0 tty4 BASIC
18:02:22 10 W 4 176500 176600 0 306 24 57000 242 0 tty4 Tmp4
18:02:23 1 Q 4 165704 166740 0 310 24 140000 77 0 tty4 cli
18:02:23 4C>;
18:02:23 4C>mpmstat
18:02:23
18:02:23 ***** MP/M II V2.0 Status Display *****
18:02:24
18:02:24 Top of memory = FFFFH
18:02:24 Number of consoles = 06
18:02:24 Debugger breakpoint restart # = 06
18:02:24 Stack is swapped on BDOS calls
18:02:25 Memory is bank switched
18:02:25 BDOS disk file management is bank switched
18:02:25 Z80 complementary registers managed by dispatcher
18:02:25
18:02:25 Ready Process(es):
18:02:25 MPMSTAT [4] BATCH [1] Idle
18:02:26 Process(es) Doing:
18:02:26 [Sched] Sched [0]
18:02:26 [SPOOLQ] Spool [0]
18:02:26 [CliQ] cli
18:02:27 [ATTACH] ATTACH
18:02:27 [Vc5in] Tmp5 [5]
18:02:27 Process(es) NQing:
18:02:27 Delayed Process(es):
18:02:27 Polling Process(es):
18:02:27 Tmp1 [1] Tmp0 [0] Tmp2 [2] Tmp3 [3]
18:02:28 Process(es) Flag Waiting:
18:02:28 01 - Tick
18:02:28 02 - Clock
18:02:28 Flag(s) Set:
18:02:28 03
18:02:28 Queue(s):
18:02:29 MPMSTAT Sched STOPSPLR SPOOLQ CliQ ATTACH MXList
18:02:29 MKDisk MXVc5 Vc5out Vc5in MXVc4 Vc4out Vc4in
18:02:29 MXProc
18:02:29 Process(es) Attached to Consoles:
18:02:30 [0] - Tmp0
18:02:30 [1] - Tmp1
18:02:30 [2] - Tmp2
18:02:30 [3] - Tmp3
18:02:30 [4] - MPMSTAT
18:02:30 [5] - Tmp5
18:02:30 Process(es) Waiting for Consoles:
18:02:31 [4] - Tmp4 [4] BASIC [4]
18:02:31 Process(es) Attached to Printers:
18:02:31 [0] - Unattached
18:02:31 [1] - Unattached
18:02:31 Process(es) Waiting for Printers:
18:02:32 Memory Allocation:
18:02:32 Base = 5E00H Size = A200H Bank = 00H Allocated to MP/M-80 [0]
18:02:32 Base = 0000H Size = C000H Bank = 01H Allocated to BASIC [4]
18:02:33 Base = 0000H Size = C000H Bank = 02H * Free *
18:02:35 Base = 0000H Size = 5D00H Bank = 00H * Free *
18:02:35 Base = 0000H Size = 4000H Bank = 03H Allocated to BATCH [1]
18:02:36 4C>;
18:02:36 4C>; Now I will attach to the basic program and find out what
18:02:36 4C>; the answer was.
18:02:38 4C>;
18:02:38 4C>attach basic
18:02:38
18:02:38 Attach:BASIC
18:02:38 the answer is 1001
18:02:39 Ready
18:02:39 rem now i will exit basic
18:02:39 Ready
18:02:39 bye
18:02:39
18:02:39 4C>;
18:02:39 4C>; Now we are back in TMP mode.
18:02:40 4C>;
18:02:40 4C>logoff
18:02:40 DEMO logged off console [4] at 18:02:40 Tue 01-Mar-1983
18:02:40 SE0J

```

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---

# Julian Date Conversion Functions

Convert to and  
from Julian  
format under  
CP/M Plus, MP/M  
II and TurboDOS



by Ron Fowler

---

**I**n the November 1983 *Microsystems*, reader Arthur Zatarain bemoaned the difficulty in making use of the time and date formats provided by Digital Research's MP/M and Software 2000's TurboDOS in applications software. Mr. Zatarain's letter suggests that the awkward, modified Julian date provided by both systems may be responsible for the absence of time and date support in languages and programs that run under both of these operating systems, and concludes with a request for source code illustrating conversion techniques between the "tight" operating system formats and the more readable (at least by human beings) character-string formats.

Mr. Zatarain is right; there is indeed very little software around, public domain or commercial, that makes use of these functions. If this lack is indeed due to the difficulty in format conversions, perhaps the routines presented in this article will be of some use to systems and applications programmers who would like to exploit the time and date functions that these operating systems provide.

---

## Format of the time/date specification

There have been variations in the function number as well as the data structure and parameter passing conventions among the different releases of both operating systems. For example, MP/M release 1 used a single system call (number 155), and the time and date returned by the system included seconds. This system call was retained in MP/M release 2, but a new system call (number 105) was added, whose only difference was that the "seconds" field was omitted. This same system call was finally added to the single-user CP/M with the release of CPM Plus. In all three releases, a pointer is passed (in DE) to a data structure in memory ordered as follows:

```
2-byte Julian date field
1-byte hours field
1-byte minutes field
1-byte seconds field (ignored
in system call #105)
```

The 2-byte Julian date field is defined as the number of days elapsed since 1 January, 1978; hours, minutes and seconds are specified as binary-coded decimal (BCD) values.

Meanwhile, early releases of TurboDOS were totally incompatible: a different function call was used (number 84), the values for hours, minutes



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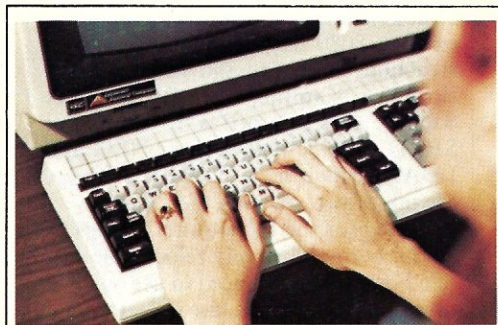
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# JULIAN DATES

Continued from page 80

and seconds were binary rather than BCD, and the Julian date was based on 1 January 1948. Finally, the parameters were all returned in the registers, rather than in a date block held in memory.

TurboDOS release 1.2 attempted to gain some MP/M compatibility. Among the changes was the addition of a fully MP/M-compatible get date/time call: number 105. No support was provided for MP/M's call 155 (the one that supports the "seconds" field); however, but the system did keep its MP/M-incompatible function 84 in order to retain support for the software developed for early TurboDOS releases.

Finally, TurboDOS release 1.3 effects a "split" of system calls: those which are MP/M-compatible are called in the usual way (via the jump instruction at location 5), while TurboDOS-only system calls are available by calling location 50 (hex) with a new set of function codes. Luckily, the MP/M-compatible function #105 is still available via a call to location 5; this is the only system call that is available through both operating systems (and CP/M Plus) with identical calling procedures (excluding the early TurboDOS releases, of course), and will be the one employed here.

## Some notes about the listings

All of the example listings presented here are written for the old TDL/XITAN assembler. This assembler still lives (although TDL and XITAN are long gone), and is now called the CDL (Computer Design Labs) assembler. This assembler is fully Z80-compatible, but uses a mnemonic set that bears much more resemblance to Intel mnemonics than to the Zilog Z80 set. Most of the mnemonics will be fairly self-explanatory to anyone familiar with the Intel set, and the Z80 instructions that add addressing modes to existing 8080 instructions have a construction similar to the Intel convention. For example, store-BC-direct is SBDCD; this is similar to the Intel SHLD. Instructions such as NEG and LDAR, which have no 8080 analogy, are taken directly from the Zilog set.

Each of the subroutines resides as an object module in my relocatable system library. When I need to use one in a program, I simply declare it "external," and call it freely. When I link the program, my linkage editor searches the system library and includes those subroutines referenced in my main program, freeing me from the tedium of re-writing a subroutine each time I use it in a program. Hence, you'll see some ex-

```

-----
*** LISTING #1 ***
-----
;
; .IDENT PRDATE ;05/17/82
;
; ROUTINE TO PRINT DATE IN FORM OF
; MM/DD/YY ON CONSOLE VIA TYPE#. ON
; ENTRY, HL = @DATE SPEC (WITH YEAR
; FIELD BASEYR# RELATIVE)
;
; .ENTRY PRDATE
;
0000 D5 PRDATE: PUSH D ;SAVE WORKING REGS
0001 E5 PUSH H
0002 7E MOV A,M ;FETCH THF YEAR
0003 23 INX H
0004 66 MOV H,M
0005 6F MOV L,A
0006 11 002A LXJ D,YEAR ;BUFFER TO HOLD DATF
0009 CD 0000:04 CALL FMJUL# ;CONVERT FROM JULIAN
000C 3A 002B LDA MONTH ;PRINT MONTH AND SEP
000F CD 0021 CALL DATSEP
0012 3A 002C LDA DATE ;THEN DATE
0015 CD 0021 CALL DATSEP
0018 3A 002A LDA YEAR ;FINALLY, YEAR
001B CD 0000:05 CALL DECOTB#
001E E1 POP H ;RESTORE WORKING REGS
001F D1 POP D
0020 C9 RET

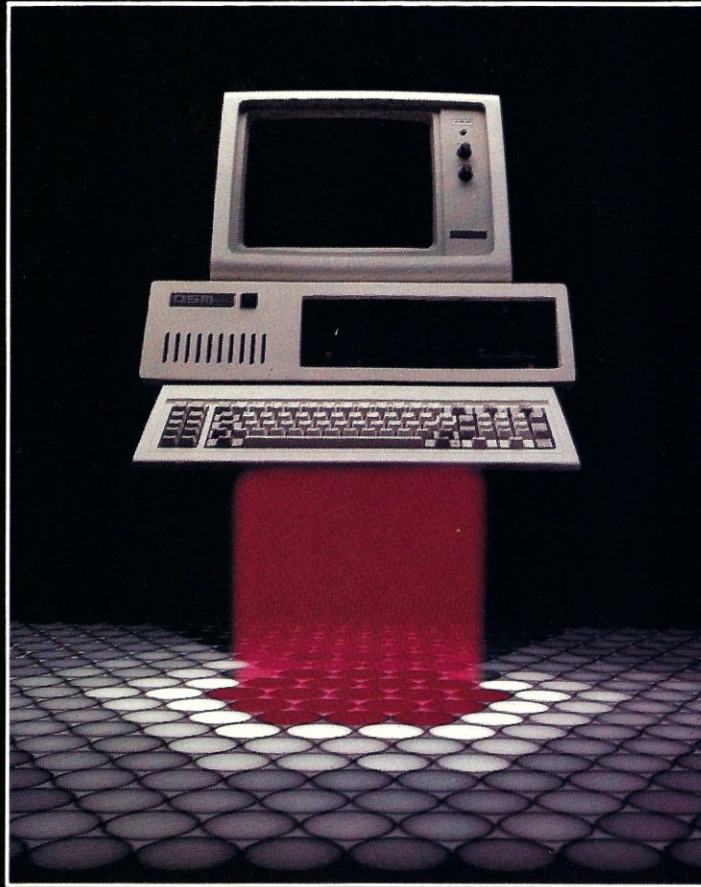
; SUBROUTINE TO PRINT A IN DECIMAL FOLLOWED BY "/"
;
0021 CD 0000:05 DATSEP: CALL DECOTB# ;PRINT IN DECIMAL
0024 3E2F MVI A,"/" ;FOLLOWED BY SEPARATOR
0026 CD 0000:06 CALL TYPE#
0029 C9 RET

;
002A 00 YEAR: .BYTE 0 ;YEAR
002B 00 MONTH: .BYTE 0 ;MONTH
002C 00 DATE: .BYTE 0 ;DATE
;
; .PRGEND
-----
*** Listing #2 ***
-----
;
; .IDENT PRTIME ;05/15/82
;
; PRINT TIME FROM DATF/TIME BUFFER @HL, FORM HH:MM
;
; .ENTRY PRTIME
;
0000 23 PRTIME: INX H ;SKIP PAST DATE
0001 23 INX H ;TO GET TO TIME
0002 7E MOV A,M
0003 23 INX H
0004 CD 0000:04 CALL PRTRCD#
0007 3E3A MVI A,":"
0009 CD 0000:05 CALL TYPE#
000C 7E MOV A,M ;NOW WITHOUT COLON
000D CD 0000:04 CALL PRTRCD#
0010 C9 RET
;
; .PRGEND
-----
*** LISTING #3 ***
-----
;
; .IDENT PARSDT ;05/20/82
;
; PARSE DATE FROM AN INPUT STRING @HL
; (FORM=MM/DD/YY) RETURN JULIAN DATE
; (BASEYR# RELATIVE) IN HL
;
; THE FOLLOWING ERRORS ARE TRAPPED AND RETURNED
; IN A REG (A=0 AND CY=0 IF NO ERRORS):
;
; 1) DATE OUT OF RANGE
; 2) BAD DATE DELIMITER
; 3) COMPONENT OUT OF RANGE (MTH, YR OR DATE)
; 4) BAD DECIMAL #
;
; .ENTRY PARSDT
;
0000 D5 PARSDT: PUSH D ;SAVE DATE POINTER
0001 CD 000B CALL ..PARS
0004 EB XCHG ;MOVE JUL DATE TO DE
0005 E1 POP H ;FETCH STRUC PNTR
0006 D8 RC ;RETURN IF PARSE ERROR
0007 73 MOV M,E ;ELSP STORE DATE INTO STRUC
0008 23 INX H
0009 72 MOV M,D
000A C9 RET
000B ED73 005D ..PARS: SSPD SPSAVE ;SAVE STACK LEVEL
000F 11 005F LXI D,DATBUF ;POINT TO DATE BUFFER
0012 0603 MVI B,3
0014 D5 ..LOOP: PUSH D
0015 C5 PUSH B
0016 CD 0000:04 CALL DECIN# ;FETCH DECIMAL DIGIT
0019 382F JRC ERROR4 ;SKIP IF NO INPUT ERROR
001B CD 0052 CALL DELMCK ;CHECK DELIMITER
001E 2022 JRNZ ERROR2
0020 14 INR D ;TEST HI BYTE=0
0021 15 DCR D
0022 2022 JRNZ ERROR3 ;MUST BE ZERO
0024 7B MOV A,E
0025 C1 ..STOX: POP B
0026 D1 POP D
0027 12 STAX D
0028 13 INX D
0029 10F9 DJNZ ..LOOP
002B 2A 005F LHLD DATBUF ;TWEAK THINGS AROUND

```



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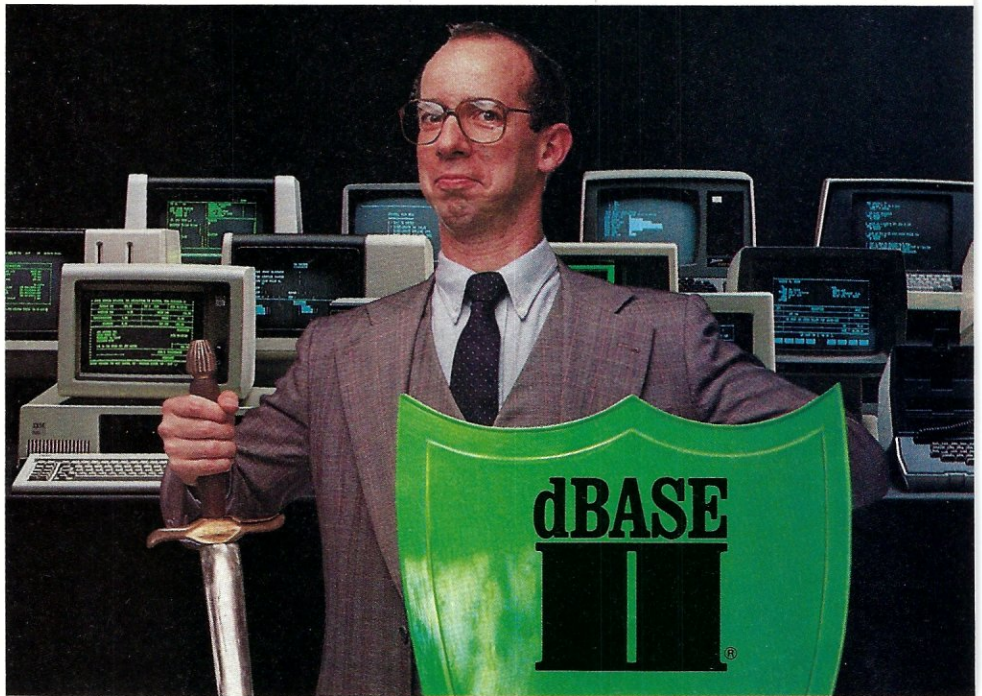
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# JULIAN DATES

Continued from page 82

ternal references in the listings—these are denoted by a pound sign at the end of the name of the reference.

These externals are defined within their own modules as globals (also called "public") using the .ENTRY pseudo-op.

For example, the program line

```
CALL DECOUT#
```

implies that the routine DECOUT resides outside of the current module. In its own module, DECOUT might begin like this:

```
.ENTRY DECOUT
DECOUT: PUSH H
```

The .IDENT statement at the beginning of each module gives the module a name. Some linkers use this module name to build module-load maps to

## TurboDOS 1.3 allows both MP/M and TurboDOS system calls.

assist the programmer in locating his code sections during debugging.

The TDL/XITAN series of assemblers allows more than one source module to be contained within a file. All modules except the last must end with a .PRGEND instead of the normal .END. This alerts the assembler that a logical assembly is complete, but more modules should be expected. Since my library takes advantage of this and is structured as a single file, only the last module (Listing 10) will be terminated by the .END pseudo-op; all others use .PRGEND.

A global used in several modules is defined in the module MTBL (Listing 7). This global is called BASEYR, and it contains the value 78 (for the year 1978, which is the Base Year of MP/M's Julian date numbering system). This was defined as an external to most modules in an attempt to allow them to be used with early releases of TurboDOS, which (as mentioned previously) use a base year of 1948.

```
002E- 3A 0061- LDA DATBUF+2 ;(TO FIT DATE ROUTINES)
0031- 32 005F- STA DATBUF
0034- 22 0060- SHLD DATBUF+1
0037- 21 005F- LXJ H,DATBUF
003A- CD 0000:05 CALL TOJUL#
003D- D0 RNC ;RETURN IF GOOD DATE
003E- 3E01 ERROR1: MVI A,1 ;RETURN ERROR #1
0040- 180A JMRP ERROR A,2 ;RETURN ERROR #2
0042- 3E02 ERROR2: MVI A,2
0044- 1806 JMRP ERROR A,3 ;RETURN ERROR #3
0046- 3E03 ERROR3: MVI A,3
0048- 1802 JMRP ERROR A,4 ;RETURN ERROR #4
004A- 3E04 ERROR4: MVI A,4 ;FLAG THE ERROR
004C- 37 ERROR: STC ;RESTORE STACK LEVEL
004D- ED7B 005D- LSPD SPSAVE
0051- C9 RET

0052- FE2F DELMCK: CPI -/
0054- C8 RZ -/
0055- FE20 CPI -/
0057- C8 RZ
0058- 78 MOV A,B ;TEST FOR 3RD PASS
0059- 3D DCR A ;(ONLY TIME ZERO TERM ALLOWED)
005A- C0 RNZ
005B- B7 ORA A ;3RD PASS, TEST FOR ZERO
005C- C9 RET

005D- 0000 SPSAVE: .WORD 0
005F- 000000 DATBUF: .BYTE 0,0,0
;
.PRGEND
```

\*\*\* LISTING #4 \*\*\*

```
.IDENT PARSTM ;05/17/82
;
; PARSE TIME FROM INPUT STRING HL TO TIME/DATE
; BUFFER @DE. CY= ERROR
;
.ENTRY PARSTM
PARSTM: INX D ;SKIP OVER YEAR
D ;TO GET TO TIME
PUSH D ;SAVE IT
CALL ..PARS ;PARSE TIME
POP D ;DESTINATION
RC ;NO XFER IF ERROR
LXI H,BUFR ;FETCH SOURCE
LDIR B,3 ;MOVE VALID TIME IN
ORA A ;INSURE CY CLEAR
RET

; ..PARS: LXI D,BUFR ;TEMPORARY HOLD
MVI B,24H ;PASS LIMIT FOR HOURS
CALL ..BCD ;GET BCD NUMBER
RC ;RETURN IF ERROR
D ;STORE IT
INX D ;POINT TO NEXT
CALL DEL1 ;CHECK DELIMITER
RC ;BOMB OUT IF BAD DELIMITER
MVI B,60H ;PASS LIMIT FOR MINUTES
CALL ..BCD ;GET BCD NUMBER
RC ;PASS ERROR BACK
D ;STORE IT
INX D ;POINT TO NEXT
CALL DEL1 ;TEST DELIMITER
JRNC ..3RD ;SKIP IF OK
ORA A ;EARLY DONE (HH:MM ONLY)
STC ;ERROR IF NOT
RNZ ;STORE SECONDS=0
STAX D ;TURN OFF CARRY
CMC ;
RET

; ..3RD: MVI B,60H ;PASS LIMIT FOR SECONDS
CALL ..BCD ;GET BCD NUMBER
RC ;RETURN BAD # ERROR
D ;TEST DELIMITER
CALL DEL1 ;RETURN IF GOOD
ORA A ;ALLOW NULL TERMINATOR AT END
STC ;RETURN ERROR IF NOT NULL
RNZ ;IT'S NULL, CY=0
CMC ;
RET

; ..BCD: PUSH D
PUSH B
CALL BCDIN# ;GET BCD VALUE
DELIM ;SAVE DELIMITER
POP B
JPC ..BACK ;IF ERROR...
MOV A,D ;INSURE <100
ORA A
STC
JRNZ ..BACK
MOV A,E
CMP B ;TEST AGAINST PASSED LIMIT
CMC ;PERVERT CARRY
POP D
RET

; TEST VALTD DELIMITERS (CY=1 IF INVALID)
;
DEL1: LDA DELIM
CPI -/
STC
RZ
CPI -/
STC
RZ
CPI -/
STC
RZ
CMC
RET
```



# JULIAN DATES

Continued from page 85

Note that the ordering of the modules does not correspond to the order in which they are presented in the text. Since they are part of a relocatable library, I've ordered them such that all external references are forward, allowing the library to be linked in a single pass of the linkage editor.

## Printing the date

Listings 1 and 2 are routines for printing the date and time, respectively, from a date/time structure pointed to by HL. This structure is identical to that returned by MP/M function #105. Thus, a typical calling sequence look like this:

```
LXI D,DBLOCK ;pass pointer to
                structure
PUSH D        ;put 2 copies on
                stack
```

**Several  
modules can be  
contained in a  
single file.**

```
PUSH D
MVI C,105      ;function call
                number
CALL BDOS      ;get date/time
POP H         ;get a pointer to
                date/time
CALL PRDATE    ;print date
                (mm/dd/yy)
MVI A,' '     ;separate date
                and time
CALL TYPE      ;with a blank
POP H         ;2nd copy of
                struct. pntr
CALL PRTIME    ;print the time
```

Note that the routine TYPE is called from both modules (and from several others in the various listings). This global routine must reside in the calling program and should print the character passed in register A on the console, while preserving all registers other than A. Supplementary routines DECOTB (decimal output byte) and PRTBCD (BCD output byte) are provided in Listing 10.

The most noteworthy aspect of these routines is the conversion of the

