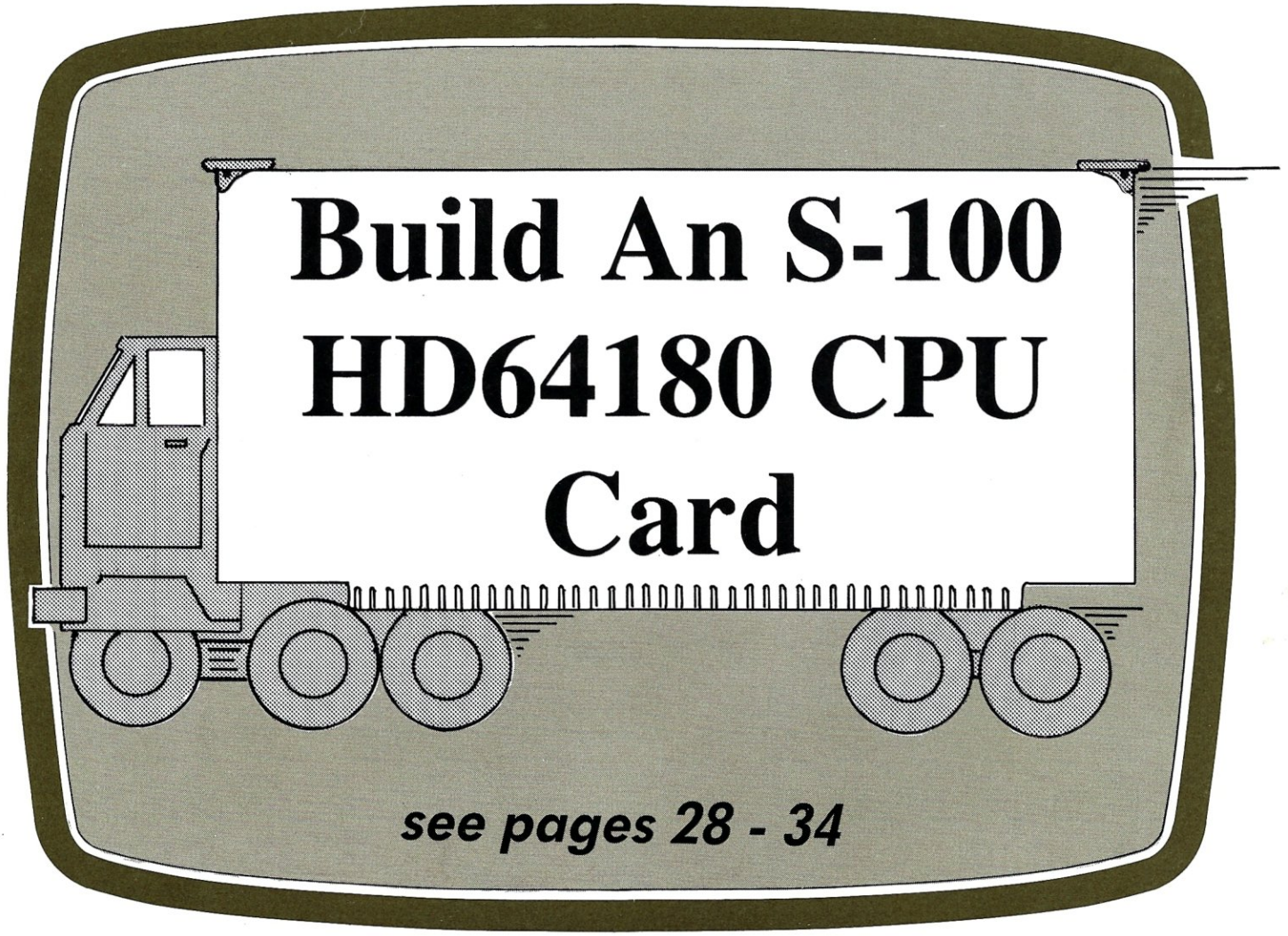
For the Advanced Computer User

Micro/Systems Journal™



Build An S-100 HD64180 CPU Card

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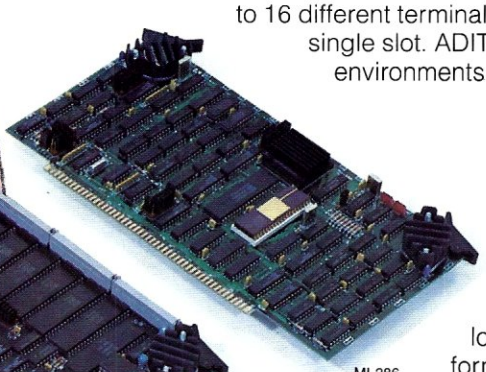
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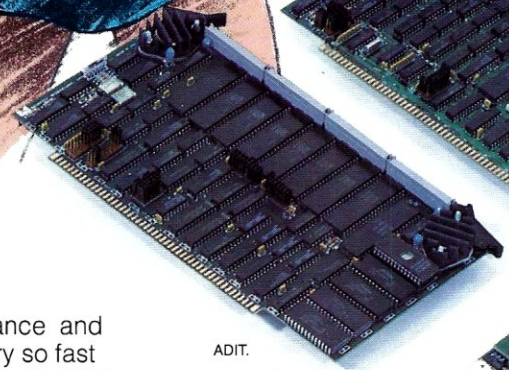
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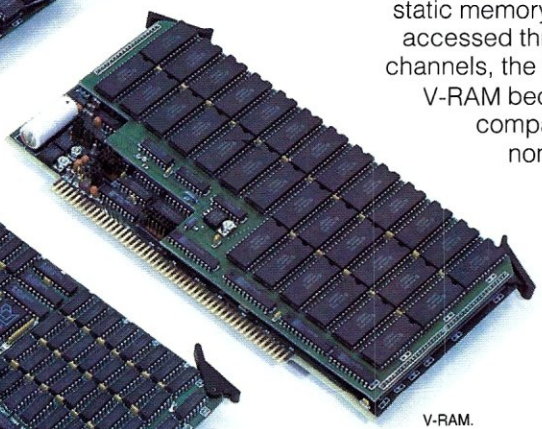
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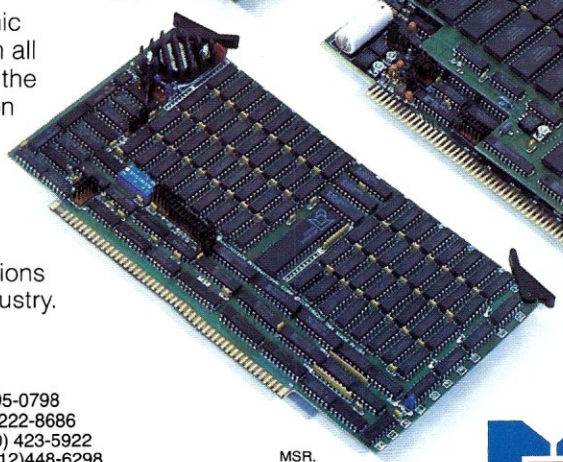
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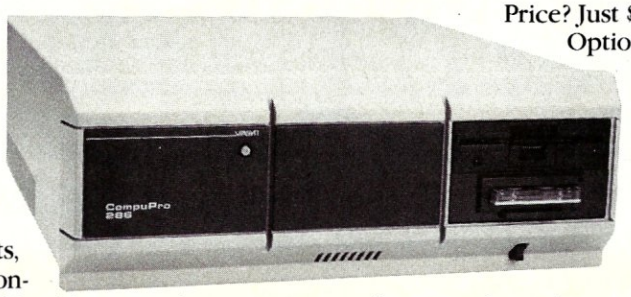

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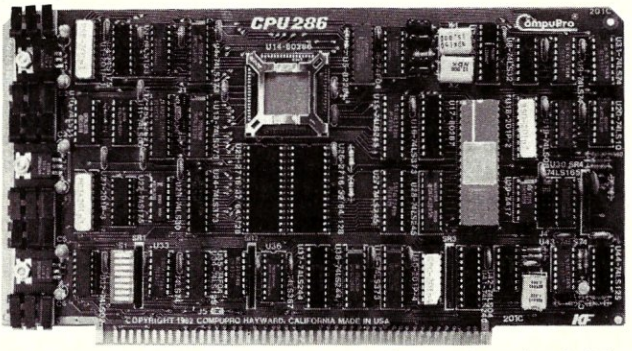

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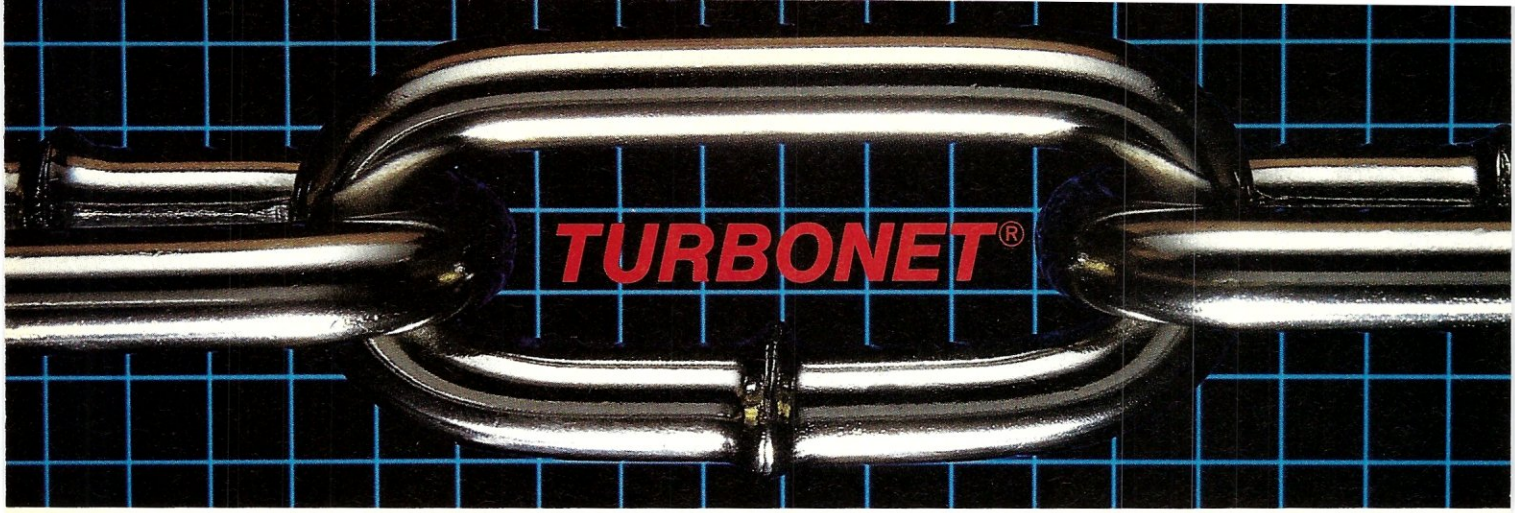

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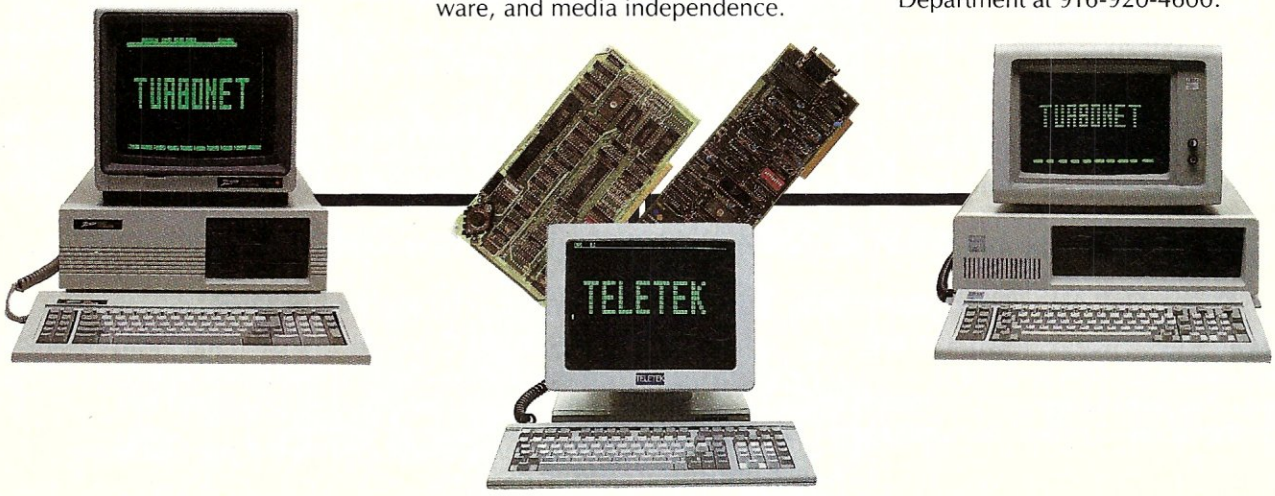

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IBM PC, PC/XT, AT	International Business Machines
MS-DOS, XENIX	Microsoft
GW Basic	Microsoft
68000, 68010,68020	Motorola

Editor's Page

by Sol Libes

GAZING INTO THE CRYSTAL BALL

Rumors are rampant that IBM is about to cut the prices for the PC, XT and AT once more. Judging by past history, this seems highly likely. When IBM sees erosion of its market share, they cut prices....and IBM has been losing market share to compatible vendors....mainly Compaq, AT&T, and the Far East clones.

Each past price cut by IBM has had disastrous consequences for most of IBM's competitors as it puts enormous financial pressures on them. Microcomputer dealers are hurt even worse as price cuts translate directly into a decrease in dollar margins. Retailers such as Businessland, Computerland, Microage, and Entre, as well as independent retailers, are hurting, not only from lower income on each sale, but from loss of customers to large mail-order operations and manufacturer direct-sales operations. Stores which used to rely on walk-in traffic, now find that they need expensive salespeople out knocking on doors.

There has also been a big change in attitude on the part of microcomputer-system buyers. Systems with specifications similar to those of the PC/XT/AT are now viewed as *commodity* items bought in much the same way as a home appliance or a piece of office equipment, like a typewriter or copier. All the systems basically do the job in the same way with small variation in features from machine to machine.

Thus, price has become a big distinguishing factor. Companies such as Leading Edge and Tandy have garnered a significant market share by selling PC and XT compatible machines for 40% less than their IBM analogs. Not only that, Leading Edge and Epson offer dealers a 40% margin (and sometimes more), while IBM only gives their dealers a 20-22% margin (Apple's dealer margin is even less, 12-14%). It is no wonder that we see dealers turning to these Far East machines. It's a matter of survival, not features or quality. It is interesting to note that IBM recently instituted a special promotion for dealers, lasting through the spring, giving them an additional 20% discount on the PC (but not on the XT or AT). This reflects the pressures IBM is now feeling.

IBM can readily afford to cut their prices as their own margins (which are kept secret) are rumored to be *astronomical*, even though the costs of semiconductors and disk drives have dropped to a small fraction of what they were two years ago. And, IBM's new microcomputer systems are expected to cost even less to manufacture by using the economies of automation and production of large quantities. With even more price pressures on competitors and dealers, we can expect to see many computer manufacturers withdraw from the marketplace. And the Japanese, Korean, Taiwanese and Hong Kong clones can be expected to make even greater inroads. With their lower manufacturing costs, investments from U.S. multi-national companies, and better government subsidies, they are in a good position to improve their foothold in the U.S. personal-computer marketplace. The Far East manufacturers reportedly already have 20% of the assembled PC/XT system marketplace. This share can be expected to grow to 30-40%, and possibly higher, within the next year or two.

As prices drop, the number of personal computers sold can be expected to increase appreciably. Computers, just a short time ago, were tools only large businesses could afford. Today, even small Mom and Pop businesses have them. They are already, to a limited degree, mass market items. In a very short time, they should become true mass-market appliance products being sold the way calculators are sold today.

The large number of personal computers and their low prices will have significant effects on the software end of the business. The number and variety of software packages sold can be expected to increase enormously to satisfy the needs and desires of the ever increasing horde of personal-computer users. However, customers who pay only a few hundred dollars for a computer system are not going to be willing to pay thousands of dollars for software. There is no doubt that the market pressures to reduce the prices of software will increase. Companies like Lotus Development and Ashton-Tate will not be able to continue to charge several hundred dollars for their packages. I suspect that their response will be to introduce limited-feature versions selling at low prices via mass-market channels. Their hope will be that many of these purchasers will move up to the much more expensive full-featured versions.

We can also expect to see more software clones of products such as 1-2-3, dBase-III, and popular word processors which should cause downward pressures on software pricing. Many of these products can be expected to come from the Far East.

Today's computer user is far less knowledgeable about the internal workings of the system then the user of ten years ago. Using a computer today takes far less skill and training than was required only a few years ago. Systems are being made easier and easier to use. Our younger generation is being made *computer literate* at a very early age. All of these factors should make the impact of personal computers in the next ten years even more dramatic than in the past ten.