```

;
;
006A^ 00      DELIM: .BYTE 0
006B^ 000000  BUFR:  .BYTE 0,0,0
;
;
-----
*** LISTING #5 ***
-----
;
;
; .IDENT TOJUL ;5/20/82
;
; ROUTINE TO CONVERT DATE @HL TO MODIFIED
; JULIAN IN HL. PASSED BUFFER LOOKS LIKE:
;
; .BYTE YEAR (BCD)
; .BYTE MONTH
; .BYTE DATE
;
; RETURNED JULIAN DATE IS THE DAY NUMBER
; USING A BASE DATE OF JAN 1 OF "BASEYR"
; RETURNS CY=1 IF A PASSED PARM WAS ILLEGAL
;
; .ENTRY TOJUL
;
; STRUCTURE OF PASSED BUFFER
;
0000 YROFS = 0 ;YEAR OFFSET
0001 MNOFS = 1 ;MONTH OFFSET
0002 DTOFS = 2 ;DATE OFFSET
;
0000^ D5      TOJUL: PUSH D ;SAVE WORK REGS
0001^ C5      PUSH B
0002^ DDE5    PUSH X
0004^ 7E      MOV A,M ;GET YEAR
0005^ E5      PUSH H ;GET USER BUFR PTR TO X
0006^ DDE1    POP X
;
0008^ FF64    CPI 100 ;PAST DECIMAL?
000A^ D2 005F JNC ERROR ;THEN GO ERROR OUT
000B^ F603    ANI 3 ;IS THIS A LEAP YEAR?
000F^ 3E1C    MVI A,28 ;(FEBRUARY 28-DAY MONTH)
0011^ 2001    JRNZ ..SKIP ;JUMP IF NOT
0013^ 3C      INR A ;IT IS, GET 29 DAYS FOR FEB
0014^ 32 0000:04 ..SKIP: STA MFFR# ;FIX FEBRUARY
0017^ 21 0000 LXI H,0 ;INIT JDATE
001A^ 11 0000:05 LXI D,MTPL# ;GET MONTH TABLE POINTER
001D^ DD7E01 MOV A,MNOFS(X) ;GET CURRENT MONTH
0020^ 3D      DCR A ;MAKE IT 0-RELATIVE
0021^ FA 005F^ JM ERROR ;CAN'T HAVE A MONTH=0
0024^ FFOC    CPI 12 ;TEST UPPFR
0026^ D2 005F^ JNC ERROR
0029^ 47      MOV B,A ;USE IT AS A COUNTER IN B
;
; SUM DAYS FROM MONTHS IN CURRENT YEAR
;
002A^ 78      ..SUM: MOV A,B ;COUNT EXPIRED?
002B^ B7      ORA A ;(MONTH CNTR=0)
002C^ 2808    JRZ ..DAY ;THEN JUMP OUT
002E^ 05      DCR B ;NO, COUNT DOWN FOR NEXT PASS
002F^ 1A      LDAX D ;FFTC # DAYS
0030^ 13      INX D ;POINT TO NEXT MONTH
0031^ CD 0065^ CALL ADDHL ;ADD IT IN
0034^ 18F4    JMPR ..SUM
;
; NOW ADD IN THE # DAYS IN CURRENT MONTH
;
0036^ DD7E02 ..DAY: MOV A,DTOFS(X) ;GET DATE
0039^ 3D      DCR A ;FIX SO CARRY WORKS ON COMPARE
003A^ FA 005F^ JM ERROR ;CAN'T HAVE DATE=0
003D^ EB      XCHG ;HL=PNTR INTO MONTH TABLE
003E^ BE      CMP M ;TEST DATE AGAINST MAX FOR CURNT
003F^ EB      XCHG ;RESTORE JUL DATE TO HL
0040^ D2 005F^ JNC ERROR
0043^ 3C      INR A ;FIX PREV DCR A
0044^ CD 0065^ CALL ADDHL ;ADD IT IN
;
; HL HAS JULIAN DATE FOR CURRENT YR. ADD IN DAYS
; SINCE BASEYR TO GET SYSTEM DATE.
;
0047^ DD7F00 MOV A,YROFS(X) ;GET CURRENT YEAR
004A^ 47      MOV B,A ;SAVE FOR COMPARISONS
004B^ 3A 0000:06 LDA BASEYR# ;FETCH BASE YEAR
004E^ 4F      MOV C,A ;BASE YEAR TO C REG
004F^ 11 016D LXI D,365 ;DAYS/YEAR
; ..LOP: MOV A,C ;GET WORKING YEAR #
0052^ 79      MOV B ;ARE WE UP TO CURRENT?
0053^ B8      CMP B ;THEN FINISHED (AND CY=CLEAR)
0054^ 280A    JRZ BACK ;SET YEAR FOR NEXT PASS
0056^ 0C      INR C ;NO, ADD IN ANOTHER YEAR
0057^ 19      DAD D ;DID WE ADD IN A LEAP YEAR?
0058^ E603    ANI 3 ;NO.
005A^ 20F6    JRNZ ..LOP ;YES, ADD IN ANOTHER DAY
005C^ 23      INX H
005D^ 18F3    JMPR ..LOP
;
005F^ 37      ERROR: STC ;RETURN ERROR
0060^ DDE1    BACK: POP X ;RESTORE WORKING RFGS
0062^ D1      POP D
0063^ C1      POP B
0064^ C9      RET
;
; ROUTINE TO ADD A TO HL
;
0065^ 85      ADDHL: ADD L
0066^ 6F      MOV L,A
0067^ D0      PNC
0068^ 24      INR H
0069^ C9      RET
;
;
; .PRGEND

```



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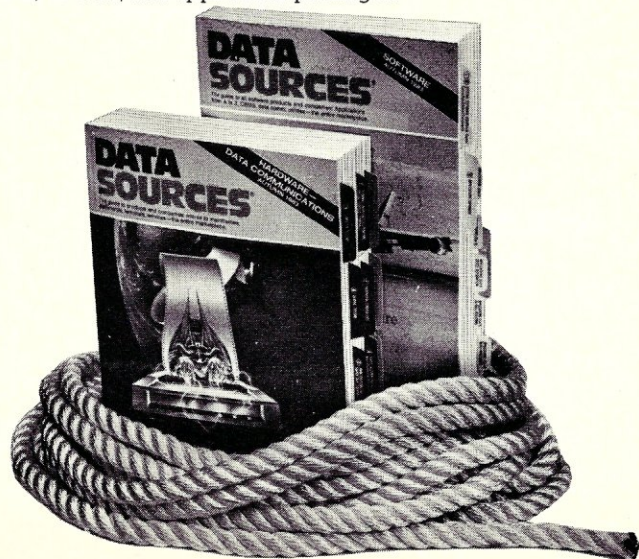
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# JULIAN DATES

Continued from page 86

MP/M-format Julian date to a string of the form mm/dd/yy. This tedious job is performed by the routine FMJUL (from Julian) in Listing 6. FMJUL is called with the Julian date in HL, and with DE pointing to a 3-byte output area that will hold the converted date in binary form. PRDATE then simply prints the decimal digits returned by FMJUL.

Another routine I'll describe shortly does the opposite of FMJUL (converts BCD dates to modified-Julian), and is called TOJUL. Both FMJUL and TOJUL use an external table of days per month (MTBL), which you'll find in Listing 7.

## Date arithmetic

I'm including two other routines from my library, both of which do some calculations based on time specifica-

**The library saved me from the tedium of rewriting a subroutine.**

tions. The first of these is ET (Elapsed Time; see Listing 8)—this routine calculates the difference between two date/time specifications. The "oldest" (earliest chronologically) is passed in the HL register pair, while the more recent is passed in DE. A pointer is passed in BC to a 3-byte area that will hold the result (see the listing for the format of this result area). This routine is valid for up to 9,999 hours and 59 minutes of elapsed time, and may be extended to even larger amounts of time with a little effort.

Incidentally, this routine should provide some justification for the format chosen by Digital Research in the original MP/M. Arithmetic manipulation of dates is much easier with a numeric form of date. If the system provided the date in the form of an ASCII string, additional conversion work would be necessary to convert the date to a number.

The second routine is called ADDTIM (Listing 9), and is designed as a companion to ET. ADDTIM calcu-

\*\*\* LISTING #6 \*\*\*

```

:-----:
:
: .IDENT FMJUL ;5/17/82
:
: ROUTINE TO CONVERT MODIFIED JULIAN DATE
: PASSED IN HL TO YY/MM/DD, INTO BUFFER
: PASSED IN DE. PASSED BUFFER LOOKS LIKE:
:
: .BYTE YEAR (BCD)
: .BYTE MONTH
: .BYTE DATE
:
: RETURNED JULIAN DATE IS THE DAY NUMBER
: USING A BASE DATE OF JAN 1 OF "BASEYR"
: (DEFINED IN MTBL MODULE)
:
: .ENTRY FMJUL
:
: STRUCTURE OF PASSED BUFFER
:
0000 YROFS = 0 ;YEAR OFFSET
0001 MNOFS = 1 ;MONTH OFFSET
0002 DTOFS = 2 ;DATE OFFSET
:
0004 D5 FMJUL: PUSH D ;SAVE WORK REGS
0001 C5 PUSH R
0002 DDE5 PUSH X
:
0004 D5 ; PUSH D ;GET USER RUF# PTR TO X
0005 DDE1 POP X
0007 3A 0000:04 LDA BASEYR# ;FETCH BASE YEAR
000A 47 MOV B,A ;SAVE IT IN B
:
: SCAN THROUGH YEARS STARTING AT BASEYR
: SUBTRACTING DAYS FROM OUR CURRENT DATE
:
000B 78 ..LOOP: MOV A,B ;FETCH CURRENT YEAR
000C E603 ANI 3 ;TEST FOR LEAP YEAR
000E 11 016D LXI D,365 ;FIRST GET # LP YR # DAYS
0011 2001 JRNZ .NL1 ;AND SKIP IF NOT LP YEAR
0013 13 INX D ;IS LEAP YEAR, FIX UP DAYS
0014 04 INR B ;BUMP YR FOR NEXT PASS
0015 B7 ..NL1: ORA A ;CLEAR CY FOR DEL SUBTRACT
0016 ED52 DSBZ D ;SUBTRACT DAYS IN CUR YR
0018 2802 JRZ ..ENDY ;JUMP IF LAST DAY OF YR
001A 30EF JRNC ..LOOP ;CONTINUE TILL WE OVERSHOOT
001C 19 ..ENDY: DAD D ;OVERSHOT, CORRECT DAYS
001D 05 DCR B ;AND YEAR
001E 78 MOV A,B ;FETCH CALCULATED YEAR
001F FE64 CPI 100 ;REWIND EVERY CENTURY
0021 3802 JRC ..PYR ;(NOW THAT'S ACCURACY!)
0023 0600 MVI B,0 ;REWIND YR 100 TO 0
0025 DD7000 ..PYR: MOV YROFS(X),B ;PUT AWAY THE YEAR
0028 78 MOV A,B ;NOW CHECK FOR LEAP AGAIN
0029 E603 ANI 3
002B 3E1C MVI A,28 ;28 DAYS FOR FEB
002D 2001 JRNZ .NL2 ;GO STORE IF NOT LP YEAR
002F 3C INR A ;ADJUST FOR LEAP YEAR
0030 32 0000:05 ..NL2: STA MFEB# ;FIX MONTH TABLE
0033 11 0000:06 LXI D,MTBL# ;POINT TO MONTH TABLE
0036 0600 MVI B,0 ;INIT MONTH NUMBER
:
: SCAN THROUGH MONTHS IN CURNT YR, SUBTRACTING DAYS
:
0038 D5 ..MNTH: PUSH D ;SAVE MONTH TABLE POINTER
0039 1A LDAX D ;GET DAYS IN CURNT MONTH
003A 5F MOV E,A ;GET IN DE AS 16 BITS
003B 1600 MVI D,0
003D B7 ORA A ;CLR CY FOR DSBZ
003E ED52 DSBZ D
0040 3807 JRC ..FND ;EXIT LOOP WHEN OVERSHOOT
0042 2805 JRZ ..FND ;LAST DAY OF MONTH?
0044 04 INR B ;BUMP TO NEXT MONTH
0045 D1 POP D ;RETRIEVE MONTH TBL POINTER
0046 13 INX D ;BUMP TO NEXT MONTH
0047 18EF JMPR ..MNTH ;AND CONTINUE
:
: ..FND: POP PSW ;CLEAR STACK
0049 F1 DAD D ;FIX OVERSHOOT
004A 19 INR B ;MAKE MONTH 1-RELATIVE
004B 04 MOV MNOFS(X),B ;PUT MONTH IN BUFFER
004C DD7001 MOV DTOFS(X),L ;REMAINDER IS DATE
004F DD7502
:
0052 DDE1 ; POP X ;RESTORE WORKING REGS
0054 C1 POP B
0055 D1 POP D
0056 C9 RET
:
: .PRCEND

```

\*\*\* LISTING #7 \*\*\*

```

:-----:
:
: .IDENT MTBL
:
: TABLE OF MONTHS FOR TOJUL AND FMJUL
: ALSO CONTAINS DEFINITION FOR BASE YEAR
:
: .ENTRY MTBL,MFEB,BASEYR
:
0000 1F MTBL: .BYTE 31 ;JAN
0001 1C MFEB: .BYTE 28 ;FEB
0002 1F1F1F1F .BYTE 31,30,31,30 ;MAR-JUN
0006 1F1F1F1F1F .BYTE 31,31,30,31,30,31 ;JUL-DEC
:
000C 4E BASEYR: .BYTE 78 ;BASE YEAR=1978
:
: .PRCEND

```



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# JULIAN DATES

Continued from page 88

lates cumulative time and takes as input the result area from ET (the one that was passed to ET in the BC register pair). A pointer to this result area is passed to ADDTIM in the DE pair. Another parameter required by ADDTIM is a cumulative-time area; a pointer to this area is expected in HL. The elapsed time is added to the cumulative time, and the result is stored back into the cumulative-time area.

These routines might find typical application in a remotely accessible MP/M system, where usage statistics might be desired for cost-accounting purposes.

## Input parsing

The final routines in my library perform parsing of date and time from strings; this might be useful in an appli-

## The ET routine is valid for up to 9,999 hours and 59 minutes.

cation where date and time specs are taken from the console operator interactively and must be converted to the more compact MP/M format (perhaps to be written into tightly packed disk records, or simply to allow calculations using routines such as ET).

These routines are rather limited in the format they will accept. Dates must be of the form mm/dd/yy (e.g., 5 December 1982 would be input as 12/05/82); times must be of the form hh:mm:ss (2:05 p.m. would be input as 14:05:00). Note that seconds are optional.

The routine PARSDT (Listing 3) parses a date from the input string passed as a pointer in HL and returns the modified Julian date (in the MP/M format) in HL. This routine calls on a secondary routine TOJUL (To Julian, Listing 5) that is the opposite of FMJUL described earlier. PARSDT calls on a decimal input routine, DECIN, included in the common sub-routines module in Listing 10.

```

-----
*** LISTING #8 ***
-----
          .IDENT ET          ;RE-WRITTEN 04/21/82
          ELAPSED TIME ROUTINE
          ON ENTRY: HL= "OLD" TIME SPEC      ("THEN")
                   DE= "NEW" TIME SPEC      ("NOW")
                   RC= ELAPSED TIME SPEC+3
          PERFORMS (ET @ RC) = (TIME @ DE) - (TIME @ HL)
          TIME SPEC FORMAT:
          .WORD DATE (MODIFIED JULIAN)
          .BYTE HOURS (BCD)
          .BYTE MINS (BCD)
          FLAPSED TIME FORMAT:
          .BYTE HOURS- THOUSAND, HUNDREDS  \
          .BYTE HOURS- TENS, UNITS         > ALL BCD
          .BYTE MINS - TENS, UNITS         / (2 DIGS/BYTE)
          .ENTRY ET
0000 AF          ET: XRA A          ;ZERO OUT CARRIES
0001 32 0076 STA MINCAR        ;MINUTES
0004 32 0077 STA HRSCAR        ;AND HOURS
          ;
0007 23          INX H          ;BUMP "THEN" TO MINUTES
0008 23          INX H
0009 23          INX H
000A 13          INX D          ;BUMP "NOW" TO MINUTES
000B 13          INX D
000C 13          INX D
000D 03          INX B          ;POINT TO MINUTES OF ET
000E 03          INX B
          ;
000F 1A          LDAX D         ;FETCH "NOW" MINUTES
0010 96          SUB M         ;SUBTRACT "THEN" MINUTES
0011 27          DAA           ;
0012 02          STAX B
0013 3009        JRNC DOHRS     ;GOOD IF NO CARRY
0015 C660        ADI 60H       ;CARRIED, BORROW 60 MINUTES
0017 27          DAA
0018 02          STAX B
0019 3E01        MVI A,1       ;AND SHOW THE BORROW
001B 32 0076 STA MINCAR        ;
001E 2B          DCX H         ;BUMP DOWN TO HRS
001F 1B          DCX D
0020 0B          DCX B
0021 1A          LDAX D         ;FETCH "NOW" HOURS
0022 96          SUB M         ;SUBTRACT "THEN" HOURS
0023 27          DAA
0024 300B        JRNC ..A
0026 C624        ADI 24H       ;SKIP IF NO BORROW
0028 27          DAA           ;BORROW A DAY
0029 02          STAX B
002A F5          PUSH PSW      ;DON'T ALTER CALCULATION
002B 3E01        MVI A,1       ;BUT SET BORROWED DAY FLAG
002D 32 0077 STA HRSCAR        ;
0030 F1          POP PSW
0031 E5          PUSH H        ;SAVE "THEN" POINTER
0032 21 0076 LXI H,MINCAR     ;AND PREPARE TO...
0035 96          SUB M         ;SUBTRACT THE MINUTES BORROW
0036 27          DAA
0037 E1          POP H         ;RESTORE "THEN" POINTER
0038 02          STAX B
0039 3009        JRNC ..DATE   ;AND CONTINUE IF NO MORE BORROWING
003B C624        ADI 24H       ;BORROW OUT OF HOURS
003D 27          DAA           ;SO ADD A DAY
003E 02          STAX B
003F 3E01        MVI A,1       ;AND SHOW THE BORROW
0041 32 0077 STA HRSCAR        ;
0044 1B          DCX D         ;"NOW" POINTER=>DATE
0045 1B          DCX D
0046 2B          DCX H         ;DITTO, "THEN" POINTER
0047 2B          DCX H
0048 7E          MOV A,M       ;LOAD "THEN"
0049 23          INX H
004A 66          MOV H,M
004B 6F          MOV L,A
004C EB          XCHG          ;DF="THEN"
004D 7E          MOV A,M       ;HL="NOW"
004E 23          INX H
004F 66          MOV H,M
0050 6F          MOV L,A
0051 B7          ORA A         ;CLR CY FOR DSRC
0052 ED52        DSBC D        ;HL="NOW"- "THEN"
0054 3A 0077 LDA HRSCAR        ;SEE IF WE BORROWED A DAY
0057 B7          ORA A
0058 2801        JRZ ..NOC     ;SKIP IF NOT
005A 2B          DCX H         ;ELSE TAKE ONE AWAY
005B EB          XCHG          ;DE=# ELAPSED DAYS
005C 60          MOV H,B       ;MOVE FT HRS POINTER TO HL
005D 69          MOV L,C
005E 2B          DCX H         ;JUMP BACK TO 100'S OF HOURS
005F 3600        MVI M,0      ;INIT IT TO ZERO
0061 23          INX H         ;NOW BACK TO TENS/UNITS
          ;
          ; THIS LOOPS ADDS 24 HOURS TO THE FLAPSED TIME
          ; @HL FOR EACH DAY COUNTED IN DE
0062 7A          DAYLOP: MOV A,D ;ANY DAYS LEFT?
0063 B3          ORA E
0064 C8          RZ            ;DNF IF NOT
0065 1B          DCX D         ;YES, COUNT IT DOWN
0066 7E          MOV A,M       ;FETCH TENS/UNITS OF ELAPSED HRS
0067 C624        ADI 24H       ;ADD A DAY
0069 27          DAA
006A 77          MOV M,A       ;UPDATE TENS/UNITS
006B 30F5        JRNC DAYLOP   ;CONTINUE IF NO CARRY

```



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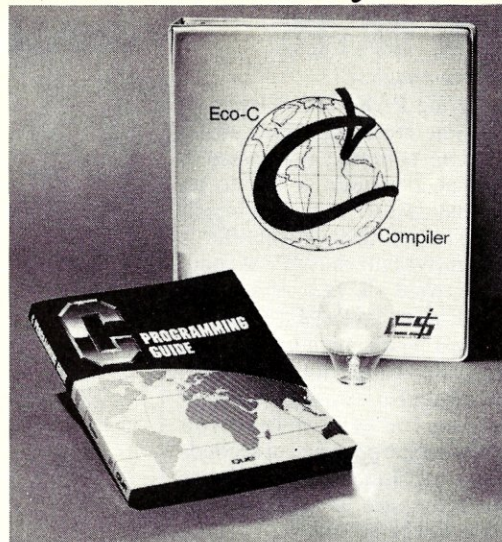
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**CIRCLE 154 ON READER SERVICE CARD**



# JULIAN DATES

Continued from page 90


The routine PARSTM (Listing 4) parses the time from the input string passed as a pointer in HL; also passed to this routine is a pointer in DE to an MP/M-format date/time buffer, which will hold the parsed time. This buffer is modified slightly from the MP/M function #105 format (in fact, it is more compatible with MP/M function #155): it must be one byte longer than normal in order to include the "seconds" field. Since this routine was originally written for MP/M function #155, I allowed the presence of seconds in the time string. In fact, if seconds are not specified (they are, as I said, optional), this byte will be zeroed.

PARSTM also uses a support routine, this one for BCD input (BCDIN). This routine may be found in the common subroutines module in Listing 10.

**These routines might be useful in a remotely accessible MP/M system.**

## Strings attached?

A good deal of recently released semi-public-domain software has carried the stipulation that the user not sell the software, or otherwise profit from it. I don't believe that such things as reusable subroutines, such as those presented in this article, should be limited this way. For that reason, the routines presented in this article may be used with no strings attached. If you'd like to include this stuff in your next big commercial project, feel free; I'd be flattered (mind you, if you feel obligated to send me a complimentary copy of your package, I'll not object!). I'd like to see a lot more software, commercial and public domain, exploit the time and date capabilities of these new operating systems.

Mr. Zatarain, did I answer your question? 

Ron Fowler, Rte. 1, Box 7, Fort Atkinson, WI 53538.

```

006D 2B      DCX  H           ;CARRY TO THOUSANDS/HUNDREDS
006E 7E      MOV  A,M          ;BUMP IT ONE
006F C601    ADI  1
0071 27      DAA
0072 77      MOV  M,A          ;PUT BACK
0073 23      INX  H           ;POINT PROPER
0074 18EC    JMPR DAYLOP       ;AND CONTINUE

0076 00      MNCAR: .RYTF  0      ;MINUTES CARRY
0077 00      HRSCAR: .RYTE  0      ;HOURS CARRY
    
```

\*\*\* LISTING #9 \*\*\*

```

; .IDENT  ADDTIM          ;REWRITTEN 04/21/82
; ADD TIME: ADD CUMULATIVE ELAPSED TIME SPEC
; @HL TO ELAPSED TIME SPEC @DF,
; RESULT @HL
; ELAPSED TIME FORMAT:
; .WORD   HOURS- THOUSAND,HUNDREDS }
; .WORD   HOURS- TENS, UNITS       } ALL BCD
; .BYTE   MINS - TENS, UNITS

; .ENTRY  ADDTIM
0000 01 0000  ADPTIM: LXI  B,0      ;B=HRSCAR C=MNCAR
0003 23      INX  H           ;BUMP POINTERS TO MINUTES
0004 23      INX  H
0005 13      INX  D
0006 13      INX  D

0007 1A      LDAX  D           ;FETCH ELAPSED MINUTES
0008 86      ADD  M           ;ADD TO ACCUM MINUTES
0009 27      DAA              ;MAKE IT DECIMAL
000A 3004    JRNC  ..SKIP      ;SKIP IF NO CARRY
000C C640    ADI  40H         ;ADD DIF BETWEEN 60 AND 100
000E 0E01    MVI  C,1         ;BORROW FROM MINUTES TO HRS
0010 FE60    ..SKIP: CPI  60H        ;MINUTES OVERFLOWED?
0012 3805    JRC   ..HRS       ;DONE IF NOT, GO DO HOURS
0014 D660    SUI  60H         ;YES, CORRECT OVERSHOOT (Z80 ONLY!!)
0016 27      DAA
0017 0E01    MVI  C,1         ;AND GET A BORROW
0019 77      MOV  M,A          ;STORE MINUTES SUM
001A 1B      DCX  D           ;BACK UP POINTERS TO HOURS
001B 2B      DCX  H
001C 1A      LDAX  D           ;FETCH ELAPSED HOURS
001D 86      ADD  M           ;ADD CUMULATIVE
001E 27      DAA              ;MAKE IT DECIMAL
001F 3002    JRNC  ..TENS      ;CONTINUE IF NO HUNDREDS OVFL
0021 0601    MVI  B,1         ;SET OVERFLOW TO HUNDREDS
0023 81      ..TENS: ADD  C          ;ADD IN ANY MINUTES OVERFLOW
0024 77      MOV  M,A          ;AND STORE THE SUM
0025 3002    JRNC  ..TEN2     ;SET HUNDREDS OVERFLOW
0027 0E01    MVI  C,1         ;POINT TO HUNDREDS OF HOURS
0029 2B      DCX  H
002A 1B      DCX  D
002B 1A      LDAX  D
002C 86      ADD  M           ;ADD HUNDREDS DIGITS
002D 27      DAA
002E 80      ADD  B           ;ADD CARRY
002F 77      MOV  M,A
0030 C9      RET

; BUMP CUM HOURS BY ONE
; .ADHR: PUSH  PSW
0031 F5      ..ADHR: DCX  H           ;POINT TO CUM HOURS
0032 2B      DCX  H           ;FETCH CUM HOURS
0033 7E      MOV  A,M          ;BUMP BY ONE
0034 C601    ADI  1           ;MAKE DECIMAL
0036 27      DAA
0037 77      MOV  M,A          ;STORE SUM
0038 3007    JRNC  ..BAK      ;SKIP IF NO HUNDREDS OVFL
003A 2B      DCX  H
003B 7E      MOV  A,M
003C C601    ADI  1
003E 27      DAA
003F 77      MOV  M,A
0040 23      INX  H
0041 23      ..BAK: INX  H
0042 F1      POP  PSW
0043 C9      RET
    
```

\*\*\* LISTING #10 \*\*\*

```

; .IDENT  COMMON          ;COMMON SUBROUTINES
; THIS MODULE CONTAINS BCD AND DECIMAL INPUT AND
; OUTPUT ROUTINES. THESE ARE CALLED FROM SOME OF
; THE PREVIOUS MODULES
; .ENTRY  DECOUT,DECOTB,PRTBCD,DFCN,BCDIN
; ROUTINE TO INPUT A RCD VALUE INTO
; DE FROM ASCII STRING AT HL
; RETURN CY IF NO RCD CHARS FOUND
; ON SUCCESSFUL RETURN, A= TERMINATOR,
; AND HL=ONE PAST TERMINATOR
0000 11 0000  BCDIN: LXI  D,0      ;INIT RETURNED VALUE
0003 7F      MOV  A,M          ;FETCH A CHAR
0004 CD 0020  CALL  ..HTST     ;TEST IT FOR HEX
0007 3002    JRNC  ..LOOP     ;SKIP IF OK
0009 7E      MOV  A,M          ;BAD, RETURN BAD CHAR IN A
000A C9      RET
000B 7E      ..LOOP: MOV  A,M      ;FETCH NEXT CHAR
000C CD 0020  CALL  ..HTST     ;TEST IT
000F 3004    JRNC  ..CONT
    
```



```

0011 7E      MOV    A,M    ;DONE, FETCH TERMINATOR
0012 23      INX    H      ;POINT PAST IT
0013 B7      ORA    A      ;RETURN CARRY CLEAR
0014 C9      RET
0015 23      ..CONT: INX    H
0016 EB      XCHG   H      ;GET VALUE TO HL
0017 29      DAD    H      ;MAKE ROOM FOR NEW DIGIT
0018 29      DAD    H
0019 29      DAD    H
001A 29      DAD    H
001B B5      ORA    L,A     ;ADD IN NEW DIGIT
001C 6F      MOV    L,A
001D EB      XCHG   H
001E 18EB    JMPR   ..LOOP

;
; TEST FOR VALID BCD DIGIT IN A
;
0020 D630    ..HTST: SUI   ^0^    ;TEST DECIMAL LOWER LIMIT
0022 DR      RC      ;TOO SMALL, RETURN
0023 FE0A    CPI    10
0025 3F      CMC
0026 C9      RET

;
; ROUTINE TO INPUT DECIMAL VALUE INTO
; DE FROM ASCII STRING AT HL
; RETURN CY IF NO DEC CHARS FOUND
; ON SUCCESSFUL RETURN, A= SEPARATOR
;
0027 11 0000  DECI:  LXI    D,0     ;INIT RETURNED VALUE
002A 7E      MOV    A,M     ;FETCH A CHAR
002B CD 004B CALL   ..DTST    ;TEST IT FOR HEX
002E D8      RC      ;OOPS, BAD
002F 7E      ..LOOP: MOV   A,M     ;FETCH NEXT CHAR
0030 CD 004B CALL   ..DTST    ;TEST IT
0033 3004   JRNC   ..CONT    ;TEST IT
0035 7E      MOV    A,M     ;RETURN DELIMITER IN A
0036 23      INX    H      ;POINT PAST IT
0037 B7      ORA    A      ;RETURN CY CLEAR
0038 C9      RET
0039 23      ..CONT: INX   H
003A EB      XCHG   H      ;GET VALUE TO HL
003B C5      PUSH  B
003C 44      MOV   B,H
003D 4D      MOV   C,L
003E 29      DAD   H      ;MAKE ROOM FOR NEW DIGIT
003F 29      DAD   H
0040 09      DAD   B      ;(MULT BY 10)
0041 29      DAD   H
0042 85      ADD   L,A     ;ADD IN NEW DIGIT
0043 6F      MOV   L,A
0044 3001   JRNC   ..NOOV
0046 24      INR   H
0047 EB      XCHG   H
0048 C1      POP   B
0049 18F4    JMPR   ..LOOP

;
; TEST FOR VALID DECIMAL DIGIT IN A
;
004B D630    ..DTST: SUI   ^0^    ;TEST DECIMAL LOWER LIMIT
004D DR      RC      ;TOO SMALL, RETURN
004E FE0A    CPI    10
0050 3F      CMC
0051 C9      RET

;
; PRINT A IN SPLIT BCD
;
0052 F5      PRTRCD: PUSH  PSW
0053 0F      RRC
0054 0F      RRC
0055 0F      RRC
0056 0F      RRC
0057 CD 005B CALL   ..TYP
005A F1      POP   PSW
005B E60F   ..TYP: ANI   0FH
005D C630   ADI   ^0^
005F CD 0000:04 CALL  TYPE#
0062 C9      RET

;
; ROUTINES TO PRINT A, HL IN DECIMAL VIA TYP#
;
0063 F5      DECOTB: PUSH  H      ;SAVE HL
0064 6F      MOV   L,A     ;MAKE A 16 BITS IN HL
0065 2600   MVI   H,0
0066 CD 006C CALL  DECOU   ;PRINT VIA DECOU
006A E1      POP   H
006B C9      RET

;
; OUTPUT DECIMAL HL: FROM CPMIC
;
006C C5      DECOU: PUSH  B
006D D5      PUSH  D
006E E5      PUSH  H
006F 01 FFF6 LXI   B,-10
0072 11 FFFF LXI   D,-1
0075 09      ..LOOP: DAD   B
0076 13      INX   D
0077 38FC   JRC   ..LOOP
0079 01 000A LXI   B,10
007C 09      DAD   B
007D EB      XCHG   H
007E 7C      MOV   A,H
007F B5      ORA   L
0080 C4 006C CNZ   DECOU   ;THIS IS RECURSIVE
0083 7B      MOV   A,E
0084 C630   ADI   ^0^
0086 CD 0000:04 CALL  TYP#
0089 F1      POP   H
008A D1      POP   D
008B C1      POP   B
008C C9      RET

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```

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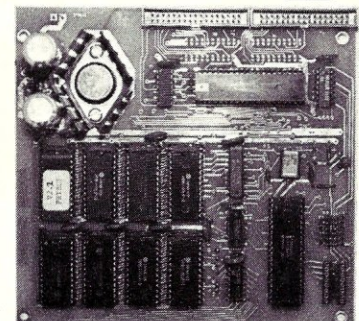
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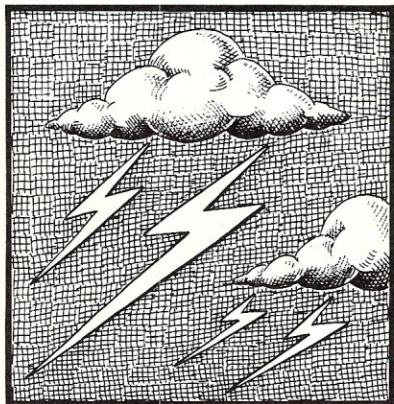
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# Lomas LDP-2 "Lightning One"

**A faster, more  
powerful  
alternative to the  
IBM PC and its  
look-alikes**



by Bruce Ratoff

**T**he truck driver struggled single-handedly with a massive wooden crate. I at first mistakenly assumed it was destined for some nearby furniture store, the thought never crossing my mind for a moment that it might actually be intended for me. After all, 8086-based computers are supposed to be puny little things like the IBM PC, right? Well, I guess not, at least in this case, for the Lomas Data Products LDP-2 turns out to be neither PC-like nor puny.

#### **Boards supplied**

Lomas Data Products was one of the first vendors to advertise 8086 and 8088 CPU boards for the S-100 bus when those processor chips became available a few years ago. The system Lomas provided for evaluation was based on their "Lightning One" CPU board, equipped with an 8086 main processor and an 8087 math coprocessor. While the 8086 supplied is capable of running at an 8 MHz clock rate, the board came set up to operate with a 5

MHz clock, since that is the fastest available speed for the accompanying 8087 chip. I also received the Lomas LDP72 floppy disk controller, the "Hazital" multifunction I/O card, and the RAM67 128K static RAM card. The board set was housed in an Integrand 800-series cabinet, along with a pair of Qume DT-8 8" dual-sided floppy drives and a 10-slot S-100 cardcage. Since no terminal was provided, I plugged in a TeleVideo 925 which happened to be on hand at the moment.

#### **CPU**

The Lomas "Lightning One" is a rather interesting CPU card with a great many options. First of all, it will handle either an 8-bit 8088 or a 16-bit 8086 as the main processor chip. By selecting the proper chip, the user can opt for full compatibility with existing 8-bit memories and peripherals, or build a true 16-bit system with 16-bit memory for maximum speed. Jumper options are provided to run the CPU board with a 4, 5, 8 or 10 MHz main clock, so the board can be set up for all the currently available chip speeds. The "Lightning One" provides sockets for the addition of an 8087 math processor and an 8089 I/O processor. The board we tested had the 8087, but not the 8089, which Lomas uses only in their multiuser systems. In



addition to all this CPU power, there is an 8259A interrupt controller and two 28-pin sockets capable of accommodating two 2716, 2732 or 2764 EPROMs. Using two 2764s, you could have up to 16K of on-board firmware.

### Disk controller and I/O

The Lomas LDP72 floppy disk controller is based on the Intel 8272 dual-density floppy controller chip. With appropriate software, it will accommodate any mix of up to four 8" and 5 1/4" single- or double-sided drives. Connectors for both drives sizes are provided at the top edge of the card. Our test system had two 8" drives, and the software was set up to allow for an optional 5 1/4" drive as a third drive. Three formats are supported on the 8" drives: single-sided single-density (SSSD), single-sided double-density (SSDD), and double-sided double-density (DSDD). The storage capacities for each format on CP/M-86 and MS-DOS are:

OS	SSSD	SSDD	DSDD
CP/M-86	243K	600K	1200K
MS-DOS	246K	610K	1221K

Performing the rest of the I/O chores in this system is the aptly named "Hazital" system support card. It contains two serial ports with software-selectable baud rates up to 9600 baud. Each port supports the major RS-232 handshake lines for asynchronous devices, and one of the ports may also be operated in synchronous mode. There is also a strobed parallel output port (usually configured as a Centronics-style printer interface), a strobed parallel input port, a programmable realtime interrupt (no software provided), a clock/calendar chip with battery backup (supported in the supplied MS-DOS implementation, but not in CP/M-86), a Winchester disk controller support port (intended to interface with a Western Digital WD1000 series hard disk controller), and an empty socket for an Intel 8231 or 8232 math processor. This last item would not normally be used with an 8086 or 8088, since the 8087 does a better job. However, it might be useful if you were to run the Hazital board with an 8080, 8085 or Z80 processor.

### Memory

The Lomas RAM67 is a 128K memory card, built using low-power, high-speed CMOS static memory chips. Due to the low power consumption, it is possible to order a special version of this board with battery backup to yield a fairly large nonvolatile memory system. A half-populated (64K) version is also available. The 128K version can be ad-

dressed on any 128K boundary, while the 64K version can be addressed on any 64K boundary. Both versions respond to the S-100 phantom line. It is also possible to disable a section of the board to avoid conflict with another memory device. Eight-bit and 16-bit-wide data transfers are handled automatically using the S-100 sXTRQ signal. The claimed access time of 130 ns should be fast enough to run with any existing 8- or 16-bit processor.

### Software and documentation

The software provided by Lomas consisted of evaluation copies of their implementations of CP/M-86 version 1.1 and MS-DOS version 2.0. In order to have some programming languages to try on the system, *Microsystems* contacted Digital Research, Inc., who graciously provided copies of PL/I-86, CB-86 (a native code compiler for CBasic), and their new Personal Basic interpreter. This is where the first snag appeared: the standard release format these days for all CP/M-86 and MS-DOS compatible software is the 5 1/4" disk. While the Lomas documentation states that a 5" drive may be added to the system, the test system contained only 8" drives. Luckily, my lab also houses an 8" CP/M-80 based system and an 8-bit 5" system that can read PC disks. I was therefore able to download all the 5" release disks to 8" single-density, and then read those copies on the LDP2. Lomas offers another version of their system, which comes with 5" drives. Potential buyers would probably do better to consider that model, unless conversion facilities are available.

Lomas supplied two large binders full of documentation for the system. One of these contained the hardware manuals of all their boards. The other binder contained a preliminary manual for MS-DOS version 2.0. A few weeks later, a third large binder arrived, containing a more complete and up-to-date MS-DOS manual. In addition to these large binders, we received the CP/M-86 manual set, in its standard IBM-style minibinders.

### Performance

At first the system did not boot up, but a quick scan of the recommended jumper settings listed in the MS-DOS

installation notes revealed one discrepancy on the Hazital board. I'm not sure why, but fixing this jumper allowed the system to come up properly with both CP/M-86 and MS-DOS. One other note page which proved handy was the sheet at the front of the hardware manual, which described the correct way to wire terminal and printer cables. The two serial ports on the Hazital are laid out as DTE devices, which means that they would connect directly to a modem (modems are DCE devices). Just to increase the confusion, the serial connectors mounted on the unit were female, which usually signifies DCE, not DTE. It would have saved a good deal of time and confusion if Lomas had laid out their connectors in such a way that special cables were not required for the terminal and printer.

My next step in getting the system up was to attempt to create some working disks. The operating systems were supplied on single-sided, double-density disks, which of course worked fine once I solved the jumper problems mentioned above. Since the system was supplied with double-sided drives, I decided to make some double-sided work disks. Well, it turns out that the utilities provided with both operating systems would not generate a double-sided system disk directly. One must instead use the direct hardware disk read and write commands in the system's PROM-resident monitor to transfer the system tracks of a single-sided disk to a double-sided disk. Other than this one anomaly, both CP/M and MS-DOS seemed to take the intermixing of single-density single-sided, double-density single-sided, and double-density double-sided pretty much in stride. Of course, switching formats usually required typing control-C when swapping disks around.

I later discovered one other strange quirk in Lomas' disk handling. Occasionally, when logging in a new disk, the system would just hang up with the heads loaded on the new disk. Whenever this occurred, the system reset button had no effect. The only way to regain control of the system was to switch the power off and on. Each time I did this I kept my fingers crossed, because on most machines removing power from a floppy drive with the heads still loaded usually results in a crunched disk. This

Table 1. Parameter values

Language	Lomas LDP2	PC clone
PL/I-86	7.1	13.2
CB-86	9.5	17.2
Personal BASIC	1:25.4	2:38.5



## LIGHTNING ONE

Continued from page 95

did not seem to be a problem on the Lomas, however, since in the dozen or so hangups that I experienced, the disk in question was never harmed.

Once I actually started programming on the system, I was immediately impressed by its speed on disk operations. The disk drives employ a large sector size along with a track-buffering scheme which appears to work quite well. Its disk I/O ranks among the fastest of the many 8" floppy systems I have used.

Computer-bound operations also seemed to be going faster. In order to see just how much faster, I entered and ran the "Sieve or Erasthones" benchmark in all three languages provided by Digital Research. For those unfamiliar with this benchmark, it uses a simple process of elimination to determine all the prime numbers in a given range. Since only addition and comparison operations are used, it's a good test of raw CPU speed. Unfortunately, I had not obtained any programming languages that would take advantage of the 8087 math processor. Although it was not available at the time I wrote this, Digital

Research has advised me that 8087-compatible versions of several of their language compilers are about to be released. By the time you read this, you should be able to obtain 8087-supporting versions of DR C, Pascal/MT+, Fortran, and PL/I-86. At the present time, all of my testing reflects the use of the 8086 by itself. For the sake of comparison, I ran the same benchmark programs on a PC clone. Since the PC look-alikes also use a 5 MHz clock, the huge timing differences must be attributed to the difference in bus width: 16 bits for the 8086 in the Lomas system, 8 bits for the 8088 in the PC clone. The results I obtained are shown in Table 1.


All times have been given as "seconds.tenths" or "minutes:seconds.tenths". As you can see, the difference in execution times was almost two to one. One can only guess what difference the 8087 might have made on each machine. Perhaps I can investigate and report this at a later date.

### Summary

What conclusions can we reach about this machine? Well, the lack of IBM PC compatible graphics and hardware architecture means that many programs for the IBM PC won't run, even

though the processor and operating system are the same. On the other hand, more generic MS-DOS and CP/M-86 programs that use only the normal I/O facilities in the operating system will run almost twice as fast, with about four times as much disk space available to them. Of course, with the Lomas machine you also have the easy expandability of the S-100 bus. Of the 10 slots provided in the chassis, only four are used by the basic system. This leaves plenty of room for additional memory and peripherals such as an S-100 modem card.

Maybe someday someone will design an S-100 graphics card that emulates the graphics of the IBM PC. Until then, we can conclude that while this machine is not for everybody, it does succeed in providing a faster, more powerful alternative to the IBM PC and its look-alikes for the serious user.

More information on this system and the rest of the Lomas line may be obtained from: **Lomas Data Products, Inc., 66 Hopkinton Road, Westborough, MA 01581, (617) 366-6434.** 

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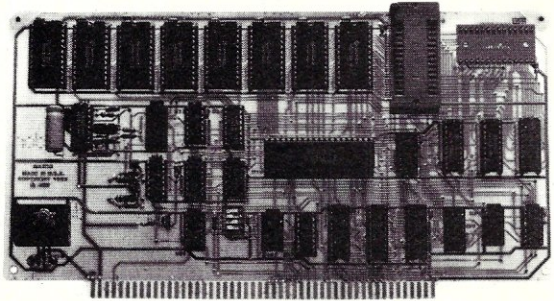
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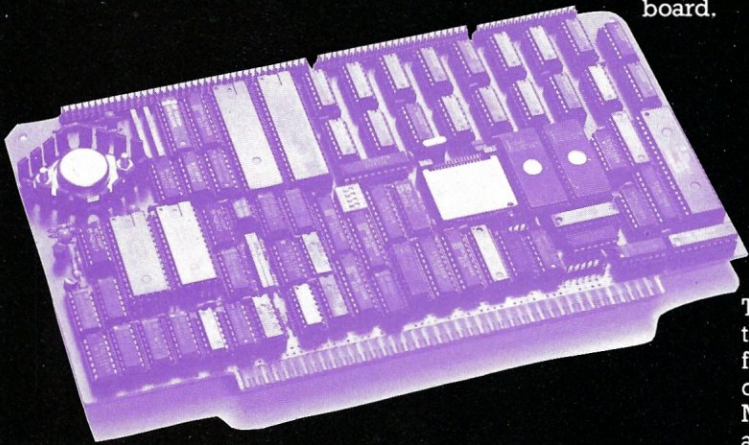
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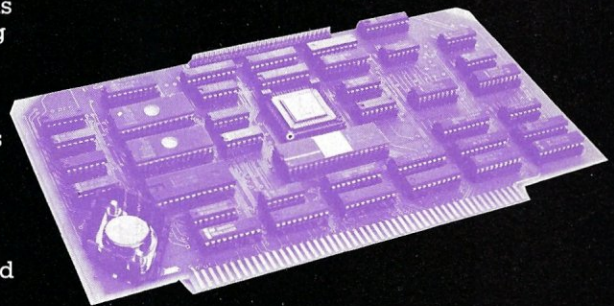
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# Fortran-80: Simple Changes for I/O

**How to  
eliminate  
problems with  
carriage  
returns and  
line feeds**

by Maynard Brandsma

---

**M**icrosoft's Fortran-80 has problems with formatted I/O to disk files, as pointed out by Robert S. Minnis in his article in the November 1983 issue of *Microsystems*. The first problem is that formatted writes to a disk file do not convert the carriage control characters of Fortran to the ASCII characters needed by some text editors and all printers to properly display the text. The second problem involves formatted input from a disk file. When an input file is prepared with a text editor that uses a carriage return-line feed combination to mark the end of a line, the presence of line feeds confuses the formatted input as described by Minnis. This technical note presents the code changes to the disk driver routine DSKDRV.MAC necessary to solve these problems. DSKDRV.MAC is the source code for the disk driver routines that Microsoft supplies as part of the Fortran-80 package. I have been using the modified DSKDRV for Fortran-80

version 3.44 with no problems.

One benefit of sending formatted output to a disk file instead of directly to the printer is that programs execute much faster if they don't have to wait for a slow printer. A second benefit is that input and output can be arranged in the same way as on an IBM mainframe. You can follow the IBM convention of reading input data from unit 5 and writing output to unit 6. When a program is through, you can review the output using your text editor. You can decide if you want to print all, or part, or none of the output file.

#### **Modification for the formatted disk read routine**

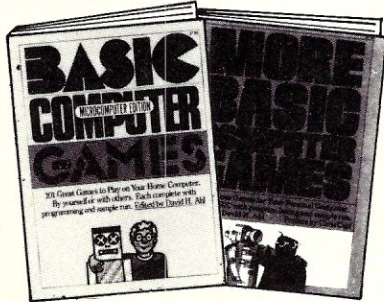
The addition of two extra lines of code to the routine that gets a character from the disk file (DSKIN) will cause this routine to throw away any line feeds it finds in an input record. Listing 1 shows the necessary changes.

#### **Modification of formatted disk write routine**

This is the more complicated situation mentioned by Minnis. I have modified the formatted disk write routine to convert the carriage control characters produced by Fortran in column 1 of formatted output to the ASCII characters



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## FORTRAN-80

Continued from page 99

for line feed or form feed needed by text editors and printers.

With this modification, you can open an output file with a statement like:

```
CALL OPEN(6, 'OUTPUT.DAT', 0).
```

Direct your program's output to that file with program statements like:

```
WRITE(6, 15) A
15 FORMAT(///, 5H A = , F5.1).
```

You can view the output file using your text editor. To print your output you can copy it to the CP/M list device using:

```
PIP LST:=OUTPUT.DAT.
```

Multiple output files can be printed using a command like:

```
PIP LST:=OUT1.DAT, OUT2.DAT,
```

## Sending formatted output to a disk file causes programs to execute faster.

The required changes to the formatted disk write routine DSKFWR are shown in Listing 2. **D**

Maynard Brandsma, P.O. Box 374,  
Drango, CO 81301

LISTING 1. Modification to DSKDRV.MAC to ignore line feeds in formatted disk reads. The routine shown, DSKIN, is part of the lengthy DSKDRV.MAC file. The CPI and JZ instructions inserted near the end cause DSKIN to ignore line feeds in the input file.

```
-----
;
;
; DISK INPUT ROUTINE
;
DSKIN:
CALL    GTBOFF      ;Buffer.offset(LUN)
ORA     A           ;BUFFER EMPTY?
CZ      REDBUF     ;YES, REFIL
RC      D          ;EOF
DCR     M          ;DECR. # LEFT
LXI     H, $FLBUF-2
DAD     D
DAD     D           ;GET $FLBUF PTR
CMA
ADI     129        ;128-#LEFT=OFFSET
ADD     M
MOV     E, A
INX     H
MVI     A, 0
ADC     M
MOV     D, A
LDAX   D           ;GET CHAR
                ...patch to ignore line feeds in input
CPI     12Q        ;line feed?
JZ      DSKIN     ;yes, ignore it
                ...end patch

ORA     A
RET
```

LISTING 2. Modification to DSKDRV.MAC to add line feeds and form feeds in formatted disk writes. The routine shown, DSKFWR is part of the DSKDRV.MAC file. Replace the section indicated (routine DSKFW2) with the patch shown in Listing 3.

```
-----
;
;
; FORMATTED WRITE
```



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```

;
DSKFWR:
    MVI    C,MD.OUT
    CALL  OPNCHK      ;OPEN FILE IF NEEDED
    XRA    A
    STA   $DSKER      ;CLEAR COUNT
    LDA   $BL         ;GET # TO WRITE
    ORA   A
    RZ    ;IGNORE NULL BUFFERS
    LDA   $BL
    ORA   A
    JP    DSKFWO
    CALL  $ERR        ;Warn User of..
    DB    OBOVF      ; Output Buffer Limit Exceeded
    MVI   A,127      ; and truncate to 127 bytes.
DSKFWO:
    CALL  RNDCHK      ;If Rnd Mode, Set offset to 0.
    LHL   $BF        ; Get buffer ptr
;
;*****
;
;
DSKFW2:
    PUSH  PSW        ; SAVE COUNT
    MOV   A,M        ;
    CALL  DSKOUT      ;SEND OUT BYTE
    INX   H          ; Increment buffer ptr
    POP  PSW        ; Retrieve count
    DCR   A          ; Decrement count
    JNZ  DSKFW2      ; One more time
;
;*****
;
DSKWDN: MVI    A,15Q
    CALL  DSKOUT      ;PUT OUT <CR>
    CALL  CTMODE      ;Mark Mode Byte with
    ORI   MD.WRT      ; Write-Data-in-Buffer.
    MOV   M,A
    LDA   $DSKER      ;GET $DSKEROR STATUS
    ORA   A          ;ERROR?
    RZ    ;NO
    STC   ;YES
    RET

LISTING 3. Patch to be inserted where shown in Listing 2.