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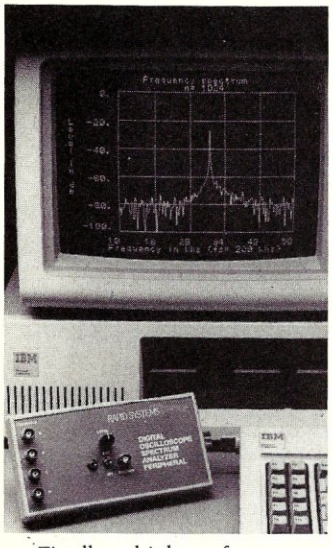

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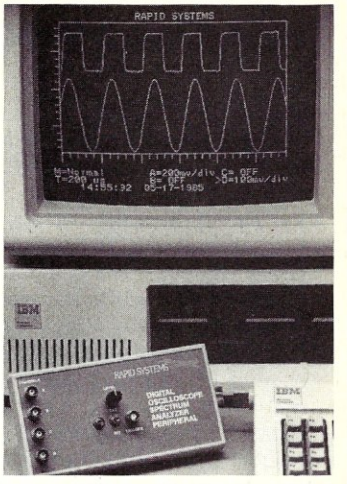

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RAPID SYSTEMS

News, Views & Gossip

by Sol Libes

GOSSIP & RUMORS

Intel is expected to start shipping limited production quantities of the 80386 microprocessor by July 1st. This means that shortly thereafter we should see the first 386-based systems announced and being shipped. There are rumors that Compaq will beat IBM and announce a 386 product this summer with shipments in the fall. Intel will soon release a new graphics chip for PC's that with single instructions will create a window, a circle and other complex graphics objects. They are boasting that it provides performance that is "a quantum leap over the IBM EGA (Enhanced Graphics Adapter)."

Apple has disclosed details about some of their new products due out this fall. First is the *Open Mac* which utilizes the Motorola 68020 32-bit microprocessor, is capable of running Unix System V, and has one expansion slot. A super Open Mac with multiple slots and a 17" color monitor is also due. There will also be two new versions of the Apple-II; a low-cost VLSI version capable of reading Mac and PC disks and a 16-bit version based on the 65816 chip and able to accommodate Mac and/or IBM plug-in boards. And, there are rumors of a dual processor (68020/80286) machine in development at Apple. It looks like Apple is knuckling under to the defacto PC bus standard.

IBM has quietly cut the price of the basic PC system by about 20%. This was done via promotional discounts to large-volume dealers good through July 31st. However, the general feeling is that IBM will continue the discount and increase it even more later this year. This is expected to apply greater pressure on clone producers, particularly the clones from Japan, Taiwan and Korea. It also may indicate that IBM is getting ready to introduce a PC replacement this summer.

There are rumors that **IBM** will soon introduce the PC-compatible JX system, currently sold in Japan and Australia, in the U.S., as a low-cost system for primary and secondary schools, a market still dominated by Apple. The system is expected to be priced at under $1,000 for a system containing 256K of RAM (expandable to 640K), one 3½" drive, two plug-in ROM slots, three internal card slots, internal graphics, and local area network interfaces.

There are also rumors, despite the IRS contract to Zenith, that both **IBM** and **AT&T** will shortly announce PC compatible portable computers. The AT&T machine is expected to use two 8088s, have 256K of RAM, expandable to 1Mbyte, a 5¼" floppy, optional 10M hard disk, and weigh in at 14lbs, less batteries. IBM is expected to release two models (80C88 and 80286 based) with 256K of RAM and everything else being optional (e.g. LCD or electroluminescent displays, one or two 3½" drives, more RAM, etc.). They will include a utility to copy files from 5" to 3½" and vice-versa to achieve PC compatibility. The portable market has not yet reached the volume needed to make it worthwhile for IBM and AT&T to enter it. However, they are under pressure to enter it as the Japanese are moving into this market segment very aggressively (e.g. Toshiba) and if IBM and AT&T waited much longer they would be in danger of being shut out of the business.

Motorola is now sampling a 20Mhz version of the 68020 and is quietly promising a 25Mhz version by year-end.

AT&T is rumored getting set to release the next version of UNIX (release 3.0). It is expected to add Streams and Remote File Sharing (between multiple 3.0 UNIX systems) features. Sun Microsystems already offers such features via its Network File Sharing (NFS). Unlike AT&T's RFS, Sun's NFS supports heterogeneous file systems so that one can connect an MS-DOS file system to a UNIX file system.

IBM FLOPS AGAIN!

Add to IBM's string of failures (the portable, the PCjr, and the desktop predecessors to the PC) the System 9000, a Motorola 68000-based system. Introduced in 1982 for engineering, scientific, and industrial automation applications running Xenix, it failed to compete against the PC/XT/AT systems and systems from Apollo, Sun, H-P, and DEC. The biggest problem was that it did not attract any 3rd party software and the software IBM provided for the machine left quite a bit to be desired in terms of performance.

It appears that IBM will make another attempt at penetrating the scientific workstation marketplace with its new RT system (Risc Technology). It will be interesting to see how successful IBM is the second time around.

IS IBM PULLING OUT OF INTEL?

IBM recently filed a statement with the Securities and Exchange Commission proposing a debt offering convertible into Intel shares. The net effect, if and when IBM goes through with this, will be to reduce IBM's holding in Intel from almost 20% to 12%. Furthermore, IBM's representative on the Intel Board of Directors resigned in December and, as of this writing, has not been replaced.

All of the foregoing happened at just about the same time that IBM introduced the new RT system, using a new microprocessor chip developed and made internally. All of this raises questions about IBM's future plans and whether they plan to continue with the Intel family of 8088, 80286 and 80386 products.

On the other hand it should be noted that IBM has acquired licenses to produce the 8088, 80286 and 80386 devices and has an agreement with Intel to continue purchasing a percentage of these devices through 1990.

THE FAR EAST ONSLAUGHT

The long-predicted personal computer invasion from the Far East (Taiwan, Japan and Korea) is now in high gear. Leading Edge and Epson are leading it with PC-compatibles priced far below the IBM, Compaq and AT&T systems (the current market leaders). They are battling for space on dealer shelves by offering greater discounts, consignment purchasing, financial assistance and margins better suited to small dealers. For example Leading Edge offers dealers 33-40% margins compared to 20-22% from IBM.

PC buyers are still very brand-name conscious. However, with price differentials of $1-2,000 there is a question as to how long this brand loyalty can last. We are already seeing IBM, Compaq and AT&T responding to these price pressures with increased dealer incentives. Second tier producers (e.g. NCR and Zenith) have already responded with flexible inventory policies such as free return of unsold product. Dealers are thus taking product on consignment.

MORROW FILES FOR CHAPTER 11

Computer companies are like desert flowers. They bloom overnight, and they're gone.....Being in the microcomputer business is like going 55 miles an hour three feet from a cliff. If you make the wrong turn you're bankrupt so fast you don't know what hit you.

George Morrow

Morrow Designs filed for protection under Chapter 11 of the Federal Bankruptcy Code in March, only 2 weeks after Zenith won a $27 million IRS contract based on a portable computer, the PIVOT, designed and also manufacturered by Morrow. A year earlier, Morrow needed funds and licensed the design to Zenith for a $1.2

million one-time fee. Zenith will manufacture the unit themselves and hence Morrow will not receive any money from the IRS contract.

Morrow, one of the pioneers in the microcomputer field, started as a garage operation in 1976 making and selling S-100 board products. In 1983 they began manufacture of a small CP/M-80 system (MD series) and in early 1984 introduced the PIVOT. In terms of compactness and integration the designs were ahead of the competition. Morrow ceased making S-100 systems in '84 and put all their efforts behind the MD and PIVOT systems, attempting to build a large company. Sales reached a peak of $27 million in '84 and Morrow had 100 employees. Most anufacturing was done in the Far East.

However, CP/M-80 systems faded from favor in 83-84 as PC compatible prices tumbled and PC software proliferated. Morrow ceased production of the MD systems and emphasized the PIVOT. However, the machine used an LCD display which, although better than the competition, still left much to be desired. Further, the market for portables never really got off the ground. The result was that by late '84 Morrow was over-extended and in trouble.

Morrow Designs is currently operating with 12 employees and seeking a buyer.

IBM RT PRELIMINARY REVIEW

Reports are starting to come in on IBM's new RT (RISC Technology) desktop system (base price $8,000; with options and software the price can double). It is a true 32-bit machine with 4 Mbytes of main memory and is capable of addressing up to a trillion bytes of virtual memory with options such as floating point accelerator and 80286 coprocessor cards ($995) which can run PC-DOS applications. Its operating system (AIX) is a more powerful version of UNIX System V with key Berkeley 4.2 enhancements and an improved user interface. A floor model (base price $12,000) can accept more plug-in cards and hard disks (up to 3-70Mbyte drives)

The system is intended for use as a graphics/engineering workstation (to compete with the Sun, DEC and Apollo) or as a small multiuser UNIX system (up to 8 users, to compete with DEC, Data General and HP systems). 15″ monochrome (1024 x 750 pixels) and color (720 x 512 pixels with 16 colors) displays, as well as a 12″ monitor are offered.