;
; begin patch for formatted writes to disk -----
; patch adds carriage control for formatted output to disk files
DCR    A            ;decrement buffer length
PUSH   PSW         ;and save it
MVI    A,15Q
CALL   DSKOUT      ;output carriage return
MOV    A,M         ;GET 1ST CHARACTER IN BUFFER
CPI    "+"
JZ     DSKFW2      ;NO PAPER ADVANCE IF 1ST CHAR = "+"
CPI    "1"
JNZ   DSKFW1      ;NO PAGE ADVANCE IF 1ST CHAR. NOT "1"
MVI    A,14Q
CALL   DSKOUT      ;INSERT FORM FEED IF 1ST CHAR = "1"
JMP    DSKFW2
;
DSKFW1: MVI    A,12Q      ;CARRIAGE CONTROL
    CALL  DSKOUT      ;ADVANCE PAPER 1 LINE
    MOV   A,M        ;GET CHARACTER BACK
    CPI   "0"
    JNZ  DSKFW2
    MVI  A,12Q      ;LINE FEED
    CALL DSKOUT      ;IF 1ST CHAR = "0", ADVANCE PAPER ANOTHER LINE
DSKFW2: POP  PSW      ;GET LENGTH BACK
    INX  H          ;INCREMENT POINTER
DSKLOP: RZ          ;RETURN IF NO MORE CHAR.
    PUSH PSW        ;SAVE CHARACTER COUNT
    MOV  A,M        ;FETCH NEXT CHARACTER
    INX  H          ;INCREMENT BUFFER POINTER
    CALL DSKOUT      ;SEND OUT CHARACTER
    POP  PSW        ;RETRIEVE COUNT
    DCR  A          ;DECREMENT COUNT
    JNZ  DSKLOP     ;DO IT AGAIN
; end of patch for carriage control-----

```

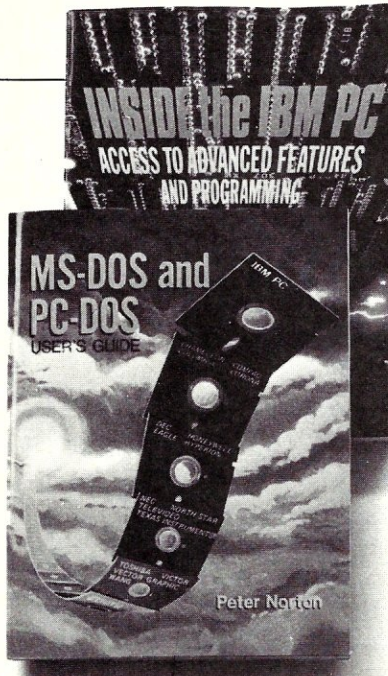


# Authoritative

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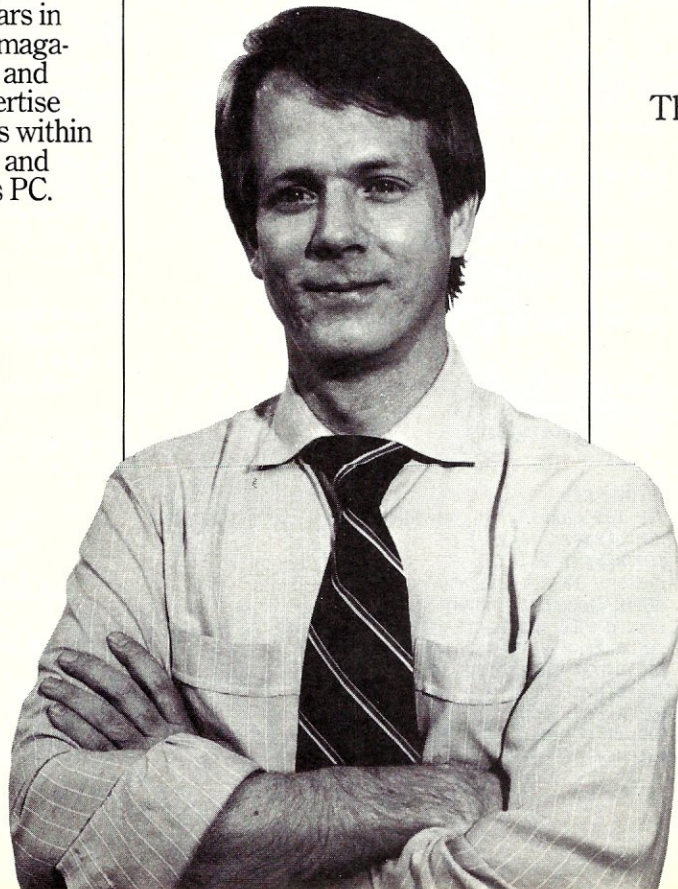
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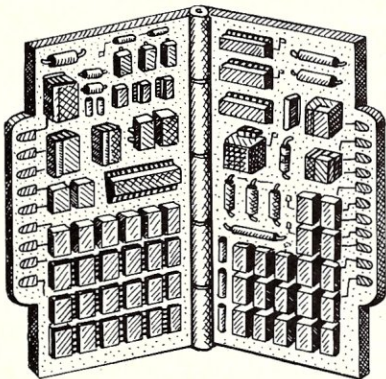


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# Dual Systems SIO-4 I/O Board

**This intelligent four-line serial I/O board, first designed for UNIX, performs well under CP/M-80**



by Ian F. Darwin

**T**here's a new and improved way of connecting terminals and printers to your S-100 system. The Dual Systems "SIO4/DMA" intelligent four-line serial input/output board was designed from the ground up with UNIX in mind, but can be used quite well with CP/M-80, as this article shows.

In fact, if you have a Dual Systems System/83 UNIX computer (see review in the September 1983 issue) *and are technically inclined*, you could alternate between CP/M 80 and UNIX as I do. Pull the 68000 CPU card, install an 8085 or Z80 CPU board, and change disks. The listing describes the portion of BIOS for the console; a BIOS for the floppy disk controller can be ordered from CompuPro (the secret is out; Dual uses a CompuPro floppy disk controller). Here's how to use the SIO4/DMA with CP/M, but first—the hardware.

#### The SIO4/DMA board

Like most Dual boards, the SIO4 is very well designed and built. It uses 24-bit (or 16-bit) addressing, has vectored interrupt lines, is a temporary master (the TMA interface), can handle a CPU

clock up to 8 MHz, and will insert from 1 to 16 wait states as needed. There is support on board for XON/XOFF protocol if you want it, for printers with a "buffer full" signal, and direct access to the USARTs. The serial line drivers are claimed to conform fully to the RS-232 signal standard. The SIO4 has a limited ability to do synchronous I/O (this could be used with high-speed intercomputer communications). Each line can be wired for a terminal or a modem (DTE or DCE). Vectored interrupts on the VIO lines can be sent for "character ready" in the FIFO and/or DMA output complete. The baud rate on each channel is settable under software control. In fact, for simple serial applications, that's all the programmer has to do, because the board itself is intelligent. It has an 8085 processor on board; the 8085 implements buffering of characters on input and DMA on output. This 8085, and its 2K of software in EPROM (2716), also takes care of initializing the USARTs. A USART is a chip that converts the parallel data from the CPU or system bus into a form suitable for transmission over serial cables to terminals, printers, and modems. The USARTS in the SIO4 are Motorola MC2661s—an extension of the Signetics 2651. And because the 8085 takes care of buffering input and doing DMA on output, the operating system



# Dual Systems

Continued from page 103

can tell the board to output an entire line of characters, and have only a single interrupt when the entire line has been sent.

Considerable CPU overhead is freed up for productive use by application programs.

However, CP/M-80 does not know how to utilize such a powerful board, since there is no call to the BIOS to write a line to the console. The developer of the CP/M system assumed that serial I/O boards would never be smarter than they were in 1975 on the particular system he was using. So the BDOS part of CP/M forcibly breaks a call to "write a line on the console" into multiple BIOS calls to "write a character to the console." You could easily write a BIOS routine to send one character at a time to the DMA output processor. Fortunately, the board designer thought to allow you direct access to the USARTs, so the BIOS can just treat the output operation like any non-DMA I/O card. This is what my BIOS does.

The SIO4/DMA also has two modes for doing input. One buffers incoming characters in a FIFO queue (FIFO stands for "First-In, First-Out"). The other is a conventional polled I/O mode. The FIFO mode means that the operating system does not have to read characters as fast as you type them. Since the Godbout BIOS is not interrupt driven, you cannot "type ahead" when using the Godbout "Interfacer 1" serial card (which Dual used in their early systems as the "SIO2" card). If you have a Dual SIO4/DMA card, you can type ahead up to 256 characters while your application is executing. Although the characters are not echoed until they are actually read by the program or by CP/M, it's still quite an improvement! The usual editing characters work as you'd expect. But once you've typed RETURN, the command is on its way! A control-C on a subsequent line will *not* be seen by CP/M until it reads the line. Thus you might occasionally need to hit RESET if you enter a command and then realize that it will have deadly effects on your files.

The big difference between the SIO4/DMA and most other cards only shows up in the 'FIFO input' mode of operation. When operating with the FIFO turned on, the SIO4/DMA provides a single input channel for all incoming characters! This shows clearly how well the DUAL designer anticipated the needs of a multitasking, multiuser operating system such as UNIX, in which a single "device driv-

```
; SIO4.ASM--CP/M-80 BIOS routines for Dual Systems Corp SIO4-DMA
; with line 0 as the console.
; This version uses FIFO input, direct output to USART.
; Other ports on board can NOT be used for input with this simple
; interface, as there is but a single multiplexed input channel.
; This version by Ian Darwin, based on some examples in the
; Dual systems manual for the Sio4/DMA board.
; Dual Systems, 2530 San Pablo Ave, Berkeley CA 94702.
```

```
sio4base equ 20H ;where their UNIX driver puts it.
DADR equ sio4base+0 ;address for DMA-addr
rctl equ sio4base+3 ;receiver control.
DBYC equ sio4base+4 ;Address for DMA byte count
STRTSTOP equ sio4base+6 ;MSB toggles ^S/^Q onboard; LSB halts output
DCTL equ sio4base+7 ;address for DMA control
UDATA equ sio4base+8 ;USART data
USTAT equ sio4base+09 ;USART status.
EPM0 equ sio4base+10 ;USART mode address
EPCM equ sio4base+11 ;USART command address.
IPST equ sio4base+12 ;input fifo status
IPDT equ sio4base+13 ;input fifo data.
LNSEL equ sio4base+15 ;address for line selection
```

```
strt equ 1 ;bit to start transfer in dtcl
rcven equ 2 ;bit to enable receiver in rctl.
done equ 40h ;bit to indicate completion in dtcl
chrdy equ 40h ;bit in ipst to indicate char in fifo.
TxRdy equ 1 ;bit in ustat says prev char still outbound
```

```
ConLin equ 0 ;line zero on board is console.
```

```
; C O N S O L E I N I T I A L I Z A T I O N
coninit: ;initialize line 0 for console.
```

```
mvi a,ConLin ;line zero
out lnSel ;select line zero.
mvi a,rcven ;enable fifo for
out rctl ;this line.
mvi b,0d0h ;code for 9600 baud
in epcm ;ensure mode reg one
in epm0 ;is next, and read it.
mvi a,0fh
ana b ;get baud rate only
mov b,a ;save baud rate
in epm0 ;read mode register 2
ani 0f0h ;remove old baud rate
ora b ;OR in new baud rate
mov b,a ;save in B
in epm0 ;read mode reg 1 again
mov a,b ;get new data for mode
out epm0 ;register 2, and write to it.
ret
```

```
; C O N S O L E O U T P U T
; call with character in C.
; sends output directly to usart.
```

```
conout: mvi a,ConLin ;get line number
out lnSel ;and select.
conota: in ustat ;get current status of usart.
ani TxRdy ;is previous char finished outputting?
jz conota ;no, spin a while.
mov a,c ;yes, get this output char into `A'.
out udata ;and send it!
ret
```

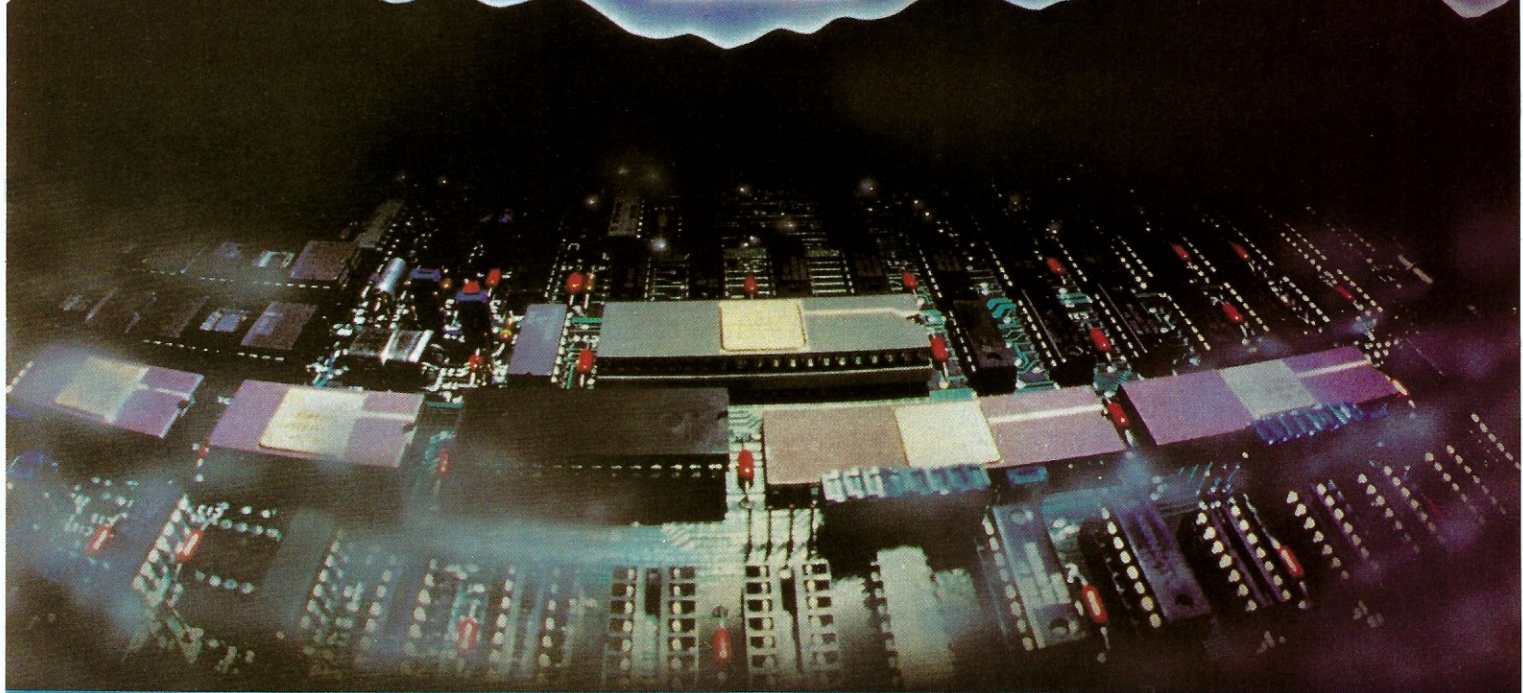
```
; C O N S O L E S T A T U S
; return a=00 if no char ready, a=FF if char ready.
```

```
const: do not select line here as we are reading from FIFO.
; in ipst ;see if char ready.
ani chrDy
jnz conavail
mvi a,0
ret
conavail: mvi a,255 ;say char ready
ret
```

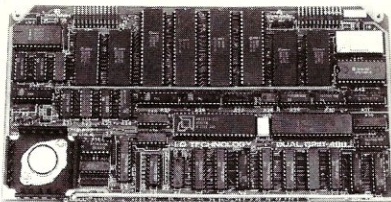
```
; C O N S O L E I N P U T
; gets a char (waiting if need be); returns it in A
```

```
conin: do not select line here since we are reading from FIFO.
; in ipst ;get status
conina: ani chrDy ;is char ready yet?
jz conina ;no, try again (and again...)
in ipdt ;read the char into A
ani 7fh ;mask off parity bit (sorry...)
ret
```





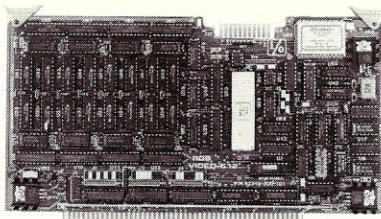
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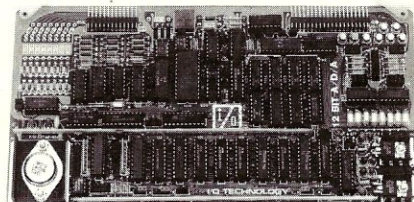
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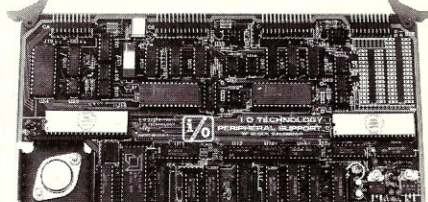
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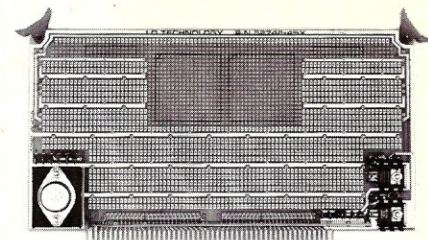
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## Dual Systems

Continued from page 104

er" controls all occurrences of a particular kind of device (such as all serial lines, all 8" disks, all 5" Winchesters, and so on). Each device in such a group is usually numbered; for example, UNIX might use the names `ttyd0`, `ttyd1`, `ttyd2` and so on, for the serial lines. If one of the lines is a serial printer, well, to UNIX's device drivers it's still just a TTY line. This all turns out very well for UNIX, but doesn't work quite as neatly in a CP/M BIOS, where each device is a special case, and where all devices are assumed to be independent of each other. So the designers allow you either to use this feature or to access the USARTs directly. And what's more, this feature can be enabled on a line-by-line basis! So you could be doing FIFO input from lines 0 and 2, and polled input from lines 1 and 3, or any such combination. That, to me, is versatility.

This explains why the board is priced above conventional serial boards. This board was not intended to compete with nonbuffered serial I/O boards, but was designed as part of Dual's System/83 UNIX product. UNIX began life on DEC hardware, and the

**When operating with the FIFO on, the SIO4/DMA provides a single input channel for all incoming characters!**

SIO4/DMA has a strong family resemblance to the preferred serial I/O board on DEC equipment, the DH-11.

The only problem I've had with the board is that it hangs my system when I erroneously refer to a nonconnected terminal. Handshaking is implemented using DTR on pin 20 (changeable), and the board will wait until the terminal is

ready. The manual describes a way around this for applications in which full handshaking is not used.

### Documentation

The manual for the board comes in two parts. Part 1 is written by Dual; it provides an overview, details the switch settings and options, and provides programming information. Part 2 is an extract from the Motorola document on the MC2661 USART; this section gives bit-twiddling details. I found the "programming" section of the Dual manual a little short of examples (only three on 8080 examples). A few details were not explicit; i.e., the baud rate and other parameters to which the on-board processor initializes the USARTs. However, a programmer accustomed to writing BIOS code should be able to handle it. And that's who this manual is written for.

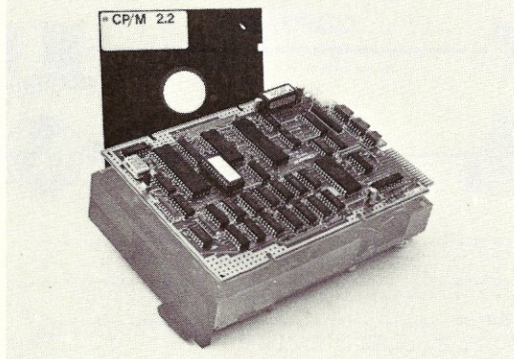
### The CP/M-80 BIOS

In the FIFO input mode, the Dual SIO4/DMA gives you a single input channel of (possibly typed-ahead) characters. The board returns the line number along with the character, and the BIOS has to sort them out. This version of my BIOS uses the FIFO for console

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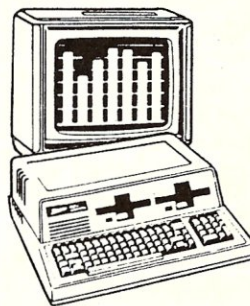
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# Dual Systems

Continued from page 107

input (because I like type-ahead), but doesn't have to sort out what character is from which line, because I've only enabled the FIFO from line zero.

To use multiple FIFO input lines, you could implement internal queuing within the BIOS, assigning a character to an input queue based upon its line number. A simpler approach, and one more in keeping with the CP/M BIOS way of doing things, would be to not enable the FIFO and access the USARTs directly. Then input is like any conventional multiline I/O card. And conventional coding techniques could be used within the CP/M BIOS.

Listing 1 contains the SIO4/DMA access routines for simple, console-only access using the FIFO for input, and sending one character at a time to the USART for output. The code for reading characters from the USART would not be much different; the input ports used by ConSt and ConIn become USTAT and UDATA, and the value of ChRdy has to be changed. The overall logic does not change much. The code for the LST: device is similar but contains only the output routines.

To use the code in Listing 1, replace the "Interfacer" access modules in the BIOS with this code. Add a call to

## At a glance

**Name:** SIO4/DMA intelligent four-port serial input/output board

**Use:** Interfacing the IEEE-696/S-100 bus to peripheral devices (terminals, modems, printers, etc.) over serial lines

**Price:** \$650 assembled and tested, with on-board software

**LSI used:** 8085 processor, 4 MC2661B USARTS

**System:** IEEE-696 S-100

**Features:** Oriented to multiuser systems; optional FIFO buffering of inputs, optional output requests via DMA, optional on-board handling of XON/XOFF.

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"coninit" in the cold boot code (label CBOOT:). Then regenerate the BIOS and system disk using a working CP/M-80 system and the Godbout documentation. If, on a System/83, you want to keep the hard disk for UNIX use only, be sure to disable the code in the BIOS for hard disk access! Enable the floppy controller's BOOT EPROM (Dual UNIX runs with it disabled). Take out the 68000 CPU and put it in a safe place. Install a 8080 or Z80 CPU card with 24-bit addressing and boot the system. (The CPU must have 24-bit addressing, since this is used on all the other cards). You should now be running CP/M from the floppy disk.

I've discussed the SIO4/DMA serial interface card, and shown one way—the hard(ware) way—to run CP/M with Dual Systems' System/83 computer. There are other ways—but that's a topic for another article. □

*Note: If you're not experienced with S-100 hardware and CP/M BIOS software, then please don't tear apart a Dual Systems' UNIX system yourself. Get your dealer to do the integration and show you how to make the changes. The instructions in this article are intended for the experienced "techie" only.*

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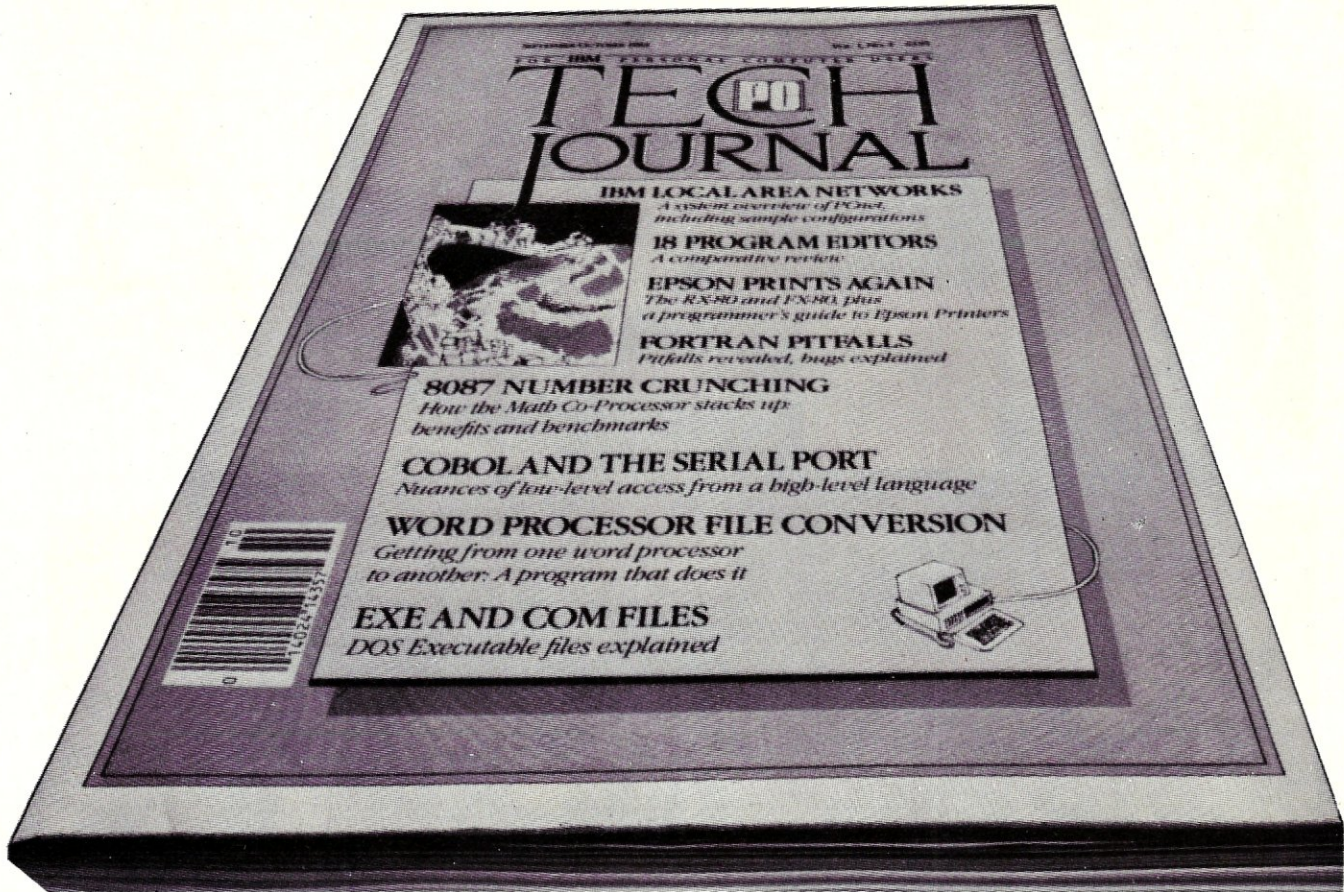
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# Magic-Bind Supersedes MailMerge

**All the power  
of MailMerge  
with none of  
the complexity**



by Roger C. Schlobin

---

**D**id you ever expect to hear the words: "MailMerge superseded"? Good old MailMerge, the indispensable add-on to WordStar that allows you to merge-print, make multiple copies, use command files, boilerplate, insert files, read variables, and all the other good features that have saved users so much tedium for a number of years. Yet, just as MicroPro's SpellStar has been challenged by superior spelling checkers such as The Word Plus, so too has MailMerge fallen under the shadow of MagicBind.

MagicBind offers all the features of MailMerge and much more—all at the same price! The first blessing MagicBind brings is a solution to that bitter insecurity that has always plagued WordStar lovers. We all know that dread moment: as you are raving to a wide-eyed audience about the joys of WordStar and all its support programs, a sardonic voice invariably carries from the back of the room: "What about proportional spacing?" Suddenly the WordStar lover, now in a cold sweat, is subject to all the smug vulgarities of

Perfect Writer, SpellBinder, and Final Word users. Never mind the fact that these word processors accomplish proportional spacing by spreading out the spaces between the words and thus haven't a real typeset quality. They had it and we didn't!

Now, through both MagicBind and its more limited cousin, MagicPrint, the WordStar user can have *true* proportional spacing with either a justified or an unjustified right margin. The increments are spread throughout both the spaces and the words, and true centering is finally a reality (no more of one letter sticking out when two words of different lines have only a one-character difference). This comes at an important time: many users are now trying to decide whether or not to update their old MailMerges and WordStars to V3.3, and I expect that many are considering the MicroPro line or the addition of MailMerge. After reading this article, you may find that MagicBind is not only a more useful utility, but a real bargain as well.

Before getting into the many joys of MagicBind, let's take a quick look at the usual requirements. To run MagicBind, you need at least 48K of RAM, WordStar (or another standard ASCII text editor like T/Maker, WordMaster, P/Mate, Magic Wand, or Electric Pen-



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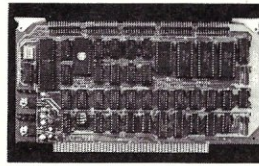


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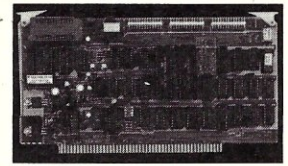
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# MagicBind

Continued from page 111

cil), CP/M-80 (a CP/M-86 version is in the works) or SB-80, and a Diablo 630/1650 compatible printer or a NEC Spinwriter. If your equipment satisfies these requirements, you can produce copy that has over 20% more text per page, and many people will not be able to distinguish it from typesetting, especially with a Diablo metal wheel (a small tip: Diablo plastic wheels work well, too).

MagicBind is, as you have probably surmised, a print formatter, among many other things. The new version for WordStar (1.11/W) will run from WordStar's "R" (Run another Program) command. This is a major improvement over the earlier version, which would only run out of CP/M. However, it will not allow you to edit one file and print another at the same time. Given MagicBind's many features, this isn't a serious limitation at all and can easily be overcome with a software or hardware spooler.

What, then, can MagicBind do, in addition to true proportional spacing and centering? For starters, it can do everything MailMerge can: it can respond

## MagicBind has all the features of MailMerge and much more—for the same price!

to all of WordStar's embedded print commands except that MagicBind has a more sensitive method of "kerning" or changing pitch, respond to all the standard dot commands (line height, etc.), and do it all easier and much faster. MagicBind can read data files created in WordStar's Document mode, not just the Non document mode, and it skips empty fields in data files automatically. MagicBind's merge commands are also much easier: instead of the ".RV" line

and ampersand delimiters, simply identify the data file (created the usual way) and pop in the number of the item of each field wherever it appears. Control-PA, a colon, and the number of the item. That's all there is to it, and there are none of MailMerge's annoying pauses while printing.

MagicBind can also do columns (speaking of another WordStar insecurity), multiple-line headers and "footers," automatic chapter and paragraph numbering, print-time record selection while merging, print-time insertion of formatting commands, and automatic handling of widow/orphan lines. Most of this is accomplished by using double dot (..) commands, allowing a file to have both MailMerge and MagicBind commands in it. As if all this weren't enough, MagicBind also has a system for automatically producing up to 15 footnotes per page with a maximum of 500 characters per note. Since Footnote (Digital Marketing) at \$125 is currently the only program that does this for WordStar, and since it does have limitations that aren't in MagicBind, many users may find this feature, by itself, enough justification to buy the program.

Believe it or not, there's even more! Two very nifty programs are included

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# MagicBind

Continued from page 113

with MagicBind: VERIFY and LABEL. VERIFY is used to check the accuracy of data files: no more of the hit-and-miss disasters discovered only at print time. LABEL is a real treasure. While installing it, the user specifies the type of labels most frequently used: four across, two across, whatever. This becomes the default (although there are other choices at print time). No more of the excessive dot commands that MailMerge demands for label formatting—just a simple control file for the merge with the data file, using the combination of Control-PA, a colon, and the item number.

It's rare to find a program as versatile and as easy to use as MagicBind. The manual is well written: the program's over 60 commands are clearly explained, and the menus are more than helpful. There are instructions for program modifications, and installation is a breeze. There is even room to get very creative with all the program's features.

MagicPrint is a smaller version of MagicBind, with all the print features, but none of the merge capabilities. Considering the \$55 difference, you'd be

**VERIFY checks data files—no more hit-and-miss disasters at print time!**

better off buying MagicBind instead of MagicPrint, unless you don't need the merge program.

Ben O. Jone, the creator of these programs, has also produced an indexing program for MagicBind and MagicPrint, called MagicIndex (necessary since both change the pagination, rendering such programs as StarIndex and Documate/Plus inaccurate in their pagination modes). When bought with MagicBind, MagicIndex is a real steal

for only an extra \$45 (as opposed to StarIndex at \$195). Computer EdiType is also working on a communications' program, MagicLink, and on an editor, MagicEditor. If these programs are as well conceived and as well coded as MagicBind, they, too, will be splendid!

*WordStar, MailMerge, and SpellStar are trademarks of MicroPro International, 33 San Pablo Ave., San Rafael, CA 94903; (415) 499-1200.*

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# SAL/80 from Protocols

**Keep your code  
under control  
and your  
programming  
understandable  
with SAL/80**

by Mike Barker

**O**n the one hand, structured languages often produce code that isn't too efficient in terms of space and time. On the other hand, assembly languages can be a haven for unstructured, unreadable, but efficient code. If you wanted to provide methods for writing structured assembly code and spent enough time with the macro capabilities of your favorite assembler, you might produce something like SAL/80. Of course, with SAL/80, you can just start writing the code for your program.

#### **The macro library**

SAL/80 version 2.1 is a macro library containing a variety of useful macros, including macros for selection (if-else, case), repetition (while, repeat, loop, do, for-until), flow-of-control (call, conditional calls), and various helpful utilities. It is intended for use with the MAC or RMAC assemblers from Digital Research, and requires a 64K 8080/Z80 system running CP/M 2.2.

The SAL/80 macro libraries contain a good collection of assembly language macros. The manual does not provide the easiest introduction to their

use, but with the original source listing provided in the manual and some experimentation, they are usable.

The utility macros in the SAL/80 libraries are, in part, adapted from those in the MAC library on Volume 24 of the CP/M Users' Group, and from other sources. They provide several varieties of console interaction, including console status, character or buffer input/output, binary converted to ASCII hex for output, and ASCII hex input converted to binary. Binary/hex and binary/decimal conversions are also included.

Utility macros for register/stack and register/memory manipulations, double-register subtracts and compares, and  $16 \times 8$ -bit multiply and divide routines act as extensions to the assembly language. Block moves, string search within a block, lower-to-upper case conversion, and string comparison macros complete the set of utilities.

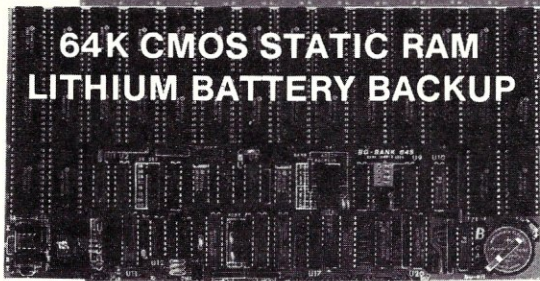
Although the utility macros are a kind of bonus in SAL/80, since the package focuses on structured assembly language programming, I would have liked a more complete set of utility macros, including interfacing to all the CP/M functions and a fuller set of string manipulations. The set of utility macros that is provided does not seem to have been as carefully designed and thought out as the set of structured lan-



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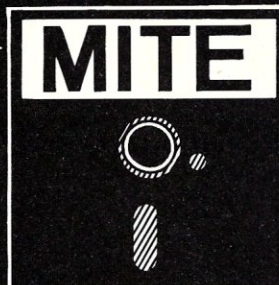
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# SAL/80

Continued from page 116

guage macros. For example, the lack of file-I/O macros forces you to write new code every time, or to write your own macros, or to use macros from yet another source.

## Documentation

The SAL/80 manual is (mostly) a hacker's explanation of an approach to programming and an example of that approach. The example uses the SAL/80 macros and assembly language. However, the description focuses on the approach, not the macros. I enjoyed this description as a working example of an approach to programming by one hacker—something that is often described abstractly, but rarely with the depth of concrete detail given here.

The manual includes a section describing the macros. This section is modeled on a syntactic description of a programming language that makes it difficult to see the macros for the syntax. I would like to see this section moved to an appendix (for those who like formal syntax descriptions). It could be replaced with a simple list or index of the macros, followed by single-

page descriptions of the macros, like those often used in language reference manuals. Each page could describe a macro structure and its parameters. This type of description is present, but is difficult to see in the current section.

## Why use SAL/80?

Programmer's tools like SAL/80 are measured by a simple question, "Why should I use it?"

SAL/80 can help assembly language programmers by providing code structures that encourage the use of structured programming techniques. Assembly languages can certainly be made friendlier by judicious use of macro libraries (some PDP-11 code seems to consist almost entirely of macros, using the well-developed libraries available for those systems).

If you have the MAC assembler (or RMAC), or if you have to write extremely fast or compact code, SAL/80 may be just the extra advantage you need. Or, if you want to learn about macros, the large collection in SAL/80 could be a useful introduction. Macros are a powerful, exciting feature in any language, and SAL/80 shows how helpful they can be.

Before you buy, decide what tools

you need for the job you want to do. If you decide that MAC or RMAC is what you need, then try SAL/80. It can help to keep your code under control, and your programming understandable. However, if you're trying to pick a structured language for programming, I would recommend a C compiler.

A lengthy "single system license agreement & support contract" of relatively normal format for microcomputers is included. The license does not indicate whether or not a royalty is required if you sell code produced using SAL/80. If you intend to use SAL/80 for serious production of salable software, you will need to negotiate a contract aimed at that production work.

Protools, a division of Newberry Microsystems, is registered with the U.S. Patent Office.


SAL/80 is a trademark of Newberry Microsystems and is available from: Protools, 24225 Summerhill Ave., Los Altos, CA 94022; (415) 948-8007.

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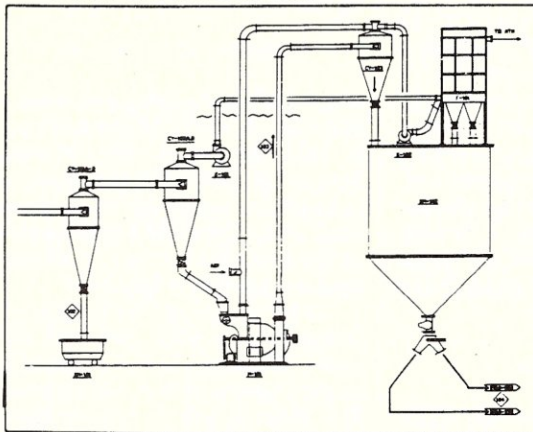
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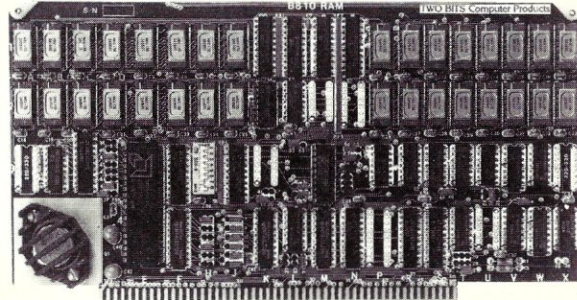
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---

# Mass Renaming by Filetype

**Rename files of one type to a different type using a single command**

by George M. Gallen

---

**O**ne major problem with the CP/M "REN" command is that you can't RENAME files of one type to a different type using a single command.

For example, if you wanted to RENAME all of your .ASM files to be .LIB files, you would have to go and RENAME them one at a time. You couldn't just type a command like:

```
REN *.LIB=*.ASM.
```

In essence this is what RENEXT (Rename extension) does: it will rename all files having a given filetype to files having the same names but a different filetype. Since RENEXT is not a CP/M function built into the operating system, the program must exist in every user area by which it is to be used. Once the program has been assembled (using ASM.COM) and turned into a .COM file (using LOAD.COM or DDT.COM), it can then be executed.

To use ED.COM, ASM.COM, DDT.COM, and LOAD.COM, see your CP/M manual. The RENEXT format is:

```
RENEXT [D:] Sext Dext
```

where [D:] is the drive you want to rename on (A: to P:). If you don't put one in, then the default drive is assumed. Sext is the SOURCE extension or the extension to search for when renaming. Dext is the DESTINATION extension or the extension to rename to once the source extension is found.

The program will display the filename as it was, and then its new name. If it comes across a filename that already exists, it *will not* rename that file. What it will do is stop execution and beep to let you know that this file already exists under the new extension. A sample session would look like this:

```
RENEXT ASM LIB (rename all
                    .ASM files to
                    .LIB files)
RENAMING TEST.ASM TO
TEST.LIB
RENAMING RENEXT.ASM TO
RENEXT.LIB
RENAMING ROUTINES.ASM TO
```



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# MASS RENAMING

Continued from page 120

ROUTINES.LIB  
DONE...

Now, if the file ROUTINES.LIB were already on disk, it would look like:


```
RENEXT ASM LIB (rename all
                 .ASM files to
                 .LIB files)
RENAMING TEST.ASM TO
TEST.LIB
RENAMING RENEXT.ASM TO
RENEXT.LIB
THE FILE ROUTINES.ASM ALREADY
EXISTS.
PROCESSING HALTED. ALL FILES
MAY NOT BE RENAMED
```

And you are returned to CP/M.

If you are on drive A: and you want to rename the files on B:, the format is:

```
RENEXT B:ASM LIB
```

Note that you only have to put the drive number on the source extension.

That's about it. If any problems do occur, please contact me. 

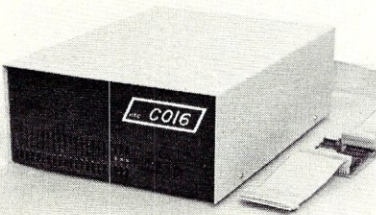
George M. Gallen, P.O. Box 17622, Philadelphia, PA 19135

```
PROGRAM BY GEORGE M GALLEN
NE SOFTWARE DEV
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PHILADELPHIA, PA. 19135

ANY PROBLEMS OR QUESTIONS ABOUT THIS PROGRAM
CAN BE SENT TO THE ABOVE ADDRESS.
```

```
0100          ORG      0100H
START:
0100 210000   LXI     H,0
0103 39       DAD     SP
0104 224803   SHLD   STACK
0107 216A03   LXI     H,STKTOP
010A F9       SPHL
; SAVE OLD STACK AND SET A NEW STACK
010B 3A5D00   LDA     FCB0+1
010E FE20     CPI     ' '
0110 CA1902   JZ      BF
0113 3A6D00   LDA     FCB0+17
0116 FE20     CPI     ' '
0118 CA1902   JZ      BF
; CHECK TO SEE IF BOTH EXTENSIONS WERE SUPPLIED
011E 215D00   LXI     H,FCB0+1
011E 112802   LXI     D,FCB1+9
0121 010300   LXI     B,3
0124 CB3D03   CALL   LDIR
0127 215D00   LXI     H,FCB0+1
012A 114802   LXI     D,FCB3+9
012D 010300   LXI     B,3
0130 CB3D03   CALL   LDIR
; MOVE THE SOURCE EXTENSION TO TWO SPOTS
0133 216D00   LXI     H,FCB0+17
0136 113802   LXI     D,FCB2+9
0139 010300   LXI     B,3
013C CB3D03   CALL   LDIR
; MOVE THE DESTINATION EXTENSION.
013F 3A5C00   LDA     FCB0
0142 321F02   STA     FCB1
0145 323F02   STA     FCB3
0148 326202   STA     FCB5
; GET THE DRIVE# AND STORE IT.
ENLOOP:
```

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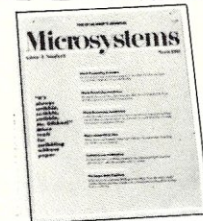


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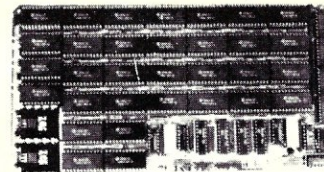
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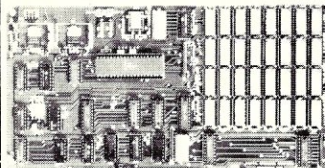
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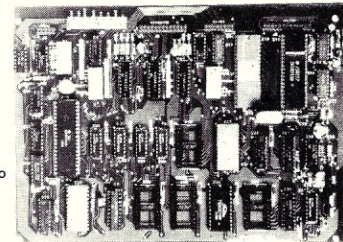
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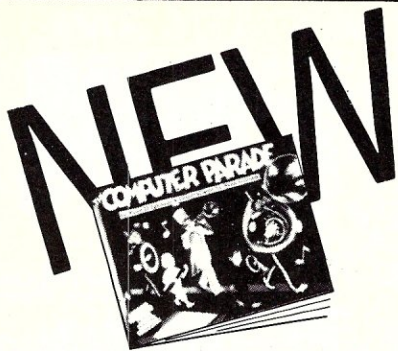
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## MASS RENAMING

Continued from page 122

```

014B 213F02      LXI    H,FCB3
014E 115C00      LXI    D,FCB0
0151 012300      LXI    B,35
0154 CD3D03      CALL   LDIR
0157 0E0F        MVI    C,OPEN
0159 115C00      LXI    D,FCB0
015C CD0500      CALL   BDOS
; FIND THE FIRST FILE OF THE TYPE "??????.[EXT]"
015F FEFF        CPI    OFFH
0161 CA0C02      JZ     ENDIT
; IF ERROR=255 THEN THERE ARE NO MORE FILES OF THAT
; EXTENSION. PROGRAM IS FINISHED.
0164 215D00      LXI    H,FCB0+1
0167 112002      LXI    B,FCB1+1
016A 010800      LXI    B,8
016D CD3D03      CALL   LDIR
0170 215D00      LXI    H,FCB0+1
0173 113002      LXI    D,FCB2+1
0176 010800      LXI    B,8
0179 CD3D03      CALL   LDIR
; MOVE THE FILENAME (NOW WITHOUT "??") WITHOUT EXTENSIONS
; TO THE APPROPRIATE SPOT. THE EXTENSION WERE PUT IN
; ALREADY IN THE BEGINNING OF THE PROGRAM.
017C 0E10        MVI    C,CLOSE
017E 115C00      LXI    D,FCB0
0181 CD0500      CALL   BDOS
; NOW CLOSE ORIGINAL FILE.
0184 213002      LXI    H,FCB2+1
0187 116302      LXI    D,FCB5+1
018A 010800      LXI    B,11
018D CD3D03      CALL   LDIR
0190 214B02      LXI    H,FCB3+12
0193 011700      LXI    B,23
0196 CD3D03      CALL   LDIR
; SET UP A FCB FOR NEW FILE WITH NEW EXTENSION
0199 216202      LXI    H,FCB5
019C 115C00      LXI    D,FCB0
019F 012300      LXI    B,35
01A2 CD3D03      CALL   LDIR
01A5 115C00      LXI    D,FCB0
01A8 0E0F        MVI    C,OPEN
01AA CD0500      CALL   BDOS
01AD FEFF        CPI    OFFH
01AF CAD301      JZ     CONT
; IF THE FILE DOES NOT EXIST, GOOD. THEN IT CAN
; BE RENAMED TO THAT NAME. IF IT DOES EXIST
; THEN WE CAN'T PROCEED ANY FURTHER.
01B2 0E10        MVI    C,CLOSE
01B4 115C00      LXI    D,FCB0
01B7 CD0500      CALL   BDOS
; CLOSE UP THE FILE, THEN DISPLAY MESSAGE, THEN LEAVE
01BA 213002      LXI    H,FCB2+1
01BD 11E602      LXI    D,MSG7
01C0 010800      LXI    B,8
01C3 CD3D03      CALL   LDIR
01C6 13          INX    B
01C7 010300      LXI    B,3
01CA CD3D03      CALL   LDIR
; PREPARE MESSAGE WITH THE CORRECT FILE THAT
; GAVE US THE PROBLEM
01CD 11E102      LXI    D,MSG8
01D0 C30F02      JMP    HOME
; DISPLAY THIS MESSAGE.
CONT:
01D3 0E17        MVI    C,RNM
01D5 111F02      LXI    D,FCB1
01D8 CD0500      CALL   BDOS
; TELL BDOS TO RENAME THE OLD FILE TO THE SAME NAME
; BUT WITH A DIFFERENT EXTENSION.
01DB 212002      LXI    H,FCB1+1
01DE 118F02      LXI    D,MSG3
01E1 010800      LXI    B,8
01E4 CD3D03      CALL   LDIR
01E7 13          INX    D
01EB 010300      LXI    B,3
01EE CD3D03      CALL   LDIR
01F0 213002      LXI    H,FCB2+1
01F1 119F02      LXI    D,MSG4
01F4 010800      LXI    B,8
01F7 CD3D03      CALL   LDIR
01FA 13          INX    D
01FB 010300      LXI    B,3
01FE CD3D03      CALL   LDIR
; PREPARE MESSAGE WITH APPROPRIATE FILE
; NAME AND EXTENSIONS TO LET US KNOW
; WHAT IT IS DOING.
0201 0E09        MVI    C,PNTSTR
0203 118502      LXI    D,MSG1
0206 CD0500      CALL   BDOS
0209 C3A801      JMP    RNLOOP
; DISPLAY THE MESSAGE, THEN PROCESS THE NEXT
; FILE.
ENDIT:

```



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# MASS RENAMING

Continued from page 124