The system features a 32-bit wide bus motherboard (can also handle 16-bit AT plug-in cards). The RISC processor and all memory (with error-correction code logic) are on plug-in cards. The motherboard contains bus interfacing, DMA and clock circuits. IBM has also abandoned the EBCDIC code in favor of the ASCII code for this mini-computer class machine. These features should encourage hardware and software add-on vendors to support the system.

Early performance tests of the RT machine indicate that it runs AT applications slower than the AT and a lot slower than enhanced AT-compatibles, such as the AT&T 6300-Plus. IBM and some other software publishers have already released languages, CAD, word processing, accounting, and integrated applications software for the system.

IBM is spending a lot of money promoting this product so we can expect to see a significant impact from this system. They are also offering a 40% discount on orders of 25 or more which is very aggressive pricing for a brand new product.

There is still a question as to how the RT will fit in since an 80386 system is expected from IBM early next year. Some analysts consider the product a stopgap product while others believe it will be a replacement for the System 36 when more software becomes available.

INTEL VERSUS NEC SUIT

As we were going to press, Intel's suit against NEC for copyright infringement went to trial. Intel charges NEC with copying microcode from the Intel 8088, 8086, 80188, and 80186 microprocessors for its V20, V30, V40, and V50 chips. If NEC wins, reverse-engineering of chips will be permitted under U.S. law and we can expect an increase in the number of Far East knockoffs. If Intel wins, the Japanese will be locked out of the clone-chip market and will have to arrange for second-source licenses from U.S. manufacturers. NEC is already a second source for many Intel chips.

The NEC chips execute code faster than their Intel counterparts (typically 5% with increases of up to 35% for math functions) and offer additional features (e.g. lower power consumption and additional instructions).

In the meantime, NEC has introduced the V60 and V70, powerful 80286 look-a-likes, and the V25, an 8087 math coprocessor look-a-like. The V60/V70 devices are full 32-bit devices with on-chip memory management (up to 4 Gbytes), arithmetic processors, and six-stage pipelining. The V60 (68 pins) has external 16-bit data and 24-bit address buses, while the V70 (132 pins) is a full 32-bit device. Both include features such as on-chip debug circuitry for single-step and breakpoint trapping. They can provide functional redundancy monitoring via a second V60 operating in lockstep; any mismatched output can force the system to halt and reconfigure. The V60 is already being sampled and should be in production late this year. V70 samples are due late this year with production expected early next year.

continued on page 76

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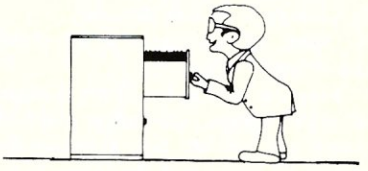

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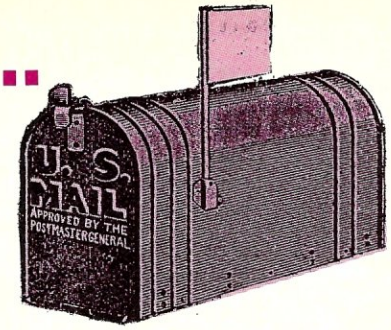

We welcome your letters with comments, compliments, criticism and suggestions. We read them all and publish the most noteworthy, even if they are critical of us. We do not have the staff to answer all letters personally. And all letters become the property of M/SJ and may be subject to editing. Further, we do not print letters that do not include a name and address.

Please send your letters to: Micro/Systems Journal, Box 1192, Mountainside NJ 07092.

MANAGING A HARD DISK WITH MS-DOS

Gentlemen:

My hard disk now has 585 files on it. I had to do something to cope with the situation. So I created a batch file to make file management easier. It took me a couple of hours of trial and error and I really learned about MS-DOS. If anyone has a better concept let me know.

```
 1: cd %1
 2: dir )dir%1.1st
 3: sort <dir%1.1st )dir%1.alf
 4: sort /+14 <dir%1.1st )dir%1.byt
 5: sort /+23 <dir%1.1st )dir%1.dat
 6: copy dir%1.* dl
 7: if %1 == dl goto not
 8: del dir%1.*
 9: :not deleted
10: cd ..
11: dir /P
```

The bat program (called SORTDIR.BAT) is executed by typing SORTDIR followed by the directory name. The program then does the following (the numbering is for reference only):

1. Changes to specified directory. %1 is the changeable parameter.
2. Create a file containing the directory.
3. Sort the directory file in alphabetic order.
4. Sort the directory by file size.
5. Sort the directory by date.
6. Copy everything to a special directory (dl, previously created) which contains these directory files.
7. If dl was the specified directory go to :not.
8. Otherwise delete the previously created files.
9. Where line 7 went to if true.
10. Change to the root directory.
11. Show all the files and directories in four column format.

I run the bat file for all the directories, one after another, then change to the dl directory and run the following bat file to create a file containing the names, size and date of all the files on the disk.

```
copy dir*.1st all.1st
copy dir*.alf all.alf
copy <all.alf )alfa.all
del all.alf
copy dir*.byt all.byt
sort /+14 <all.byt )byte.all
del all.byt
copy dir*.dat all.dat
sort /+23 <all.dat )date.all
del all.dat
```

Jurgen Wuster
Cosmos Software
Shibuya-ku, 6-32-5 Jingumae Dormir
Harajuku 304
Tokyo Japan

V20 CHIP EXPERIENCES

Dear Sol,

Regarding the articles on the NEC V20 chip, your readers might be interested in my experience. I have two Heath/Zenith H/Z-100s, and have installed V20s in both. One machine runs at 5MHz and has an 8MHz V20 on a Hudson 8087/256K DRAM board. The other runs at 7.5MHz and has the V20 and 8087 on a D.E.L. "2+2" board. I have found the V20 speeds up quantum chemical calculations (MS-FORTRAN) (HEAVY number crunching, the 8087 gets a workout!) by 7-10%. Compiled BASIC (no '87 support) shows off the V20 much better, in some cases as much as a 50% improvement. Your readers should also know that there are some underspeed V20 chips around. These have the NEC markings for 5MHz Magic Markered out and "8MHz" somehow marked on them. I got several of these by mail order, and they wouldn't run at 7.5MHz! It's a good idea to insist on chips with authentic NEC labelling; I got my present chips at a local show and was able to eyeball them before purchase.

Alfred A. Hagedorn III, Ph.D.
Edison, NJ

DIRTY PROGRAMMING

Dear Sol,

The highly competitive business of software development and marketing seems to encourage *quick and dirty* programming that works and captures a slice of the market but which causes headaches and anguish for other people later on. One example is found on page 11 of M/SJ Volume 2/No 1, where Jim Prince, in a letter to the editor, lists some compatibility problems he has encountered - "Some programs point to the FCB and send the file name to the screen without terminating it with a $." Whoever wrote such programs should be ashamed of such a dirty trick! Either terminate the string with a $ and then use CP/M Point String call or else use a loop which senses 11 (or 8, if the type is omitted) characters using the CP/M Console Character Out call. But *never* such a cheap, dirty trick as Jim Prince was confronted with!

Graeme Costin
Artarmon Australia

FFP MATH BUGS

Dear Mr. Libes,

Two bugs have turned up in the routines that are presented in my article *Faster Floating Point Math*, which appeared on pp. 46-54 of the Nov/Dec 1985 issue of Micro/Systems Journal.

One of them affected over- and underflow detection and reporting on conversion from C/80's floating point format to the format used by the AMD 9511A. To fix this, the first few lines at C2AMD: should be changed thusly:

```
C2AMD:
      MOV A,B       ; 4
      ORA A         ; 4
      JZ FPPZERO    ;10—B=0 implies x=0
;the next lines handle range checking properly
      ;does exponent lie in FPP's range?
      CPI 64+80H    ; 7
      JNC EXPHI     ;10—exceeds 2^63
      CPI -64+80H   ; 7
      JC EXPLO      ;10—smaller than 2^-64
      exponent ok, proceed
      SUI 80H       ; 7—corrects exponent
;end of range check changes
      ANI 7FH       ; 7—mask out hi bit of B
```

The second bug occurred once in a while when I used printf() to report a series of floating point numbers. This only happened for values that C/80 represented by the *magic numbers* 7d4c cccaH through 7d4c ccccH. The cause and cure of this bug were more difficult to determine. It turned out that printf() handles *e-format* by calling ftoa(), and that routines called by ftoa() access the two words at locations facl_ and facl_2 in fltlb, instead of the usual convention of using the stack or registers BCDE to pass arguments. Fixing this bug requires changing the code at label div10.

```
div10.: CALL   movfr.    ;get facl_2 into BC,
                         ;     facl_ into DE
        CALL   C2AMD     ;load 1st arg into fpp
        LXI    B,8420H
        LXI    D,0
        CALL   C2AMD     ;load fpp with "10"
        MVI    A,FDIV
        CALL   DOIT      ;return with result in BCDE
        PUSH   DE        ;in case needed later
        ;save DE in facl_& BC in facl_2,
        ;     so ftoa gets proper value
        CALL   movfr.    ;note: destroys DE
        POP    DE
        RET              ;previously fell
                         ;     through to fpdiv
        ;End of div10.fix for ftoa
```

I am sorry for any inconvenience that these bugs may have caused.