```

020C 11AE02          LXI    D,MSG5
                   ; THAT'S IT. WERE DONE. PREPARE DONE MESSAGE
                   ; THEN DISPLAY IT.
                   HOME:
020F 0E09           MVI    C,PNTSTR
0211 CD0500         CALL   BDOS
0214 2A4803         LHL   STACK
0217 F9             SPHL
0218 C9            RET
                   ; DISPLAY APPROPRIATE MESSAGE (ERROR,SUCCESSFULL,BAD FORMAT)
                   ; THEN RESET THE STACK TO WHAT IT WAS THEN *RET* TO CP/M
                   ; THIS RETURN DOES NOT DO A WARM OR COLD BOOT. IT JUST
                   ; GOES BACK TO THE *A>* OR WHATEVER DRIVE IT WAS ON.
                   BF:
0219 11BA02         LXI    D,MSG6
021C C30F02         JMP    HOME
                   ; GET READY TO DISPLAY *BAD FORMAT* MESSAGE THEN EXIT.
0017 =             RNM    EQU    23
0010 =             CLOSE  EQU    16
000F =             OPEN  EQU    15
0009 =             PNTSTR EQU    9
005C =             FCBO  EQU    5CH
0005 =             BDOS  EQU    5
                   ; SYSTEM CALL EQUATES AND OTHER MISC. EQUATES.
                   FCB1:
021F 00            DB     0
0220 3F3F3F3F3F   DB     '????????'
0228 3F3F3F       DB     '???'
022B 00000000     DB     0,0,0,0
                   FCB2:
022F 00            DB     0
0230 3F3F3F3F3F   DB     '?????????'
0238 3F3F3F       DB     '???'
023B 00000000     DB     0,0,0,0
                   FCB3:
023F 00            DB     0
0240 3F3F3F3F3F   DB     '?????????'
0248 3F3F3F       DB     '???'
024B 0000000000   DB     0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
                   FCB5:
0262 00            DB     0
0263 3F3F3F3F3F   DB     '?????????'
026B 3F3F3F       DB     '???'
026E              DS     23
                   ; MISC. FCB'S USED BY PROGRAM FOR SCRATCH AREA (USED TO
                   ; OPEN THE '????' FILE , DETERMINE IF DESTINATION FILE
                   ; IS ALREADY EXISTENT, AND IF NOT RENAME IT.
                   MSG1:
0285 52454E414D   DB     'RENAMEING '
                   MSG3:
028F 2020202020   DB     ' ' ; 8 spaces
0297 2E           DB     ' ' ; 3 spaces
0298 202020       DB     ' ' ; 3 spaces
029B 20544F20     DB     ' TO '
                   MSG4:
029F 2020202020   DB     ' ' ; 8 spaces
02A7 2E           DB     ' ' ; 3 spaces
02AB 202020       DB     ' ' ; 3 spaces
02AB 0D0A24       DB     13,10,'$'
                   MSG5:
02AE 444F4E452E   DB     'DONE.....',13,10,'$'
                   MSG6:
02BA 2A20424144   DB     '* BAD FORMAT *',13,10
02CA 52454E4558   DB     'RENEXT CD:TEXT EXT',13,10,10,7,'$'
                   MSG8:
02E1 5448452046   DB     'THE FILE '
                   MSG7:
02EA 2020202020   DB     ' ' ; 8 spaces
02F2 2E           DB     ' ' ; 3 spaces
02F3 202020       DB     ' ' ; 3 spaces
02F6 20414C5245   DB     ' ALREADY EXISTS. ',13,10
0309 50524F4345   DB     'PROCESSING HALTED. ALL FILES MAY NOT BE RENAMED'
0338 0D0A0A0724   DB     13,10,10,7,'$'
                   ; MISC. SYSTEM MESSAGES TO LET YOU KNOW WHAT IS GOING ON.
                   LDIR:
033D 7E           MOV    A,M
033E 12           STAX  D
033F 23           INX  H
0340 13           INX  D
0341 0B           DCX  B
0342 78           MOV  A,B
0343 B1           ORA  C
0344 C8           RZ
                   ; THIS ROUTINE *SIMULATES* A Z-80 *LDIR* FUNCTION
                   ; NOTE: THIS ROUTINE *DOES NOT* REQUIRE YOU HAVE
                   ; A Z-80 MICROPROCESSOR. AN 8080 WILL HANDLE IT FINE
                   ; DUE TO THE FACT THAT IT IS NOT AN *LDIR* IT JUST
                   ; DOES THE SAME THING.
0345 C33D03       JMP    LDIR
0348 0000         STACK DB 0,0
034A             DS    32
036A =           STKTOP EQU $
036A             ; THE STACK GETS RESET TO HERE (16 LEVELS, 32 BYTES)
                   END
    