Yours truly,
Ted Carnevale
Stony Brook, NY

RE: EPROM EMULATOR

Editor:

While bringing up a Godbout 68K CPU, I needed to emulate 16 bits wide of PROM. Your article *Build an S-100 Eprom Emulator* (Jan/Feb 1986) was right on time, but needed some mods to work in my case. I added a 74LS244 in the data path between U7 and U8 to allow data to goto U8 only. Enable this chip (1&19) with U7 and U8's WE* (pin 27). To get the data out, use a 81LS95 just like the U11 arrangement. The quarter of U10 used to gate the output device U11 is not needed; take the two inputs that went to the AND gate and use them to drive the EW* line of each output driver. This isolates and provides two separate data paths, but with common address paths. I found a better way to arrange the cable pin outs and it is listed below (Table 1). I also use DDT as I can change code and then write it to the emulator, all within DDT. The code is shown in Listing 1. Should you like more information catch my next *Computer Corner* in the *Computer Journal*, where I'll discuss the whole operation in more detail.

Bill Kibler
Contributing Editor
Computer Journal
190 Sullivan Crossroads
Columbia Falls, MT

Listing 1.

Assemble this code at 8000hex where it will be safe even if DDT must be reloaded after a control C.

```
8000 21  00 01 LXI  H,0100  ;START OF HEX CODE TO BE LOADED
8003 11  FF 07 LXI  D,07FF  ;LENGTH OF CODE
8006 01  00 00 LXI  B,0000  ;STARTING PROM ADDRESS
8009 D3  ?1    OUT  ?1      ;BASE ADDRESS +1 FOR LOAD MODE
800B AF        XRA  A       ;SET ADDRESS TO ALL 0000
800C D3  ?2    OUT  ?2      ;SET LOW ADDRESS TO ZERO
800E D3  ?3    OUT  ?3      ;SET HIGH ADDRESS TO ZERO
8010 7E        MOV  A,M     ;GET FIRST BYTE
8011 D3  ?4    OUT  ?4      ;PUT IN U7 PROM (EVEN)
8013 23        INX  H       ;POINT TO NEXT BYTE
8014 7E        MOV  A,M     ;GET NEXT BYTE
8015 D3  ?5    OUT  ?5      ;PUT IN U8 PROM (ODD)
8017 23        INX  H       ;POINT TO NEXT BYTE
8018 03        INX  B       ;POINT TO NEXT ADDRESS IN PROM
8019 79        MOV  A,C     ;GET NEW LOW ADDRESS
801A D3  ?2    OUT  ?2      ;PUT NEW LOW ADDRESS OUT
801C 78        MOV  A,B     ;GET NEW HIGH ADDRESS
801D D3  ?3    OUT  ?3      ;PUT NEW HIGH ADDRESS OUT
801F BA        CMP  D       ;SEE IF HIGH END OF CODE SOURCE
8020 C2  10 80 JNZ  8010    ;JUMP IF NOT MATCH
8023 79        MOV  A,C     ;REGET LOW ADDRESS
8024 BB        CMP  E       ;SEE IF LOW BYTE A MATCH
8025 C2  10 80 JNZ  8010    ;JUMP IF NOT MATCH
8028 D3  ?0    OUT  ?0      ;SET INTO EMULATE MODE
802A FF  FF FF RST  7       ;REENTRY CODE INTO DDT
```

"?" Is base address of EPROM emulator....

Table 1.

CABLES: use 34 pin dual header strip and flat ribbon cable. Use flat ribbon DIP headers and connector for solderless connection. Pin 1 or the stripe will mark GROUND and be pin 12 of 2716/32.

CABLE 1			CABLE 2			DIP HEADERS	
						2716/32	2764
GND	1!2	D3	GND	1!2	D3	12!13	14!15
D2	3!4	D4	D2	3!4	D4	11!14	13!16
D1	5!6	D5	D1	5!6	D5	10!15	12!17
D0	7!8	D6	D0	7!8	D6	9!16	11!18
A0	9!10	D7		9!10	D7	8!17	10!19
A1	11!12	CE*		11!12	CE*	7!18	9!20
A2	13!14	A10		13!14		6!19	8!21
A3	15!16	OE*		15!16	OE*	5!20	7!22
A4	17!18	A11 #		17!18		4!21	6!23
A5	19!20	A9		19!20		3!22	5!24
A6	21!22	A8		21!22		2!23	4!25
A7	23!24			23!24		1!24	3!26
# A12	25!26			25!26			2!27
	27!28			27!28			1!28

Lines not used must be grounded to maintain proper addressing on proms.

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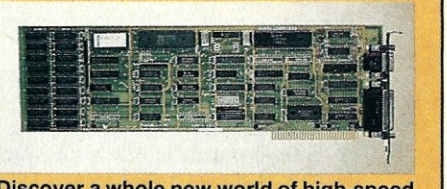

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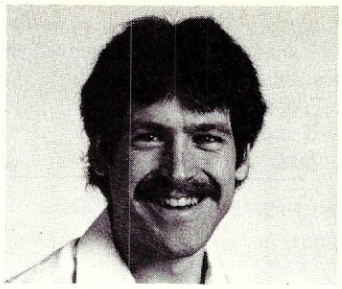

by Don Libes

The International Obfuscated C Code Contest

In the September '85 M/SJ, this column covered the results of the 1984 Obfuscated C Code Contest. This contest is run annually by Landon Noll (nsc!chongo) who collects C code that is so awful to read, it is actually funny. Viewed in the right light, you might even call it educational. (See the 9/85 issue of M/SJ for more background on this contest as well as the previous year's winners.)

The 1985 winners are in and the 1986 contest is now open. The 1985 winners are presented towards the end of the column. First let me restate the rules.

The goal is to write the most obscure C program within the rules below:

1. The source must be 1024 bytes or less. No exceptions!
2. Include in your letter:
   a) Name (or anonymous), Company/School, City, State and Country.
   b) Your path from a major network site, if applicable.
   c) A brief statement of what the program should do.
   d) The Machine(s)/Operating system(s) on which it runs.
   e) Enclose your source between the following lines:

      —start of program—
      ⟨place obfuscated source of 1024 bytes or less here⟩
      —end of program—
3. The entry should be written in common C. (K&R + common extensions)
4. The program must be of original work. All programs must be in the public domain. Copyrighted programs will be rejected.
5. Entries must be received before 30-May-86 (00:00 GMT). Electronic mail your entries to: decwrl!nsc!obfuscate

Entries sent by electronic mail will be confirmed starting 1-May-86. People are encouraged to submit entries via electronic mail; however, one may mail entries to the following address:

International Obfuscated C Code Contest
National Semiconductor
Attn: Landon Noll Mail Stop: 7c266
1135 Kern Ave.
Sunnyvale, CA 94086
U.S.A.

JUDGING

Awards will be given to the best entry in a number of categories. The actual category list will vary depending on the types of entries received. At the moment, we are considering using the following:

* The most obscure algorithm
* The worst abuse of the C preprocessor
* The strangest source layout
* The best small one line program
* The most useful program
* ⟨anything else we need to give recognition to a good entry⟩

We will attempt to run each of them on a VAX 785/4.2BSD system. Don't let the lack of such a system stop you! Try to avoid operating system/machine specific code if you do not have such a system. Extra points will be given for programs which:

a) pass lint without complaint
b) do something quasi-interesting
c) are portable

A larger program size was selected to allow for a wider range of program ideas. However, if you don't need 1024 bytes don't use them. Given two programs with similar techniques and similar levels of obfuscation, we will tend to favor the more concise entry.

POLL

We want to know what you think is the most poorly coded utility released with 4.xBSD and/or Sys V. The top results plus the best flameage will be posted along with the contest results. To vote, please follow the guidelines below:

1. Include at the top of the letter:
   a) Name (or anonymous), Company/School, City, State and Country.
   b) Your path from a major network site, if applicable.
   c) the name of the poorly coded utility
   d) the name of the operating system on which it is found
   e) the line: ⟨⟨⟨FLAME ON⟩⟩⟩
   f) up to 1024 bytes of flameage of the source
   g) the line: ⟨⟨⟨FLAME OFF⟩⟩⟩
2. Confine your vote to the standard set of commands; i.e., don't flame about local commands or user contributed software.
3. Submit your votes electronically to:

   for 4.xBSD: decwrl!nsc!bsd_util
   for Sys V: decwrl!nsc!sysV_util

   or, you may send your votes by letter to the same address used by the contest. Please place your votes on different sheets of paper.

Good luck!

The judges for the 1985 contest were Landon Noll and Larry Bassel. Unlike last year where there was one grand winner and several runner-ups, the judges have selected entries based on several different categories.

Let me point out that the contest judges will bend the rules in order to recognize outstanding obfuscation wherever it is found. So, if you absolutely can't get your program shorter than 1024 bytes, don't worry about it. Or, if your one-year old refused to include a single comment in the piece of code she banged out one day by rolling her head across the keyboard, but it solves Fermat's last theorem, send it anyway. I'm sure the judges will give it its fair due.

After all, it can't be any worse than much of the C code that we've seen, and who knows, it might even end up as an essential part of the next release of the operating system.

And here are the winners from 1985. These are truly impressive. As with last year's, I decided I should completely come to terms with at least one of these programs (the smallest, naturally) and stare with astonishment for awhile at the rest. But after studying it for about 20 minutes I was hopelessly confused.

My usual tactic was to look at the output of the C preprocessor and then run that through a C indenter. I struggled a little and then slowly succumbed to the preprocessor and indenter, in turn. My next tactic is to change variable names which was of very minor help since there were only two variables in the program!

Then I rewrote the *for* loop into a *while*, just to simplify the statement. Then I put in parentheses, and saw, much to my dismay, the execlp was indeed being called. Unfortunately, this is a UNIX-specific function. Briefly, it overlays the calling program with the program named in its first argument. The remaining arguments are passed to the new program. With this new information, you should be able to complete the puzzle.

THE 1985 WINNERS

Note that every entry had lines so long that they had to be broken up in order to fit in the magazine. Lines that originally continued will appear with a backslash at the end.

The categories are:

The best *small* program was this 128-byte record by Jack Applin (with help from Robert Heckendorn) (hplabs!hp-dcd!jack).

```
main(v,c)char**c;{for(v[c++]="Hello, world!\n)";
(!!c)[*c]&&(v--||--c&&execlp(*c,*c,c[!!c]+!!c,!\
c));**c=!c)write(!!*c,*c,!!**c);}
```

Judges comments: none

My comments: execlp is a UNIX subroutine that overlays the current program with a program by the name of the first argument. The remaining arguments are passed as arguments to the called program. It is convention that argv[0] is the name of the program itself. This should be a big enough hint as to what the program does, although it's still rather bizarre.

The *most obscure* program was supplied by Lennart Augustsson (seismo!mcvax!enea!chalmers!augustss).

```
#define p struct c
#define q struct b
#define h a->a
#define i a->b
#define e i->c
#define o a=(*b->a)(b->b,b->c)
#define s return a;}q*
#define n (d,b)p*b;{q*a;p*c;
#define z(t)(t*)malloc(sizeof(t))
q{int a;p{q*(*a)();int b;p*c;}*b;};q*\
u n a=z(q);h=d;i=z(p);i->a=u;i->b=d+1;s
v n c=b;do o,b=i;while(!(h%d));i=c;i-\
>a=v;i->b=d;e=b;s
w n o;c=i;i=b;i->a=w;e=z(p);e->a=v;e-\
>b=h;e->c=c;s
t n for(;;)o,main(-h),b=i;}main(b){p*\
a;if(b>0)a=z(p),h=w,a->c=z(p),a->c->a\
=u,a->c->b=2,t(0,a);putchar(b?main(b/\
2),-b%2+'0':10);}
```

My comments: This is really obscure. I recommend running this first, then renaming the functions more descriptively.

In the category of *worst abuse of the C preprocessor* was the following entry by Col. G. L. Sicherman (decvax!sunybcs!colonel).

```
#define C_C_(_)~' '&
#define _C_C(_)('\b'b'\b'>=C_C>'\t'b'\n')
#define C_C_|_
#define b~* _|_
#define C /b/
#define V _C_C(
main(C,V)
char **V;
/*   C program. (If you don't
 *   understand it look it
 */  up.) (In the C Manual)
{
    char _,__;
    while (read(0,&__,1) & write((_=(_=C_C_(__),C)),
    _C_,1)) _=C-V+subr(&V);
}
subr(C)
char *C;
{
    C="Lint says "argument Manual isn't used."\
    What's that mean?"; while (write((read(C_C\
    ('"'-'/*"'/*"*/))?  :  - +
    '\b'b'\b'|((_-52)%(~\b~b~\b'+C_C_('\t'b'\n\
    '))+1),1),&_,1));
}
```

Judges comment: This program confused the C preprocessor so badly that it left some comments in the preprocessed version. Also, lint DID complain that *argument Manual isn't used.*

My comment: This is the only program that was supplied with any indentation. Naturally, it is completely misleading.

In the category of the *strangest appearing* program was one submitted by Ed Lycklama (decvax!cca!ima!ism780!ed).

```
#define o define
#o ___o write
#o ooo (unsigned)
#o o_o_ 1
#o _o_ char
#o _oo goto
#o _oo_ read
#o o_o for
#o o_ main
#o o__ if
#o oo_ 0
#o _o(_,__,___)(void)__o(_,__,ooo(___))
#o __o (o_o_<<((o_o_<<(o_o_<<o_o_))+(o_o_\
<<o_o_)))+(o_o_<<(o_o_<<(o_o_<<o_o_)))
o_(){_o__=oo_,___,____,_____[__o];_oo_____\
;    :   =  o-o_o;  ____:
_o(o_o,____,__=(_=o_o<___?_-o_o:___));\
o_o(;__;o(o_o,"\b",o_o),--);
_o(o_o,"  ",o_o);o__(--__)_oo  ______;\
_o(o_o,"\n",o_o);_____:o__(_=_oo_(
oo_,____,__o))_oo_____;}
```

Judges comment: It looks like tty noise.

My comment: Not only does it look funny, but it acts funny, too!

And the grand prize for *most well-rounded in confusion* is a program by Carl Shapiro (sdcrdcf!otto!carl).

```
#define P(X)j=write(1,X,1)
#define C 39
int M[5000]={2},*u=M,N[5000],R=22,a[4],\
1[]={0,-1,C-1,-1},m[]={1,-C,-1,C},*b=N,\
*d=N,c,e,f,g,i,j,k,s;main(){for(M[i=C*R\
-1]=24;f|d>=b;){c=M[g=i];i=e;for(s=f=0;\
s<4;s++)if((k=m[s]+g)>=0&&k<C*R&&1[s]!=\
k%C&&(!M[k]||!j&&c>=16!=M[k]>=16))a[f++\
]=s;if(f){f=M[e=m[s=a[rand()/(1+2147483\
647/f)]]+g];j=j<f?f:j;f+=c&-16*!j;M[g]=\
c|1<<s;M[*d++=e]=f|1<<(s+2)%4;}else e=d\
>b++?b[-1]:e;}P(" ");for(s=C;--s;P("_")\
)P(" ");for(;P("\n"),R--;P("|"))for(e=C\
;e--;P("_"+(*u++/8)%2))P("| "+(*u/4)%2);}
```

My comment: rand is a UNIX-specific function. It returns pseudo-random numbers from 0 to the largest int value. This program also depends on 32-bit integers. If you have smaller integers, you might try declaring all the int variables as longs.

Don Libes is a computer scientist working in the Washington, DC area. He works on artificial intelligence in robot control systems. He is also the son of Lennie and Sol Libes.

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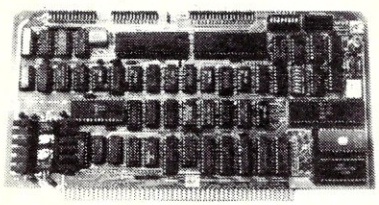

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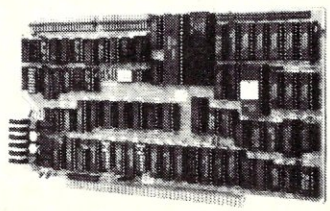