```



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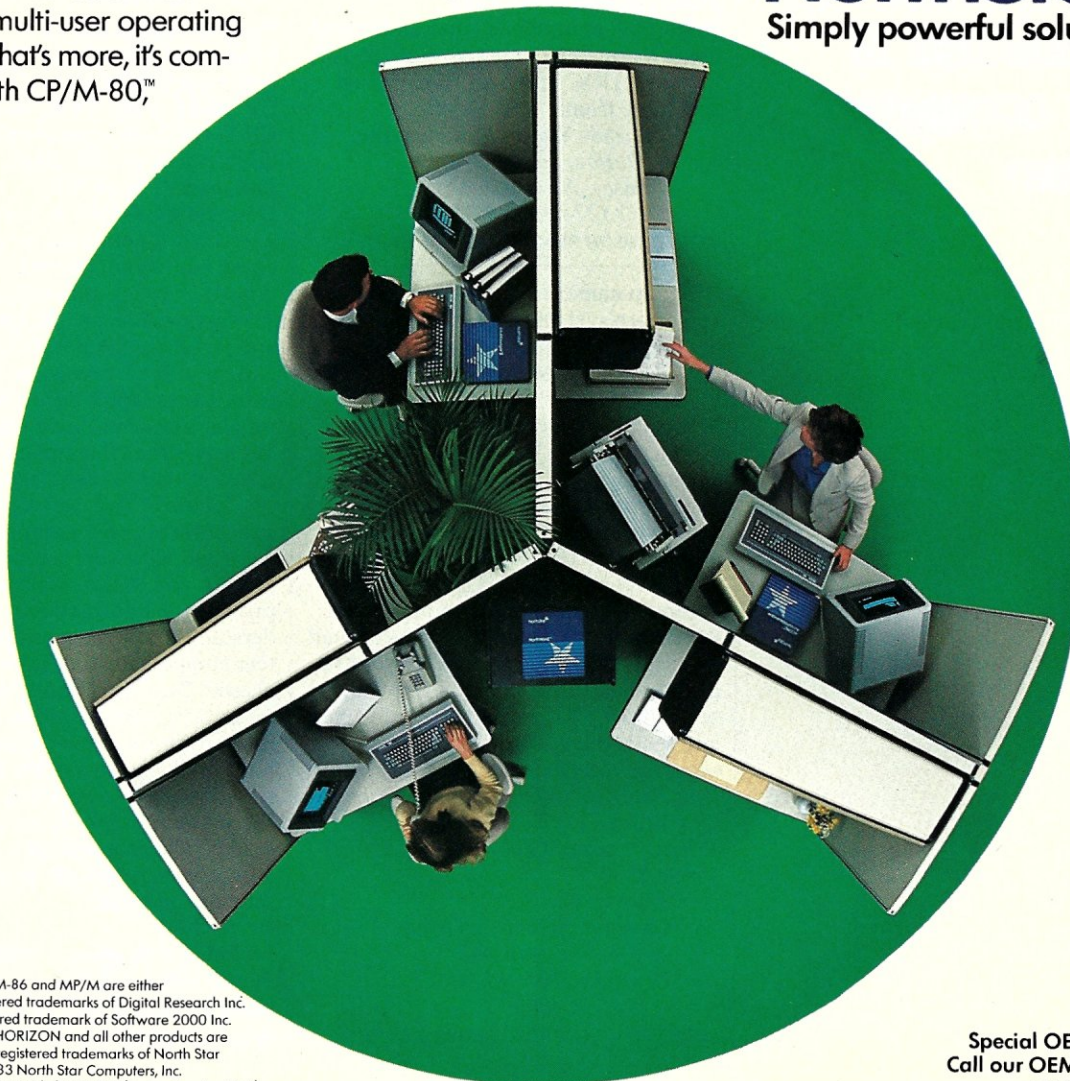
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# Software



# Directory

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**Program name:** DataCURE: Error-correction disk backup/restore utility.  
**Hardware system:** 8080/Z80; CP/M 2.2; 8" drive

**Minimum memory:** 48K

**Language:** 8080 Assembler with some Fortran.

**Description:** dataCURE is a utility program to ensure the integrity of data or programs on archive or interchange disks. It uses very powerful proprietary error-correction algorithms.

DataCURE rebuilds files affected by bad sectors, restoring the original data to replacement sectors. It can regenerate a complete track, including the directory track.

Information for detecting bad sectors and correcting the data in them is kept in duplicate "protection" files occupying about 5% of disk space.

DataCURE supports all CP/M compatible formats and sector sizes. It is self configuring, with both menu and command modes, and gives English-language error messages.

**When released:** May 1983

**Price:** \$99, including 8" disk and bound user's manual. Demo disk priced at \$19; includes .DOC file. Add \$5 shipping.

**Available from:**

**Colorado Online Systems, Inc.**  
40 Balfour Lane  
Ramsey, NJ 07446  
(201) 327-5155

**CIRCLE 310 ON READER SERVICE CARD**

**Program name:** TXL: Telex Link

**Hardware system:** A modem; runs on any microcomputer with CP/M, CP/M-86, MP/M, MP/M II, MP/M-86, MS-DOS

**Minimum memory:** 48K (8-bit); 64K (16-bit)

**Language:** C

**Description:** TXL is a telecommunications package to interface most microcomputers to the Western Union Telex II (TWX) network. TXL allows your computer to function as an intelligent telex station, replacing the conventional paper tape telex machine. Edit your telex messages to perfection using your text editor. TXL automatically formats and sends them. Incoming telex messages are received, displayed, stamped with date and time and then written to disk storage.

**When released:** 1979

**Price:** \$350

**Available from:**

**Cawthon Scientific Group**  
24224 Michigan Ave.  
Dearborn, MI 48124  
(313) 565-4000

**CIRCLE 311 ON READER SERVICE CARD**

**Program name:** CTL: Computer Telex Link

**Hardware system:** A modem; any microcomputer with CP/M, CP/M-86, MP/M, MP/M-II, MP/M-86, MS-DOS

**Minimum memory:** 48K (8-bit); 64K (16-bit)

**Language:** C

**Description:** Computer Telex Link is a communications program designed specifically for use with Western Union's EasyLink service. With your personal computer, CTL, and an EasyLink account you can conveniently send and receive messages to and from any telex station anywhere in the world. In addition, You can originate mailgrams, telexgrams, and international cables. CTL is delivered complete and ready to run. No user software patching is required.

**When released:** 1982

**Price:** \$165

**Available from:**

**Cawthon Scientific Group**  
24224 Dearborn, MI 48124  
(313) 565-4000

**CIRCLE 312 ON READER SERVICE CARD**

**Program name:** GINA +

**Memory and hardware requirements:** 64K with CP/M-80 or 128K with CP/M-86 or PC-DOS, an 80-column CRT; two high-capacity double-sided double-density disk drives.

**Language:** Pascal MT +

**Description:** GINA + is a software program that functions as a point-of-purchase microcomputer retail sales assistant. It is designed to help the salesperson educate, acclimate, qualify, and instill confidence in apprehensive and/or curious prospects. GINA + helps the prospect decide which of the retailer's systems could meet his needs, but leaves the "fine tuning" and personalized selling to the salesperson.

The GINA + software system consists of three major components: 1) software and hardware tutors, 2) the consultant, and 3) the proposal. The tutors provide the information required to understand the purpose and use of the system components that need to be purchased. The consultant conducts an interview to obtain information on what is to be done by the system, as well as how much and how often. Follow-up information is also obtained. Based upon the answers supplied, a proposal is generated. The proposal then serves as a model upon which the prospect and salesperson build.

**Price:** \$495

**Included with price:** a program to configure GINA + for your terminal, a customizer that allows the dealer to input specific items from his inventory by



brand name, the GINA+ system, and documentation.

**Available from:**

**System Vision Corporation**  
199 California Drive, #207  
Millbrae, CA 94030  
(800) 352-9999 or  
(415) 697-3861

CIRCLE 313 ON READER SERVICE CARD

**Program name:** Informail

**Hardware system:** IBM VMCMS

**Minimum memory:** 256K

**Description:** Informail is a proprietary electronic mail system offered to time-sharing users of the Informatics data center. It provides each user with an electronic mailbox which acts as a storage device, backs up all files automatically, and only permits users to read mail sent to their own mailbox ID. The directory function allows mail to be addressed to a user's name if the Informail ID is unknown. Even if the user does not supply exact spelling, the directory recognizes names of recipients by abbreviations, partial names and phonetic spelling. When a perfect match is not found, the system presents the user with a list of options. The directory also contains information about organizational structure and allows the user to request the names of all employees reporting to a particular manager. The directory can also create distribution lists for future use. The system's create function

---

**Informail's directory recognizes abbreviations, partial names, and phonetic spellings.**

---

prompts the user for standard memo fields and text entry. A send feature allows the user to specify each receiver's mailbox ID. A read capability allows the user to receive mail from other system users. Mail may be directed to the terminal, the printer or disk. The modify function permits the user to cancel any mail received and add or delete names and IDs from a distribution list. A list of outgoing mail can be created including subject, date and time sent, intended receiver and information on

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CIRCLE 209 ON READER SERVICE CARD



## SOFTWARE

Continued from page 129

whether mail has been read or cancelled.

**Price:** \$25 per hour

**Available from:**

**Informatics General Corporation**  
6 Kingsbridge Road  
Fairfield, NJ 07006  
(800) 631-1156

CIRCLE 314 ON READER SERVICE CARD

**Program name:** SmartKey II

**Hardware system:** any microcomputer running CP/M; the IBM PC

**Minimum memory:** SmartKey II: 4.25;

SmartPrint: 4K (2.2K when run with SmartKey II)

**Language:** Some Assembler, some C

**Description:** SmartKey II is a background utility program that allows the user to customize a microcomputer keyboard to reflect software needs. All keys may be redefined at will to become other characters, software commands, or whole words, phrases or boilerplates. Definitions may be changed at any time and saved to disk. Features of SmartKey II include instantaneous installation of special function keys, an expanded buffer capable of handling 3,750 definitions at a time, a text compiler that can reduce entire text files to a sin-

gle keystroke, and a built-in editor for complex reorganization of key definitions. SmartPrint, an upgrade to SmartKey II, enables users to implement all of a printer's built-in functions and character sets.

**Price:** SmartKey II: \$89.95

SmartPrint: \$49.95

Both programs together: \$129.95

**Available from:**

**Heritage Software**  
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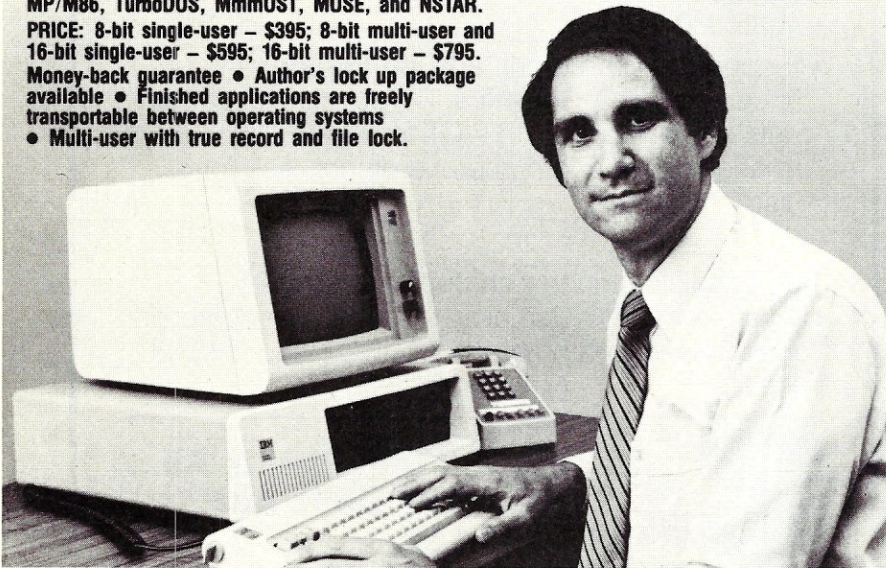
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CIRCLE 196 ON READER SERVICE CARD

**Program name:** MICA General Ledger Package

**Hardware system:** MS-DOS or PC-DOS

**Language:** MBasic

**Description:** The MICA General Ledger Package was designed for first-time users and offers many easy-to-use features, such as on-line help screens, formatted data entry screens, full screen editing during input, extensive error trapping, and batch entry with proofing prior to updating permanent records. The package comes with a comprehensive user's manual that is a self-teaching guide for all aspects of program setup and operation. The chart of accounts is totally user-definable, with account numbers ranging from three to six digits. Departmentalization of revenue and expense accounts is permitted for up to

## Departmentalization of accounts is allowed for 99 departments.

99 departments. MICA General Ledger also has master/sub account relationships to provide flexibility in formatting the balance sheet and the P&L statements. Reporting flexibility is also provided through the grouping of accounts in up to 20 user-definable account categories including a special category for nonoperating format, and is balance-verified by the computer to eliminate an unbalanced ledger situation. Transaction entry is also performed in batch mode which enables the user to print a data entry proof and make corrections prior to updating permanent account



balances.

Available from:

Micro Associates, Inc.

2300 Highway 365, #510, LB 131  
(409) 724-6583

CIRCLE 316 ON READER SERVICE CARD

Program name: MITE/MS

Hardware system: any microcomputer running IBM PC-DOS or MS-DOS

Minimum memory: 64K

Language: Assembler

Description: MITE/MS is a menu-driven data communications package that converts any computer into an intelligent terminal for use with online services such as Dow Jones, The Source, CompuServe, TWX and for transferring both text and binary files between 8 and/or 16-bit microcomputers.

MITE/MS can also be used to access

corporate data centers. It has user-protection features that prevent operator errors. All communications parameters (parity, baud rate, etc.) are under full user control on all versions. Various user-selectable options allow MITE/MS to capture text from or send text to virtually any asynchronous/ASCII online system. The user may also define up to 10 programmable macro strings which can be invoked via function keys from within the link. This mechanism also sports fully automatic logon on most systems. A full set of system interface functions (DIR, TYPE, etc.) are available from within MITE/MS. It also supports three binary file protocols, (XMODEM, CLINK, CROSSTALK, and HAYES) for compatibility with the largest possible number of other pro-

grams. These protocols allow transfer of any file with error checking and automatic retransmission. MITE/MS is now available preinstalled on the IBM PC-XT, Columbia, Compaq, Corona, VICTOR and on other MS-DOS systems. MITE, the CP/M-80 version, is available on Xerox, Exxon, Sanyo, TeleVideo, Heath/Zenith, KayPro, North Star, Radio Shack, and others. MITE/86, the CP/M-86 version, is available on many CP/M-86 machines.

Price: \$195

Included with price: 5' disk and reference manual

Available from:

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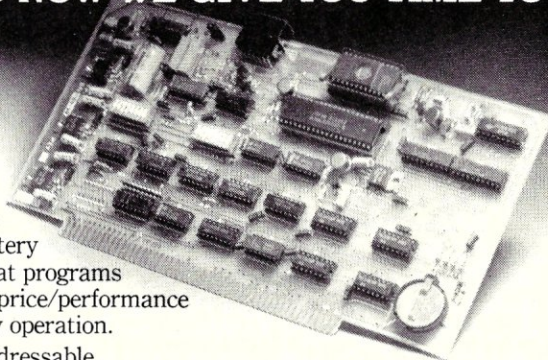
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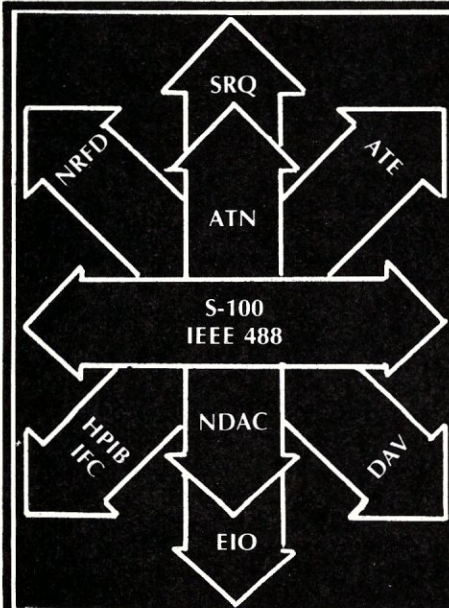
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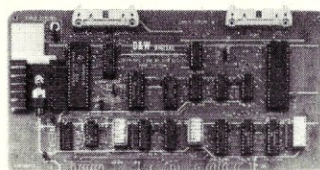
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# New Products

**What's new:  
a quick roundup  
of recent  
innovations and  
improvements**

## Hard disk systems for CP/M

CFX Disk Systems, Inc., formerly a part of CF CompuTrax, has announced the release of its first two hard disk systems for CP/M machines: the CFX-10 and the CFX-16. Both these systems incorporate a 5 $\frac{1}{4}$ " Miniscribe hard disk.

These systems are currently available for most Z80- or 8080-based machines running CP/M and having the Digital Research utility MOVCPM.COM. Additionally, special models are available for the NEC 8000, Apple II and III, and the IBM PC. Setup and use is fast and simple. Both systems included a manual that gives step-by-step instructions for adding the adapter to the computer and a complete explanation of the software sold with the disk. The software is used not only to format, verify, and run the system, but also to check out the disks, controller card and buffer in the event a problem should arise.

The CFX-10 disk system is actually a 12 MB disk which, when formatted, yields 10 MB of usable space. The CFX-16 disk system is based on a 20 MB disk before formatting.

**Prices:** Current mail order pricing is \$1,995 for the CFX-10 and \$2,395 for the CFX-16. Future products will include a tape backup system for the hard disk, 40 MB formatted to 32 MB—to be called the CFX-32—and chaining up to four disks for even greater storage.

**CFX Disk Systems, Inc., P.O. Box 920152, Norcross, GA 30092; (404) 255-3030.**

**CIRCLE 320 ON READER SERVICE CARD**

## High-performance hard disk drives

Percom Data Corporation has announced the release of a new generation of high-performance PHD™ hard disk drives for a variety of personal computers. The new product line will provide speed enhancements and one of the most efficient implementations of memory caching available today.

Percom Data claims to have improved on Winchester technology by implementing a very efficient form of caching driver. Their design permits speed performance increases four times greater than that of key competitors. Percom's benchmark tests show that the PHD hard disk product line is more than five times faster in data transfer than the IBM XT hard disk. The new hard disks are fast, responsive and flexible in performance.

Caching design permits the Percom Data hard disk drive to work with the

host computer so that most used files are actually stored and processed in memory—to increase speed—then transparently returned to hard disk memory for data security.

This will benefit sophisticated users, programmers, office managers, network resource managers, and anyone anticipating future applications with multitasking, multiuser functions.

The new Percom Data PHD product line is immediately available for the IBM-PC, and supports PC DOS 2.0. High-performance PHDs for IBM-compatible microcomputers will soon be available.

**Prices:** Caching driver "personality kit," \$149.95. Percom PHD hard disk subsystems will continue to be priced from \$1,895 (for a 5 MB version) and up. A caching driver software upgrade kit is also available direct from Percom Data for \$50. This will enable present Percom IBM DOS 2.0 PHD owners to upgrade to the high-performance version. Cost of the upgrade package is \$50 and is available only from Percom Data. Minimum memory requirement: 256K RAM.

**Percom Data Corp., 11220 Pagemill Rd., Dallas, TX 75243; (214) 340-5800.**

**CIRCLE 321 ON READER SERVICE CARD**

## 16-bit SBC built around Intel 80126

Advanced Digital has announced the introduction of the SUPER 186™, the first 16-bit S-100 single board computer built around the Intel 80186. The 8 MHz SUPER 186 can be configured as a stand-alone bus master or bus slave to serve both single or multiple users with superior speed, versatility, and reliability.

SUPER 186 features 256 KB of memory, expandable to 1 MB, and a floppy disk drive controller that can simultaneously support both 8" and 5 $\frac{1}{4}$ " disk drives. It also comes with four serial RS-232 and two parallel I/O ports, DMA controller, parity and monitor EPROM to aid in initial loading. The board is compatible with CP/M-86, MP/M86, Turbodos and MS-DOS operating systems. Performance of existing CP/M-86 systems can be improved by as much as 2 $\frac{1}{2}$  times with SUPER 186.

In a TurboDOS environment, SUPER 186 can also function as a powerful 8/16-bit bus slave. By using the SUPER 186 for large processing demands, the user frees the remaining, less-powerful boards for other tasks, while the SUPER 186 board rapidly completes the assigned job.

**Price:** \$1,650; quantity discounts available for OEMs and independent sales organization.



SUPER 186 is the latest addition to Advanced Digital Corporation's S-100-based modular microcomputer line that includes SUPER SYSTEM II, one of the most powerful multiuser microcomputer systems available; SUPER STAR, the first S-100 system with both a fixed and removable Winchester drive and expandable to four users; SUPER SIX (16 MHz, Z80-based) and SUPER QUAD (4MHz, Z80-based) 8-bit, single board computers; SUPER SLAVE, a powerful single-board processor; and a compact, microprocessor-based hard disk controller.

**Advanced Digital Corp., 5432 Production Drive, Huntington Beach, CA 92649; (714) 891-4004.**

**CIRCLE 322 ON READER SERVICE CARD**

### Disk subsystems

PH Associates, Inc. has announced three new additions to its continuing disk subsystem product line. The DSS-5B, DSS-10B, and DSS-15B are designed to provide economical disk storage for those users not requiring the high performance (capacity and speed) of the MARK series. These 85 ms average access drives use industry standard Seagate ST-400 series compatible drives. The DSS series comes as a complete subsystem assembled in its own stand-alone chassis or in OEM versions consisting of drive, cables and controller for use by system integrators.

The subsystems include a smart controller with intelligent formatting and automatic alternate sectoring. Features include • 85 ms average access speed (buffered seek) • 90-day parts and labor warranty on *both* the controller and the disk unit, including heads and platter • 5 1/4" floppy physical size compatibility • 5, 10, and 15 MB disk capacities (formatted) • Heat dissipation less than 40 watts • Interfaces to DEC Q-BUS, S-100, and any Z80 processor such as the Northstar Advantage, Apple IBM PC, TRS-80, Zenith Z-100, Motorola VME BUS, Multibus, and NEC as well as any 8-bit parallel port • Complete software currently available for CP/M and Apple, TRS-0, NEC, IBM-PC • 5 megabit per second disk transfer rate.

**Prices:** Formatted capacities of 5, 10 or 15 MB are available with list prices of \$1,995, \$2,295, and \$2,695 respectively. Significant quantity and OEM discounts are available.

**PH Associates, 8720 Old Courthouse Rd., Vienna, VA 22180; (703) 281-5762.**

**CIRCLE 323 ON READER SERVICE CARD**

### Stand-alone array processor for APL software

Anallogic Corporation has an-

nounced the APL Machine, the first stand-alone general-purpose computer system using array architecture to deliver mainframe APL performance at a fraction of the cost. Featuring the interaction and response of a personal computer, the APL Machine is a convenient yet powerful development tool for high-level decision making. Designed to replace traditional costly and less flexible methods of processing APL, the APL machine can be used for strategic planning and forecasting, as well as financial, actuarial, graphics animation, and scientific applications.

A typical configuration consists of a 4 MB array processor, an IBM PC as the programmer's workstation, a 124 MB hard disk, a dual-mode tape drive, an I/O processor supporting up to 8 terminals, and the Anallogic software system. System architecture supports several levels of overlapped and parallel processing, permitting a very high level of performance and throughput.

While the APL interpreter runs in the 12.5 MHz 16/32-bit super micro control processor, handling all of the aspects of syntax and conformance checking, the array portion of the machine concurrently executes arithmetic and logical expressions. Moreover, it pro-

vides several high-speed processing elements executing additions, multiplications, and logical operations at the same time. The APL Machine's array processor can execute up to 10 million full floating-point operations per second. Because of hardware design efficiencies, pipeline throughput is competitive with machines rated at 15 million operations per second.

The Anallogic 32-bit floating-point array processor used in the APL Machine is also programmed directly in APL. Since the primitive functions and operators of APL reside in pipeline microcode, high-speed execution in most applications is achieved directly from APL. For applications using different software such as compiled or assembled code, Anallogic's APL implementation provides shells to incorporate the non-APL code. These "shells" are similar to UNIX shells and handle non-APL code in the same manner as if it were written in APL.

The Anallogic multiuser, virtual memory APL environment is designed to bypass the need for setting up independent workspaces and files. A sophisticated memory manager allows the user to nest applications and to share code among concurrent processes.

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## NEW PRODUCTS

Continued from page 133

A sophisticated operating environment on the PC workstation, designed by Analogic and called InSight, allows the user to display up to 10 concurrently running tasks on overlapping and sliding windows. The PC environment is itself a multitasking, virtual memory system that communicates to the array processor through a packet protocol. Its capabilities extend to using the PC for concurrent interaction with multiple processes on multiple systems.

Analogic is engaged in the design and manufacture of high-precision data conversion products, medical imaging systems, control instrumentation, and signal processing computer equipment.

Prices for a basic APL Machine with 1/2 megabyte of memory start at \$44,000. The typical system described above is about \$85,000.

**Analogic Corp., Audubon Rd., Wakefield, MA 01880; (617) 246-0300.**  
CIRCLE 324 ON READER SERVICE CARD

### Sierra Data Sciences 8 MHz micros

Sierra Data Sciences is producing two new S100 bus, Z80H single-board computers (SBCs). The boards, a master (SBC 100/8M) and a slave (SBC 100/8S) are the first production-run SBCs to feature 8 MHz speeds. In addition, this new generation of high-speed, very powerful microcomputers takes full advantage of the design benefits offered by the IEEE-696/S-100 bus standard for exceptional throughput rates. Typically, there is a 100% increase: SBCs operating under the latest versions of Sierra Data-supported CP/M or TurboDOS are significantly faster than most 8-bit micros.

On board each standard SBC, master or slave, is a Z80H central processor with 64 to 512K RAM, bank selectable in 8K segments. Additional support chips include DART for two serial ports, 4K to 32K EPROM, and an optional math coprocessor.

Two parallel ports and clock timing are provided for on the master via Zilog CIO. Similar functions are handled through a PIO and a CTC on the slave. The slave also features a 4K static RAM buffer for high-speed 8- or 16-bit bus transfers and upward compatibility to 16-bit systems.

The master uses a DMA controller that provides for very fast data transfers without CPU intervention and no wait states. Disk reads, for example, are typically 200 to 500% faster. DMA transfers are possible when moving data from master memory to slave memory and from master to or from floppy disk or

hard disk. Additionally, a floppy disk controller that can simultaneously run 5 1/4" and 8" media is another onboard feature. A high-speed Winchester DMA port is also standard.

Built for speed and functional reliability, the SBCs are multilayer boards with separate ground and power planes. Yet both boards meet the IEEE-696/S-100 standard and therefore fit any compatible system.

In stand-alone configuration, the master makes an exceptionally powerful system for personal computing or standard data processing tasks. Applications requiring high-speed real-time monitoring, dedicated process control and communications are especially well suited to the new SBCs.

Prices: Standard boards (128K RAM) are "quantity-one" priced at \$995 for the SBC 100/8M and \$895 for the SBC 100/8S.

**Sierra Data Sciences Inc., 25700 First Street, Westlake, OH 44145; (216) 892-1800.**

CIRCLE 325 ON READER SERVICE CARD

### "Watchdog" timer added to multipurpose Q-Bus board

Codar Technology, Inc., has announced a new version of its Q-Timer™ single-board system module that adds a watchdog timer to existing functions such as a calendar clock and nonvolatile CMOS memory.

Designed for integrators of real-time systems based on the DEC family of microprocessors, the dual-wide Q-Timer board is the only product of its kind with complete software support stored in an on-board EPROM. The board provides built-in compatibility with DEC's 16, 18 and 22-bit bus architectures and, in some instances, can replace up to four dual-wide modules.

The watchdog timer makes the Q-timer particularly suitable for unattended or remote operations in that it will reboot a system if program execution stops because of a noncatastrophic problem, such as a bad memory cell, static discharge, or a failure to transfer data from a peripheral device.

If, for some reason, a programmed instruction is not completed, the machine may sit there and wait forever unless a person or an escape technique intervenes. The watchdog device will automatically activate power-fail/restart logic if a user program does not read the watchdog register at least once during a user-defined interval. Thus, when program execution stops prematurely, the timer is not reset and the system is rebooted.

Also integral to the Q-timer is a CMOS calendar clock that provides tenths of seconds, seconds, minutes,

hours, days, the day of week, month and year, with automatic leap-day insertion. It uses a 3.768 KHz crystal oscillator for reference.

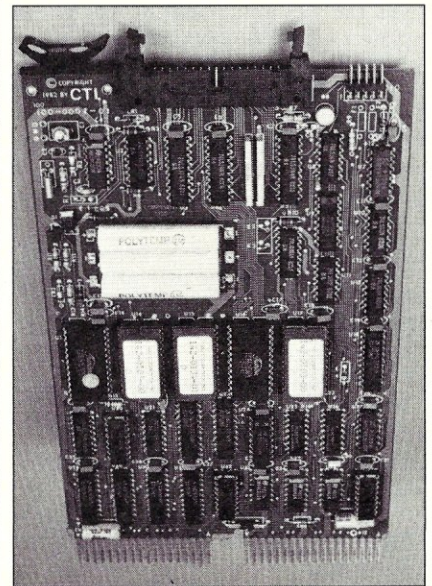
An on-board CMOS RAM memory provided 2K X 16 bits of storage for data and/or programmed parameters. This feature is particularly useful for scientific or process applications where there is no disk storage.

CMOS devices are backed up by an on-board NiCad battery pack (with recharging circuit) that will maintain operational readiness for a minimum of 60 days.

All of the software necessary to operate the Q-Timer functions is stored in EPROM, eliminating the requirements of a SYSGEN or patching of either RT-11 or RSX operating systems. An EPROM software monitor provides self-diagnostics of on-board devices and has bootstrap routines for RL01/02, RK05, RK06/07, RM02, TU58, and TM11 storage devices. In addition to the self-diagnostic routine, the software will run complete CPU and memory diagnostics.

Expandable 8-bit parallel input and output provide a path by which the Q-Timer can perform a variety of I/O functions in addition to routine calendar clock tasks, often eliminating a DRV11-type interface board.

Codar's Computer Products Division was formed in 1982 to market DEC system enhancement products developed by the company for its own use in a ruggedized data acquisition/HF radar system used in remote sensing of ocean surface conditions.



**Price: Codar Technology Inc., 437 Main St., Longmont, Co 80501; (303) 772-2782.**

CIRCLE 326 ON READER SERVICE CARD



**S-100 modules for Intel 80286**

Performics Inc. has recently introduced a pair of S-100 modules aimed at the high-performance end of the computer market. The P-286 CPU module is designed around Intel's 80286 micro, allowing it to execute software developed for the 8086/8088. On-board resources include a socket for the optional 80287 math coprocessor, three 16-bit programmable and cascadable system timer, programmable interrupt controller, and sockets for 64K bytes of IPROM/ROM. The P-128 is a 128K-byte that features 8K x 8 CMOS RAM chips for low power consumption. The boards interface via an IEEE-696 interface and a private access bus for no wait states.

**Prices:** Initially, the P-286 and P-128 boards are being offered as a pair at a price of \$3,000.

**Performics Inc., P.O. Box 3207, Nashua, NH 03061; (603) 881-8334. CIRCLE 327 ON READER SERVICE CARD**

**Hard disk backup**

Stok Software, Inc. has announced nine major enhancements to their hard disk backup program. BackRest now runs on TurboDOS, MS-DOS (PC-DOS) and local Area Networks such as CP/NET and OMNI/NET. Other enhancements include: • Ability to select predefined backup routines • Password protected backup and restore • Repeated backup to the same hard or floppy disk • Improved error handling • Optional use of screen color attributes • German language version with European date format.

On Local Area Networks the user can back up files on the server or any node. The destination disk can be at any location. It has successfully been tested on CP/NET and OMNI/NET.

Unique backup routines can be predefined for flexible control. For example, individuals in a large organization can have their own backup procedures. With complete security BackRest can now back up and restore password-protected files on MP/M, MP/M-86 and Concurrent CP/M. BackRest can now use another hard or floppy disk as the destination with the option of updating or scratch- previously backed up files. Improved error handling now prevents errors that occur while other errors are being handled.

Three popular features that never 1) BackRest creates management reports to show what it has done 2) provides statistics of hard disk usage 3) handles sparse files; and 3) files

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## NEW PRODUCTS

Continued from page 135

too large for a single disk are split. BackRest is available for CP/M, MP/M, CP/NET, CP/M-86, MP/M-86, Concurrent CP/M, TurboDOS, MMMost, and MS-DOS.

**Stok Software, Inc., 17 West 17th St., New York, NY 10011; (212) 243-1444.**

**CIRCLE 328 ON READER SERVICE CARD**

### ESDI/ESTI drives

OMTI has announced the introduction of the Series 6000 family of intelligent data controllers designed to attach disk and tape drives having the ESDI/ESTI (Enhanced Small Disk/Tape Interface) to a variety of host systems. The host computer bus is the industry standard SASI (ANSI-SCSI) bidirectional bus interface, with its associated high-level command set.

The ESDI/ESTI disk and tape interface was developed by a cooperative effort of disk and tape drive manufacturers interested in meeting the demand for increased performance and capacity while providing an industry standard interface. Described as an evolution of the ST506/412 interface, the ESDI/ESTI interface standard is data rate independent (NRZ), encoding method independent, and defines a serial command and response protocol. This makes it possible for controllers to dynamically determine the drive parameters. The ESDI/ESTI interface is unique in the sense that both disk and tape drives can be attached on the same bus without sacrificing the performance characteristics or cost of either.

The Series 6000 controllers are designed around OMTI's third-generation advanced VLSI data controller chip set. This 15-megabit chip set provides performance features such as consecutive sector transfers, 2.0 MB host data transfer rates, and intelligent buffer management. The Series 6000 family will initially consist of the Model 6100 ESDI controller and the Model 6300 ESDI/ESTI controller, with other products to follow.

The Model 6100 disk controller is packaged in the industry standard 5 $\frac{1}{4}$ " form factor and will support up to four ESDI disk drives. Features include disk data rates up to 10 megabits per second, 2.0 MB host data transfer rates, consecutive sector transfers, overlapped seek operation, automatic configuration of disk parameters (heads, cylinders, sectors/track, data encoding method, etc.) on power-up, format using the drive manufacturers prerecorded defect list, 48-bit ECC error correction code with 20-bit error correction capability,

defective sector/track handling and interdevice copies.

The Model 6300 disk/tape controller is also packaged in the industry standard 5 $\frac{1}{4}$ " form factor and will support up to four ESDI/ESTI and/or ST506 devices. The ESTI devices may be streaming, start/stop, and/or block addressable tape drives. In addition to the Model 6100 features, the Model 6300 disk/tape controller supports tape data transfer rates to 5 megabits per second, automatic configuration of tape parameters (tracks, tape speed, tape density, data encoding method, etc.) and interdevice copies.

The ANSI-proposed Small Computer System Interface (SCSI) (also known as SASI) is implemented in the OMTI Series 6000 intelligent controller family. SCSI defines a host level I/O bus structure that can be operated at data rates in excess of 1.5 MB per second. The primary objective of this interface is to provide host computers with device independence, so that disk drives, tape drives, and future devices can be added to the host computer without requiring modifications to the generic system software or hardware. The ESDI/ESTI device level interface supports this concept by supplying the important device parameters upon request.

**Prices:** (in quantities of 1000): Model 6100, \$255; Model 6300, \$350.

**OMTI, 557 Salmar Ave., Campbell, CA 95008; (408) 370-3555.**

**CIRCLE 329 ON READER SERVICE CARD**

### PC bubble memory board

Helix Laboratories, Inc., has introduced the PC Bubble board, a half-megabyte bubble memory expansion board designed to emulate a "mini-Winchester" in the IBM Personal Computer. The board brings many of the convenient features of the fixed disk to the PC without requiring an increased or external power supply.

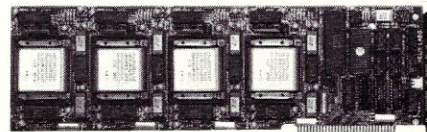
The PC Bubble board responds to fixed disk commands under most operating systems including MS-DOS 2.0, Softech Pascal IV.13, and CP/M-86 for the PC/XT. Software features such as the RESTORE and BACKUP commands as well as partitioning to hold multiple operating systems are available to the user. If the AUTOSCAN ROM BIOS is installed, the PC Bubble can also cold boot any of the above operating systems.

The all solid-state PC Bubble contains four Intel 7110 one-megabit bubble memories, providing rugged, non-volatile mass memory with no moving parts, as well as immunity to dusty, hostile environments. Operation is completely quiet. Mean access time (40 ms)

and data transfer rate (400 kbit/s) of the board result in file transfers that are several times faster than floppy disk. Bubble memory technology makes the PC Bubble several orders of magnitude more reliable than either the fixed or floppy disk.

In addition to the PC, the PC Bubble works in the IBM XT and most IBM-compatible computers. The lower power demands and compactness of the PC Bubble make it a unique enhancement to compatible portables, such as the Compaq and Corona.

**Price:** \$1,495, with a four-to six-week availability time.



**Helix Laboratories, Inc., 16776 Bernardo Center Dr., Ste. 106A, San Diego, CA 92128; (619) 451-0270**

**CIRCLE 330 ON READER SERVICE CARD**

### Monolithic Power FET Arrays

Supertex Inc., active in CMOS and DMOS technology, has introduced monolithic power FET arrays designed to drive high-voltage, nonimpact printers or flat panel (plasma, LCD or electroluminescent) displays. The 8-channel, AN01 (N-channel) and AP01 (P-channel) devices are fabricated using lateral DMOS technology.

The devices, which are available in 18-pin DIPs, reduce the cost per channel by up to 40% compared to similar circuits designed with discrete TO-92 parts. In addition to cost benefits, the arrays reduce insertion costs and improve board space utilization.

The arrays have common-source construction with underdedicated gates and drains. This provides the circuit design flexibility by allowing each FET to be independently driven. Designers using these arrays can directly interface CMOS logic with high voltages.

The AN01 and AP01 can sustain continuous drain currents of 30 mA and 15 mA per channel respectively and are rated from 200 to 400 volt drain to source voltage. Both are available from stock in production quantities.

**Prices:** Pricing depends on voltage level and whether the devices are plastic or ceramic. AN01 20NA (200 volts): \$249 in 1K quantities; AP01 20NA (200 volts): \$309 in 1K quantities. Both also available at 300 and 400 volt levels; prices are higher for the ceramic models.

**Supertex Inc., 1225 Bordeaux Dr., Sunnyvale, CA 94086; (408) 744-0100.**

**CIRCLE 331 ON READER SERVICE CARD**



# Z80 Software

## SOFTWARE DESCRIPTIONS

**TPM (TPM I)** - \$80 A Z80 only operating system which is capable of running CP/M programs. Includes many features not found in CP/M such as independent disk directory partitioning for up to 255 user partitions, space, time and version commands, date and time, create FCB, chain program, direct disk I/O, abbreviated commands and more! Available for North Star (either single or double density), TRS-80 Model I (offset 4200H) or II, Versafloppy I, or Tarbell I.

**TPM-II** - \$125 An expanded version of TPM which is fully CP/M 2.2 compatible but still retains the extra features our customers have come to depend on. This version is super FAST. Extended density capability allows over 600K per side on an 8" disk. Available preconfigured for Versafloppy II (8" or 5"), Epson QX-10, Osborne II or TRS-80 Model II.

### CONFIGURATOR I

This package provides all the necessary programs for customizing TPM for a floppy controller which we do not support. We suggest ordering this on single density (8SD).

Includes: TPM-II (\$125), Sample BIOS (BIOS) SOURCE (SFREE), MACRO II (\$100), LINKER (\$80), DEBUG I (\$80), QED (\$150), ZEDIT (\$50), TOP I (\$80), BASIC I (\$50) and BASIC II (\$100)

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	TRS80-I	TRS-80 Model I (4200H Offset)
	TRS80II	TRS-80 Model II
	V18	Versafloppy I 8"
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## LETTERS

*Continued from page 45*

bank is currently selected. This memory is known as common, or global, memory. Code which changes banks must execute in common memory so that the instruction executed after the one which switches banks is the following instruction, rather than whatever happens to be at the corresponding address in another bank. This arrangement can be achieved using memory boards smaller than 64K, by having one board for the common memory addresses which ignores the extended address.

In order to try to solve this problem with memory boards of 64K or larger, things begin to get tricky. I would like to discuss both a straightforward solution and a more sophisticated one. Since these involve more complicated circuits, rather than simple changes to Bender's circuits, I will discuss them only in general terms.

The straightforward solution checks the regular address lines to determine whether an address is in common memory or not. (With an 8K common memory, it would check lines A13-A15.) If the address is not in common memory, the action is as before, using the contents of the latch to assert the extended address lines; but if the address is in common memory, a constant value of 0 is used. In either case, the ADSB\*-gating is used, of course. In this way, addresses in common memory will always be mapped to bank 0.

The problem with the straightforward solution is that the memory in other banks which is "hidden" by the common memory in bank 0 will never be used, and is thus wasted. If this is unacceptable, then a more sophisticated memory mapping circuit must be used, which maps "logical" addresses (as specified by the address lines of the CPU and an extended address latch port) onto arbitrary 24-bit physical addresses. With such a circuit the physical memory could be arbitrarily divided up into a common memory section and some number of banks of whatever size is desirable, and no memory would be wasted. A memory mapping circuit could be built with a RAM (or a ROM, if your configuration doesn't change much) and some support circuitry, but there are two disadvantages to keep in mind: the necessary circuit is fairly complicated, and it requires interception of the CPU address lines before they reach the bus; therefore modification of, and a jumper cable to, the CPU board is necessary.

A few unrelated complaints: the Bender article mentioned a "Listing 1"; try as hard as I might, I couldn't find

one. Also, in general, I have found the placement of listings and figures in your magazine to be distressingly distant from the text which references them.

Kurt Gollhardt  
128 E. 7th St., Apt. 308  
Plainfield, NJ 07060

*Editor's note:*

*The listing to Dr. Bender's article, which was inadvertently omitted, was subsequently published on page 140 of the December 1983 issue.*

Dear Mr. Libes,

I found both "The New 16-bit Super Microcomputers" and "An Introduction to Local Area Networks: Part II" unnecessarily hard to read because the figures were so many pages beyond the text. I would prefer smaller figures, all on one or two pages, or the text squeezed among the illustrations so they flanked the text or (perhaps best) a combination of the two, since I felt many of the figures were too large for their content and thus could have been smaller and closer to the text.

I suspect that the figure on page 40 could have been clearer, since it seems the table names (GDT, etc.) are in the "visible" part, while the actual registers are in the "invisible" part. Also, having the top section of a table white (e.g., "BASE ADDRESS") usually indicates that it is a title block, which does not seem to be the case here.

Mike Firth  
104 N. St. Mary  
Dallas, TX 75214

Dear Mr. Libes,

Andrew Bender's hardware review of the CompuPro 86/87 system (November 1983) touched on many of the problems involved in configuring CompuPro boards with older hardware. Here are some observations resulting from my own recent experiences.

1) Older I/O boards: the problem with many I/O boards is not so much a problem of speed as it is a problem of bus compatibility. Just as the CompuPro CPU and disk controller will not work on a nonterminated motherboard, some of the older I/O boards (at least the TEI 3P+3S vintage 1977 I have) will not work on terminated motherboards. In my case, the addition of address buffers fixed the I/O board.

2) Stepper motors employing the steel band widget technology such as found in the Shugart 850 will run much cooler than the screw mechanism types.

3) For some reason the CBIOS is written with the ACT86 assembler rather than the assembler supplied with CP/M-86. One is therefore compelled

to buy an additional assembler if one wants to make significant changes to the CBIOS. Finally, those with System Support Boards (or other similar boards) can use the EPROM at the top of memory to initialize any nonstandard hardware they might have. That is, put a jump at the reset point (FFFF0) to an area in the EPROM, do whatever you have to do, then jump to the disk loading process.

David Langmann  
2900 Connecticut Ave. NW  
Washington, DC 20008

Dear Mr. Libes,

I have some comments on the S-BASIC Compiler that was reviewed in the October 1983 issue. First, the reviewer, when stating how fast S-BASIC was, did not make clear whether he was referring to execution speed or the amount of time taken to compile the source code. Having written quite a few programs in it over the last year, I must say that it compiles code fairly swiftly and compactly, but the execution times are extremely slow, in some cases slower even than DR's CBASIC2. Intepreted MBASIC-80 runs circles around it, even on long programs. Floating point calculations are especially tedious, running almost 10 times slower than MBASIC for equivalent precision.

Speaking of floating point, there is a bug in S-BASIC's square root algorithm such that the error of the function increases with increasing value of the operand. Users are advised to use the equivalent  $(x)^{.5}$  instead, which gives accurate results. Also, when doing character or string I/O via PRINT # statements, CHR\$(0) is not allowed. And, although procedures and functions can have local variables, the names of these variables must be unique, i.e., all of your math functions cannot use 'X' as their dummy parameter. This is an annoyance, especially when creating libraries of functions and procedures, which the compiler handles so nicely.

Excepting these minor (?) quibbles, I must agree with Mr. Parker's assessment of the power and flexibility of the language. If it weren't for the lack of speed in execution, it would be my favorite BASIC for the 8080/Z80. Considering its low cost, it is still quite a deal.

If only it were fast . . .

W. John Bau  
Director  
SPICA  
1601 Paseo de Peralta  
Santa Fe, NM 878501

Dear Mr. Libes,

*Re: Loading and calling machine code from Basic:*



In the October 1983 issue of *Microsystems*, Costa and Leibson describe a method by which a Basic program can load a .HEX file produced by an assembler such as ASM. Here is a simpler way, which depends on the realization that you can read a .HEX file directly from Basic, sort out the subroutine (you know it's got to be in there somewhere), and poke it into memory.

Listing 1 shows the .PRN file of a demonstration subroutine. When this subroutine is called, it prints a message to the console and returns to Basic. The associated .HEX file is shown in Listing 2. Notice the correspondence between the second column of the .PRN listing and the data field of the .HEX listing (F5 at 8000H, C5 at 8001H etc.). The file is structured in what is called Paper Tape Record Format. The colon signals the start of the record. The record type is 00 for data records. The sum of all the bytes in the record, starting with the record length and ending with the checksum, should be evenly divisible by 256. A record length of zero indicates end-of-file.

Listing 3 is a program in Mbasic to load the subroutine and run it. To use this method you will need to splice the

## A simpler way to sort out a subroutine and poke it into memory.

loader segment (lines 210 to 350) into your program and provide the appropriate memory limit, subroutine name and call location (lines 130, 140 and 150). A different Basic dialect may require, in addition, some attention to the syntax of the file handling instructions, variable naming restrictions, and hexadecimal number representation. In some of the earlier Mbasic version 5.xx releases, the Clear instruction (line 130) doesn't work. You can accomplish the same thing by using the highest memory initialization option when loading Basic (e.g., A > MBASIC /M:&H7FFF).

Dave Russell  
12 Winchester Street  
Southboro, MA 01772

### LISTING 1