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Functions

abs	conbuf	feof	getcseg	isascii	movmem	replace	strcat
asm	conc	ferror	getdseg	iscntrl	open	repmem	strcmp
asmx	cos	fflush	getd	isdigit	outp	rewind	strcpy
atan	cpystr	fgets	putd	islower	peek	right$	strlen
atof	creat	fileno	getdate	isprint	perror	rindex	strncat
atoi	cursblk	filetrap	gettime	ispunct	poke	rmdir	strncmp
atol	curslin	find	geti	isspace	poscurs	scanf	strncpy
bdos	curscol	floor	puti	isupper	pow	setbuf	strsave
bdosx	cursrow	fopen	getkey	itoa	printf	setbufsiz	system
bios	cursoff	fprintf	getmode	keypress	putc	setcolor	tolower
biosx	curson	fputs	setmode	left$	putchar	setdate	toupper
calloc	delete	fread	gets	len	puts	settime	ungetc
ceil	drand	free	getw	log	putw	setjmp	ungetch
cfree	exec	freopen	heapsiz	log10	rand	setmem	unlink
chain	execl	fscanf	heaptrap	longjmp	read	sin	write
character	execv	fseek	hypot	lseek	readattr	sound	writechs
chdir	exit	ftell	index	malloc	reach	sprintf	xmembeg
chmod	exitmsg	fwrite	inp	alloc	writech	sqrt	xmemend
clearerr	exp	getc	insert	mathtrap	readdot	srand	xmemget
close	fabs	getch	iofilter	mid$	writedot	sscanf	xmemput
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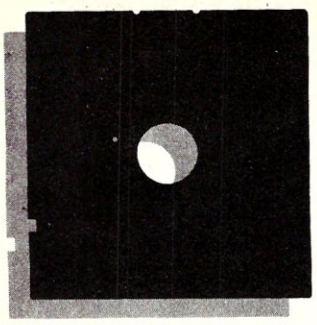

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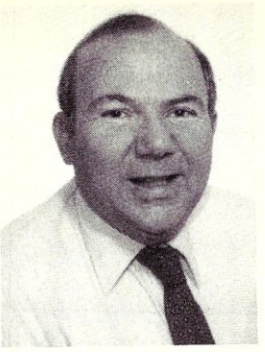

by Stephen M. Leon

There is much to say in this issue. Many new things happened. Our mailbox was full of new software and we released only part of it, squirreling away some for a leaner month.

We knew from our extensive correspondence with Bill Bolton, that CP/M was big in Australia. We had also seen a demonstration of one of the new Japanese MSX (CP/M-80 compatible) machines and assumed they had a developing CP/M interest. It was not until we received a set of 12 CP/M volumes from the Japan User Group that we realized how advanced their CP/M development was. As a teaser we have released one of these volumes (Volume 255). More will come in the future. For now we suggest you look at some of the code on the disk before you question the future of CP/M.

Volume 255 includes DP, a disk patch utility in CP/M-80 and -86. DU does much the same: dump, list, edit, copy, find, etc., but Keizo Maeda and Sakurao Nemoto, with their DP have what seems to me to be a far easier program to use. Also on the disk is SCAN, a bad sector utility for CP/M+. FINDBAD is not yet out in CP/M+, so SCAN is welcome.

At the other extreme, we have the Commodore-128 people with CP/M+. We borrowed a Commodore-128 to test some of our software on it. We found that a DSDD Kaypro 4 format was easily written on the PC with UNIFORM and read without error on the 128. The CP/M+ software in the library seemed to run well as did many of our favorite utilities.

The end result is a two-volume test release to introduce CP/M public domain software to Commodore users. If you have a 128 (or a 64 running CP/M) you may be interested in SIG/M Volumes 800 and 801. We have both on CompuServe and on a few BBS systems. If you send me two five inch disks and return postage, I will be glad to send them to you as soon as I can. The address is 200 Winston Drive - 1707, Cliffside Park, NJ 07010. Otherwise, send $14 for next day shipment of the set to Dusch Computer Services, 405 East 6th Avenue, Roselle, NJ 07203.

A number of people have asked about setting up a bulletin board system. In this issue Hank Kee discusses the topic in terms of MS-DOS software. We not only admit that it takes more work to set up a CP/M BBS system, but are quite proud of the fact. Isn't it true that much of the MS-DOS world spoon feeds users? A BBS operator should not be an appliance user. He or she should know enough about the system to be able to not only customize it, but also to prepare the system for a defense against some of the clowns who take pride in destroying it.

In the last issue I pointed out that SIG/M Volumes 249 and 250 contained the latest version of RBBS (Remote Bulletin Board System) and that Volume 251 has ROS, a Turbo Pascal BBS System. CITADEL, a bulletin board system in C, is on Volume 150. A BDS C version of RBBS from Australia is on Volume 178. The SIGNON RCP/M System is on 130. And an earlier RBBS and SIGNON is on 112.

We have not really tried to keep up with all of the BBS software. Our advice, if you are thinking of setting up such a system, is for you log on to a good system and enlist the aid of the SYSOP. Trevor Marshall's system on the West Coast (805-493-1495), Dave Hardy in Michigan (313-846-6127), Jim Mills in Illinois (312-469-2597), Bill Earnest in Pennsylvania (215-398-3937), Charlie Wells in Georgia (404-636-6130) or Dave Mitton in Mass (617-646-3080) are all good starting points in the learning curve. When you're finished learning and set your system up, you may be allowed entry into the SYSOP BBS network. So, if you want to be an appliance BBS operator (or set up a truly private system), go Capital. Otherwise, do it like a pro and be proud of it.

We could probably write a dozen columns about Rich Conn. *Mr. Z* is coming out soon with *son of ZCPR3*. As the first step, we now have available four new volumes (SIG/M 261 to 264). They contain SYSTLIB 3.6, VLIB 1.1 and Z3LIB 1.3. These are libraries of routines which are of great value to assembly language programmers. We expect the update to ZCPR3 within a few months. Rich also sent in two volumes of ADA source code. We are going to hold them in reserve until someone comes up with a way to compile them on a micro computer. The SIG/M library has a variety of languages - so how about someone writing and donating an ADA for public domain release.

Also in the last issue we mentioned that DRI was asking computer clubs to support CP/M. In line with this policy, they have released, to the public domain, four volumes of a GSX library for CP/M-86 and Concurrent-CP/M. The code is on SIG/M 257 to 260. This material should be invaluable to CP/M-86 or Concurrent users.

Steve Leon is the SIG/M Disk Editor. In other words, he is the person who assembles, complies, and edits all of the SIG/M public domain software disks. Thus, he speaks with the greatest authority as to what is going on in the SIG/M public domain software area.

Volume 256 has our first CP/M-68K utilities. All that we have so far is a file compare and a query/erase. They came via Edmund Ramm, in the Federal Republic of Germany. Hopefully, people will remember that SIG/M is the common repository of CP/M software and contribute 68K material as they write it. The mailman also recently brought 21 new volumes from Australia, and since 68K is big there, we may already have some of it - but release of the new Australian material will have to wait at least a month.

Also on 256 is a file transfer utility between MS-DOS and CP/M by Dave Koski of Fort Bragg CA. The program is written in Turbo Pascal and requires a Z-80. I could not test it, but it looks as if it should work well, especially on Kaypro equipment. SIG/M Volume 254 is another gem from Professor Harold McIntosh of the Universidad Autonoma de Puebla in Mexico. This is an update of ENCOL (SIG/M 206). It will give you multi-column printing of up to four columns and four files on one or two sides of a page. As usual, the good professor has provided full documentation and versions for both CP/M-80 and CP/M-86.

James D. Mooney of the Department of Statistics and Computer Science of West Virginia University has provided an experimental IEEE 855 (MOSI) interface for CP/M-80 and a language interface for Pascal MT+ (SIG/M Volume 253). The MOSI (Microprocessor Operating System Interface) Standard defines a set of *system calls,* referred to as FUNCTIONS, which can be invoked from various high level languages by application programs designed to be portable across various operating systems.

The MOSI standard, under development since 1980, has been approved by the IEEE Standards Board for TRIAL USE until 1987. During this period, potential users are encouraged to study and experiment with the standard, and to submit comments to help in establishing its final form. Professor Mooney is Chairman of the MOSI working group. The well-documented software he has provided is intended to serve as both a useful implementation in its own right and, as a model for additional implementations for other languages and systems.

The last item on which we will comment, in this issue, is Volume 252. Alan Hess of Lake Zurich, Illinois sent us a disassembler he wrote for the Kaypro. Please note that it will only work on the older models with a non-graphics screen.

SIG/M Volumes are available on 8" SS SD Disks for $6.00 each ($9.00 foreign) directly from SIG/M, Box 97, Iselin, NJ 08030. Printed catalogs are $3.00 each ($4.00 foreign). Disks in a variety of formats may be obtained through the worldwide SIG/M distribution network. The distributor list is included with the printed catalog. A disk version of the catalog (Volume 00) is available for $6.00. Many bulletin boards have the software for downloading and most new releases on available on the CP/M Sig on Compuserve.