```

; "SUBROUT"
; DEMO MACHINE CODE SUBROUTINE
; D. RUSSELL 10-01-83

0005 = FDOS EQU 5 ; CPM SYSTEM ENTRY POINT
0009 = PCBFN EQU 9 ; PRINT CONSOLE BUFF FUNCTION NO.
8000 PCBFN EQU 8000H ; STARTING ADDRESS OF ROUTINE

8000 F5 SRENTRY: PUSH PSW ; SAVE
8001 C5 PUSH B ; CPU
8002 D5 PUSH D ; REGISTER
8003 E5 PUSH H ; CONTENTS

8004 0E09 MVI C, PCBFN ; SET UP FUNCTION NUMBER AND
8006 111180 LXI D, MSG ; MESSAGE LOCATION PARAMETERS

8007 CD0500 CALL FDOS ; GO DO THE JOB

800C E1 POP H ; RESTORE
800D D1 POP D ; CPU
800E C1 POP B ; REGISTER
800F F1 POP PSW ; CONTENTS

8010 C9 RET ; RETURN TO BASIC

8011 0D0A484552MSG: DB 0DH, 0AH, 'HERE I AM', 0DH, 0AH, '$'

801F END

```

### LISTING 2

#### TYPE SUBROUT.HEX

RECORD MARK	RECORD LENGTH	LOAD ADDRESS	RECORD TYPE	DATA	CHECKSUM
00	10	80000000	F5	C5D5E50E09111180CD0500E1D1C1F10D	
01	0F	80110000	C9	D0A48455245204920414D0D0A240B	
02	00	00000000			

### LISTING 3

```

100 REM "LOADER"
110 REM DEMO MACHINE CODE LOADER PROGRAM
120 REM D. RUSSELL 10-01-83
130 CLEAR : &H7FFF ; FENCE BASIC OUT
140 SRNAME$ = "SUBROUT" ; NAME OF SUBROUTINE
150 SRENTRY = &H8000 ; SUBROUTINE CALL LOCATION
160 REM
170 REM
180 REM *****
190 REM SUBROUTINE LOADER
200 REM *****
210 OPEN "I", #1, SRNAME$ + ".HEX"
220 INPUT #1, R$ ; READ A RECORD
230 IF EOF(1) THEN GOTO 350 ; END OF FILE?
240 RECLEN = VAL("&H" + MID$(R$, 2, 2)) ; NUMBER OF DATA BYTES IN RECORD
250 LAH = VAL("&H" + MID$(R$, 4, 2)) ; FIRST
260 LAL = VAL("&H" + MID$(R$, 6, 2)) ; DATA BYTE
270 LOADADDR = 256*LAH + LAL ; LOAD ADDRESS
280 FOR BYTENUM = 1 TO RECLEN ; SORT OUT
290 ADDR = LOADADDR + BYTENUM - 1 ; EACH
300 POINTER = 2*BYTENUM + 8 ; DATA BYTE
310 BYTE = VAL("&H" + MID$(R$, POINTER, 2)) ; AND
320 POKE ADDR, BYTE ; LOAD IT
330 NEXT BYTENUM ; INTO MEMORY
340 GOTO 220 ; GO READ ANOTHER RECORD
350 CLOSE #1 ; ALL DONE LOADING
360 REM END OF LOADER
370 REM
380 REM
390 REM RUN SUBROUTINE
400 INPUT "DO IT NOW"; DUMMY$ ; ANY KEY MAKES IT HAPPEN
410 CALL SRENTRY
420 PRINT
430 PRINT "HOW ABOUT THAT!" ; IT WORKED
440 END

```



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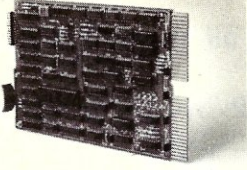
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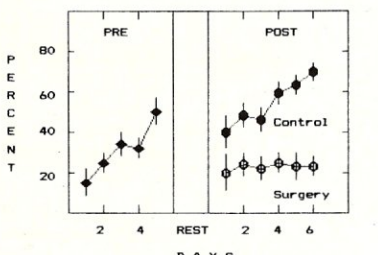
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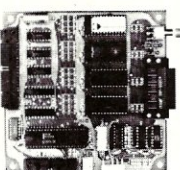
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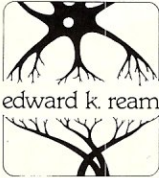
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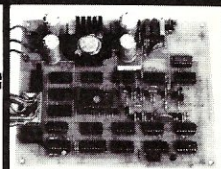
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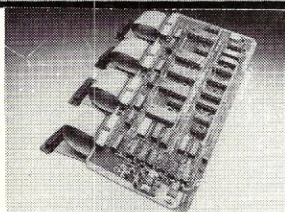
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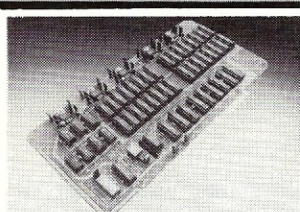


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# LETTERS

Continued from page 139

Gentlemen,

The machine code loader for MBASIC-80 presented by Larry Costa and Steve Leibson (*Microsystems*, October 1983) is relatively fast when compared with the use of DATA and POKE statements, as described by the authors. By the use of a technique from the Microsoft Softcard BASIC Interpreter Reference Manual, an even greater increase in speed and in efficiency can be obtained.

Costa and Leibson make use of the ASC and MID\$ function in a FOR-NEXT loop to pick out each individual byte of machine code in a 128-byte sector, and then POKE it into memory. The loop is repeated until every sector is loaded into memory. Instead of this byte-by-byte method, each sector of code can be placed into memory by the use of a single LSET statement. This is done by first setting up a dummy string, C\$, of 128 bytes in length, and pointing it into the area reserved for machine code, via the VARPTR and POKE functions. To the MBASIC interpreter C\$ now consists of the 128 bytes of memory where the sector of machine code is to reside. This sector of code is

**Instead of using the byte-by-byte method, place each sector of code into memory via a single LSET statement.**

then read from the disk, and placed into C\$ by the LSET statement, which left justifies the string and so avoids dynamic reallocation of string space for C\$. Then the pointers are updated to point to the next 128 bytes of memory, ready for the next sector of code.

In order to implement this method, line 30040 of Costa's and Leibson's MBASIC code should be replaced with the lines shown in Listing 1.

The speed of this technique really

## LISTING 1

```
30040 C$=T$: P%=VARPTR(C$)+1:      Set up 128-byte dummy string,
                                     and get location of address
                                     pointers.
                                     Get low byte, high byte of
                                     base address of machine code.
      L%=&HOO: H%=&HB8
30045 FOR I=1 to NS%:              Loop through each sector of
                                     code.
      POKE P%,L%: POKE P%+1,H%:     Set the pointers of C$ to
                                     point to the machine code
                                     reserved area.
      GET#2,I: LSET C$=T$:          Get the code, and put it
                                     into C$.
      L%=(L% XOR 128): H%=H%-(L%=0): Update the pointers to point
                                     to the area for the next
                                     sector.
      NEXT I                        Loop around for the next
                                     sector.
```

becomes evident when it is used to set up a large machine-language environment in high memory of Basic. I have used it to load an area of 4K in less than 6 seconds. It is a versatile method, able to be adapted to save and/or move a block of memory quickly. The use to which it is put in the Microsoft manual is the loading and saving of high-resolution graphics screens.

Peter Tyler

Department of Clinical Chemistry  
The Queen Elizabeth Hospital  
Woodville, South Australia 5011

Dear Mr. Libes,

The article on "Floppy Problems" in the December '83 issue struck home with me, as it probably did with many S-100 readers. In particular, the editorial comments at the end of the article were most interesting.

However, they presented only half the problem. The gist was that an S-100 board manufacturer does not (and should not have to) provide support for system configurations using its board other than the systems for which the manufacturers made the board.

Consider the poor customer. S-100 board manufacturers rarely put in their ads or catalogs all the 'fine print' which describes the gotchas. My favorite horse which, I think, richly deserves flogging is the Texas company that advertised its disk controller in stand-alone ads. Naive purchasers like me found to their dismay that they faced a considerable dilemma. Either there were many other purchases required from the same company because all the software was tied together (key portions of the BIOS coming with each of several boards), or there was considerable programming to be done to bring the controller up. The company involved was monumentally uncooperative. After a considerable period of time, I disposed of the board on

principle, preferring the products and approach of a more honest company.

I think a prospective purchaser seeing an ad unfettered by restrictions is entitled to expect that the board can be used in a variety of systems of the customer's choosing. Details to facilitate the user's reasonably expected needs should be included. This certainly doesn't mean that the manufacturer itself has to go through all the effort of interfacing with every board and every conceivable combination of products; there are many capable customers buying stand-alone S-100 boards who will be glad to accept that challenge, given sufficient information on the product in the manual.

I guess the solution is to ask manufacturers to be more honest and forthcoming in their ads, and to give us customers a fair shake when preparing a manual. Let's be frank before purchase about the limitations and restrictions as well as the benefits. Most of us will be glad to share our unusual applications and solutions with the manufacturer (user-group style), providing the manufacturer doesn't unfairly commercialize our work.

Joseph Reymann  
953 Avenida Ladera  
San Dimas, CA 91773

Dear Mr. Libes,

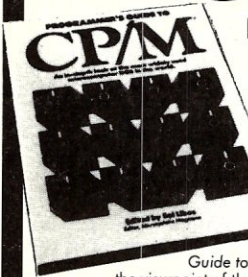
Ian Ashdown's XERA (August 1983, page 54) is a lovely program and I am glad to have it—but alas for those "six hours of file reconstruction" which prompted it! And alas too for the hours it cost him to write it! The easy solution for his inadvertent erasures was to load DUU (CP/MUG Vol.71), go to Track 3 and replace all those E5 bytes with 00. Simple.

R. W. Odlin  
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			36	Micro-Timer	133	174	Teletek	4
219	Easi Software, Inc.	117	157	Microtype	112	37	2500 AD	72, 73
154	Ecosoft, Inc.	91	99	Mom's Computing	119	75	Two Bits Computer Products	119
57	Electralogics, Inc.	19	77	Multimicro	10			
102	Electronic Specialists Inc.	114	83	MuSYS Corp.	9	274	Unified Software Systems	118
122	Encyclopedia Publishing Co.	91	171	Mycroft Labs, Inc.	117	82	United Controls	79
142	Extended Processing	112				108	US Digital Corp.	108
			123	New Generation Systems, Inc.	31	109	US Robotics	34
181	G & G Engineering	106	19	North Star Computers, Inc.	127			
	GMR	98				177	Wave Mate, Inc.	21
181	Gifford Computer Systems	106	254	OSM Computer Corp.	83	278	Workman & Associates	123



# Four Answers To Your S-100, Multi-User Problems.

Intercontinental Micro Systems makes everything you need for S-100 bus multi-user systems, networks or single user systems.

At a price that won't break your budget.

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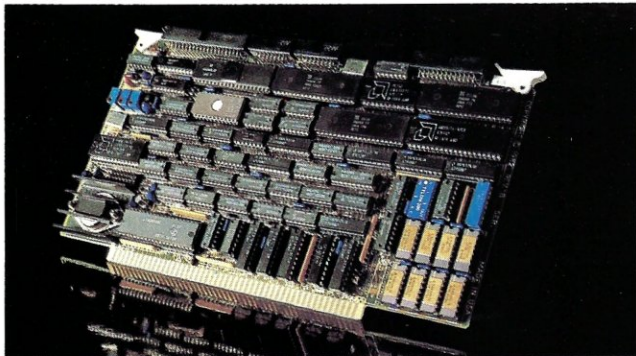
and the prices are what you'd expect from a company that uses the most advanced design, software and production techniques to keep costs down.

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Read the specs, then call, write or circle the bingo number below. We'd be glad to send more information and help solve your S-100, multi-user system problems.

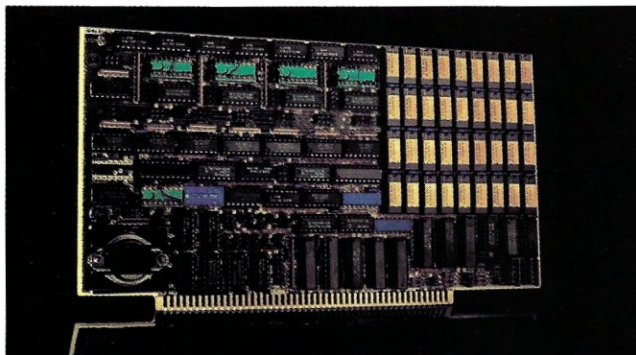
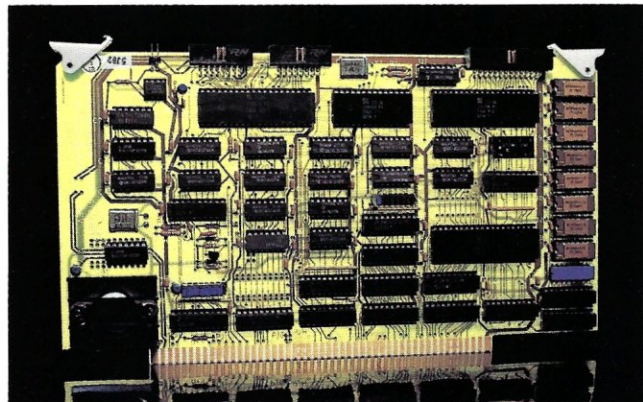


## 1 CPZ-48000 SINGLE BOARD COMPUTER.

- IEEE 696.1/D2 S-100 compliance.
- Z80A™ 4MHz Operation.
- Floppy disk controller (FDC). Single or double sided. Single or double density. 8" or 5 1/4"
- Two synchronous or asynchronous serial I/O channels (SIO).
- Two parallel I/O channels (PIO).
- Four channel DMA controller.
- 64K on board RAM.
- Memory management unit (MMU). Addresses up to 16 megabytes of system memory.
- Eight Vectored priority interrupts.
- Provisions for 2K or 4K onboard EPROM.
- Software selectable baud rates.
- IBM Bisync, HDLC, SDLC and other protocols.
- CP/M™, MP/M™, and TurboDOS™ operating systems available.
- Turbo-Disk® implementation included.

## 2 CPX-MX SLAVES.

- IEEE 696.1/D2 S-100 compliance.
- Compatible with CPZ-48000 SBCP any Z-80A based CPU with extended address capability or 16 bit based CPUs complying with IEEE 696.1/D2 bus specification.
- Z-80B™ 6MHz (CPS-6X) or Z80A 4MHz (CPS-4X) operation.
- Two synchronous (CPS-MS) or asynchronous (CPS-MA) serial I/O ports.
- TurboDOS™ & CP/NET™ compatible.
- Master confiscation of slave memory for diagnostic purposes.
- Two parallel I/O ports; eight data bits + 2 handshake lines per port.
- 64 Kbytes of onboard dynamic RAM.
- Master/slave memory-to-memory transfers under DMA control @ 571 Kbyte/sec transfer rate when used with CPZ-48000 SBCP.
- Software selectable baud rates.
- Usable as an intelligent I/O processor in single user system.

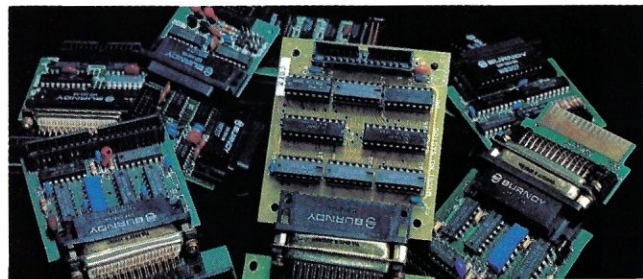


## 3 256KMB-100 256K MEMORY.

- IEEE S-100 bus, spec 696.1/D2 compliance. The 256KMB-100 is compatible with most IEEE S-100 board products now on the market.
- Linear addressable to 2 megabytes.
- 225 nano-second access time, maximum, 160 nano-seconds, typical.
- 295 nano-second read-write time, minimum.
- Bank selectable 16K increments.
- I/O port address bank selection.
- Configures for phantom deselection.
- Parity error detection, visual and/or interrupts.
- Bank selection compatible with CROMIX™, CP/M2.2™, MP/M™, Alpha Micro, and other major systems.

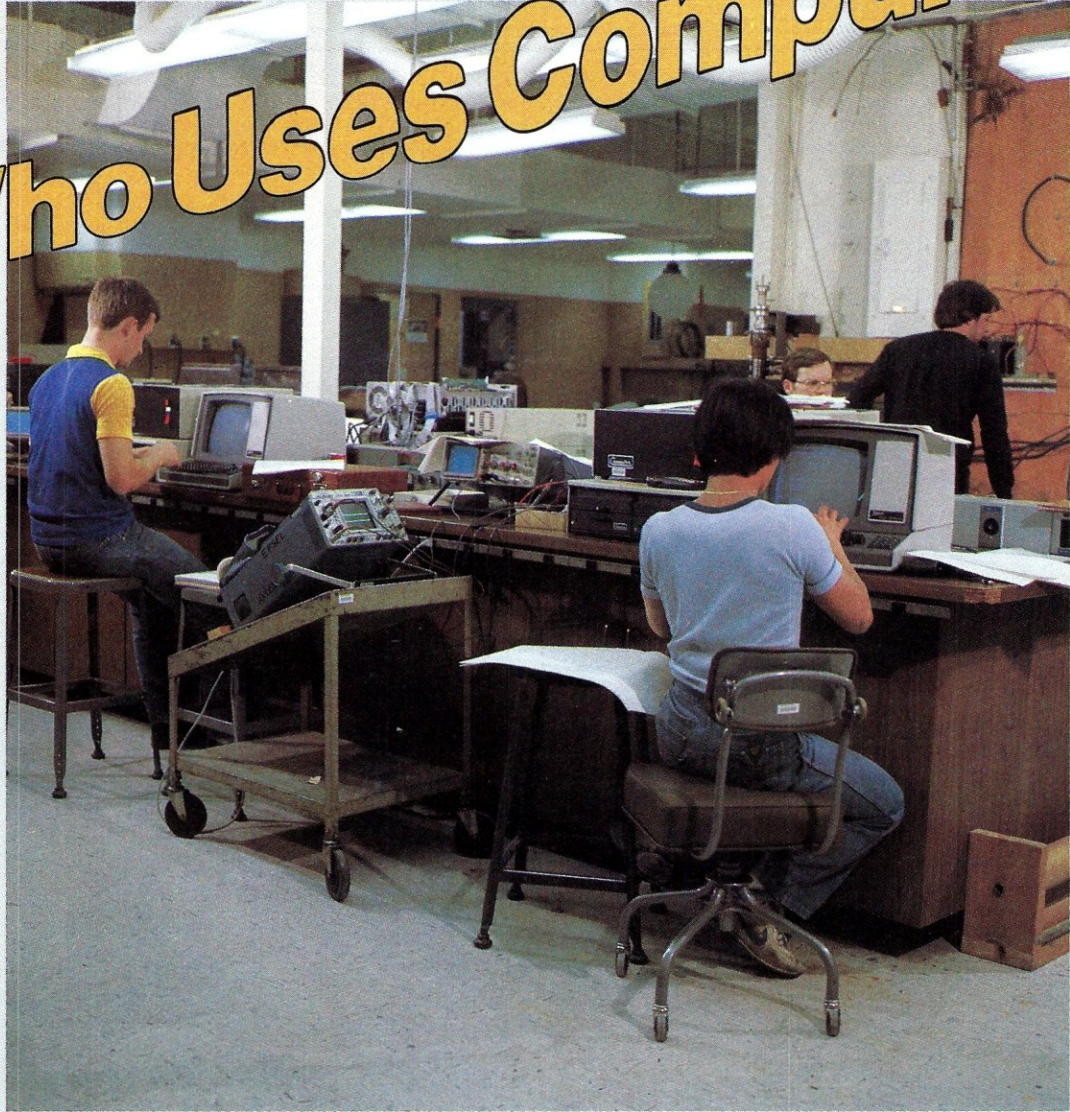
## 4 PERSONALITY BOARDS.

- Centronics printer.
- 8 inch floppy disk.
- 5 1/4 inch floppy disk.
- RS232 serial communications.
- Synchronous/asynchronous modem.
- Priam smart/smart E hard disk.
- Long distance serial communication (2000 ft @ 9600 baud).
- Shugart Associates Systems Interface (SASI).
- Clock/calendar.
- Konan David, Jr.™ hard disk.
- Archive tape drive.





# Who Uses CompuPro?



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In a laboratory at the Massachusetts Institute of Technology, students in computer-assisted engineering courses rely on a network of **CompuPro** systems.

Dr. Richard Thornton and Dr. Jeffrey Lang teach future engineers to use computers for realtime control of "everything in principle from automobiles to a nuclear power plant to a wind

turbine to heat pumps," he says.

Several factors persuaded Dr. Thornton to put **CompuPro** in his lab. Associates who use **CompuPro** systems recommended them as very fast and highly reliable, which was an important consideration because the lab's machines rarely rest. Also, other equipment in the lab relies on the same S-100 bus that **CompuPro** uses, which makes

interfacing easier.

"And it has the flexibility too," Prof. Thornton says. "If we want to change processors or add more memory, we can do that."

To students or staffers, **CompuPro** delivers performance, quality and reliability. Call (415) 786-0909 ext. 206 for the location of the **Full Service CompuPro System Center** nearest you.

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