NEW SIG/M PUBLIC DOMAIN SOFTWARE RELEASES

Volume 252
Kaypro Dynamic Tracing Disassembler
Novation Smartcat Overlay for MDM740

Volume 253
Experimental IEEE 855 (MOSI) Interface for CP/M 80 and Language Interface for Pascal MT+

Volume 254
Printer Utility (CP/M 80 & 86) Multi Column & Multi File Printing

Volume 255 Japan User Group-CP/M Volume 4
Disk Patch utility - CP/M 80 & 86
Linkage Parameter for LINKMT+86 & LINKMT+
Screen Edit subroutines
I/O for CP/M 80 & 86
PAS main routine of DP for Pascal/mt+
Printout utility for printer or console
Bad sector scan utility for CP/M 3.0
Get program size - CP/M 86

Volume 256
File compare in CP/M 68K
Query erase in CP/M 68K
Script for BBS logon (compiles with BASCOM)
Osborne games
SC template for chemical compositions
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Volume 259
DRI GSX Library for CP/M 86 & CCP/M (Volume 3 of 4)

Volume 260
DRI GSX Library for CP/M 86 & CCP/M (Volume 4 of 4)

Volume 261
SYSLIB 3.6 - Library of Routines (Volume 1 of 4)

Volume 262
SYSLIB 3.6 - Library of Routines (Volume 2 of 4)

Volume 263
SYSLIB 3.6, VLIB 1.1 -Library of Routines (Volume 3 of 4)

Volume 264
SYSLIB 3.6, Z3LIB 1.3 Library of Routines (Volume 4 of 4)

Volume 800 - SIG/M Commodore CP/M Sampler (Volume 1 of 2)
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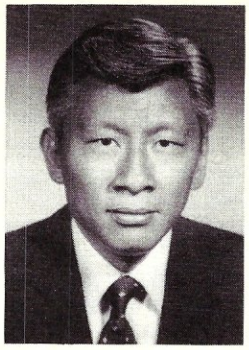
Program to update C128 CPM
Configuration program
IMP modem program for C128
MEX modem program for C128
Overlays for C128 modem programs
SIG/M Directory Volumes 256 - 151

Volume 801 - SIG/M SAMPLER - Commodore 128 (Volume 2 of 2)
A Collection of Z80-8080 Favorites from the SIG/M Library of Public Domain Software

PC/Blue Report

by Hank Kee



PC-based Bulletin Board Systems (BBS) have grown in popularity during the past two years. No one knows exactly how many are in operation. A number of factors have contributed to this phenomenon. With decreasing cost of PCs and compatibles, many users have purchased a *second* system just for bulletin board operation.

The expense of setting up a BBS has reached a very affordable level. A DC Hayes compatible 1200 baud modem can be purchased for less than $200 and the offshore PC clones have literally knocked the socks off the traditional home units like Atari and Commodore. It is now possible to purchase an PC clone for a little more than the comparably equipped Commodore system. Such a system is capable of running the *universal* repetoire of PC-DOS software. Add to this the public domain RBBS-PC software system, from the Capital PC Users Group, and you have a ready-to-install and easy-to-operate home BBS. And a large number of RBBS-PC systems are running on PCjrs.

The traditional BBS is message-based and file-oriented. Files are uploaded and downloaded. These files are typically public domain or user-supported software. There are now a large number of message-only BBS's dedicated to specific subjects such as photography, psychology, games and flea market exchange.

Many businesses use unattended PC-based BBS's to exchange and collect data. For example, this column is transmitted to a BBS run by M/SJ for authors. This extends the time needed to meet deadlines.

SETTING UP A BULLETIN BOARD SYSTEM

RBBS-PC (Remote Bulletin Board System for the PC) is widely available and comes complete with source code. For this reason I chose to use it to run the BBS I operate for the New York Amateur Computer Club. Access of source code allows me to *customize* the system to meet my needs. Installing the system is simple. The system operator (SYSOP) need only run the CONFIG program and specify the drive where the system files are located.

The sysop later can *fine tune* the BBS once some experience is gained with the system. Sysop control functions include different levels of security access, and the application of password control on files. RBBS-PC uses a referenced file called RBBS-PC.DEF which defines the operating environment.

The compiled version of RBBS-PC is approximately 107K (138K is required for multi-user). That's right, RBBS-PC may also be used for multiuser access! A 128K configuration is possible if you compile and link RBBS-PC without the multi-user support and you use PC-DOS 1.1. However a minimum of 192K is recommended. Under the BASIC interpreter, multi-user access is unavailable!

RBBS-PC can be run on a floppy disk -based system. However, the less disk space available the more file maintenance the SYSOP must perform. This is all right for a message-based system. A hard disk is mandatory for file upload and download functions.

The program requires the use of a DC Hayes 1200 Smartmodem or equivalent to function properly. I use a US Robotics 2400 modem operating at 300/450/1200/2400. Callers who wish to communicate at 450 baud have to call in at 300 baud and then switch to 450.

The files used by RBBS-PC are:

MESSAGES - This file contains the message text for the system. RBBS-PC expects the message file to exist and to have been created by CONFIG. If CONFIG does not find the MESSAGES file, it will create it and initialize it to the size the SYSOP specifies. The MESSAGES file can be shared among multiple RBBS-PC's.

USERS - This file is a record log of each user that used the system. The record contains a profile of each user that has signed on. To initialize the system simply ERASE this file. RBBS-PC expects the USERS file to exist. If CONFIG does not find the file on the system it will create it to the size specified by the SYSOP. The USERS file can be shared among multiple RBBS-PC's.

CALLERS - This file contains a log of all callers as they sign-on the system along with the caller's city and state, the date and time. The names are added to the end of the file as well as the names of the files uploaded/downloaded by the caller. If the file is not found RBBS-PC creates one. The file should be ERASEd to clear the log. The CALLERS file cannot be shared among multiple RBBS-PC's.

Editor's Note: Hank Kee is the librarian for the PC/Blue public domain software library. He is the person who collects, assembles, and checks all the software issued by PC/Blue and then compiles and edits them into the released volumes.

COMMENTS - This file contains comments left by users for the sysop. The file can be scanned by a SYSOP function or it can be TYPEd or edited outside the RBBS system. A SYSOP function is available to delete this file, or it can be emptied outside of DOS. The file will be created by RBBS-PC if it is not found. The COMMENTS file can be shared using Multi-link or Orchid.

99.DIR - This file contains a list of the files that have been uploaded by name, file size, date, and description. The file can be shared using Multi-link or Orchid.

RBBS-PC.DEF - This ASCII text file is created by CONFIG and contains the configuration parameters for the RBBS. It is read by RBBS to determine the configuration settings tailored to your RBBS-PC.

BULLET - This is a text menu printed following the WELCOME file when a user first enters the system. This lists the table of contents of bulletin subjects.

BULLET1 to BULLET99 - There can be from 1 to 99 *bulletins*. RBBS-PC checks for the existence of a specified bulletin.

DIR.DIR (1.DIR to 99.DIR) - At least one DIR.DIR file has to be present on one of the drives available for downloading.

FILESEC - is the password security file assigned to downloaded files.

Copies of the PC/Blue printed software directory can be ordered from Micro/Systems Journal, Box 1192, Mountainside NJ 07092 ($4 U.S, Canada & Mexico; $6 foreign).

PC/Blue disks are available from the New York Amateur Computer Club, Inc., Box 106, Church Street Station, NY NY 10008. Price is $7 per volume which includes media, postage, and handling. On foreign orders, please add $2 per disk.

HELP01 to HELP09 - Represent the nine on-line help files for RBBS-PC users. They have been prepared with specific messages for different functions.

MENU1 to 5 - contain the various commands for the subsystems. It is recommended that these be placed in a RAM disk rather than on a floppy or hard drive.

NEWUSER - This is a text file displayed for new users just before registration occurs.

TRASHCAN - is a text file containing user names that the sysop does not want used. RBBS-PC uses this file, if it exists, to deny access to anyone using one of these names for either their first or last name.

WELCOME - This text file is printed when a user first enters the system. It must be present, and should be modified to identify your system.

CONFENCE - This text file is printed when a user selects the J)oin function from the main menu. It is created using a text editor and should contain a list of the special interest conferences that you have on your system.

The RBBS-PC.DEF file (if you don't have it, it is created by the CONFIG program) contains the system's default operating parameters and values. You can run the CONFIG program at any time to change the system parameters.

Most SYSOP's organize their file directories by subject. DIR.DIR is the primary file directory used to define the other directories, in a tree-like structure. Most RBBS-PC SYSOP's use numbers to speciy these sub-directories (e.g. 1.DIR, 2.DIR, etc.).

If RBBS-PC is run under the BASIC interpreter, it uses the RBBS-PC.DEF file for its configuration parameters and ignores any parameter used when RBBS-PC was invoked. This is the standard default for SYSOPs running a single copy of RBBS-PC. If running multiple copies of RBBS-PC, it is not possible to run RBBS-PC under the BASIC interpreter!

RBBS-PC SECURITY FEATURES

All user and RBBS commands have assigned security levels controlled by the SYSOP. To use a command, the caller's security level must be at least as high as the command's security level.

The sysop can assign a file, or group of files, a security level and password. To download a file, a caller must have a security level at least as high as the file's security level and be able to give the file's password (if one is present). All users must pass these security tests, including those with sysop privileges.

Messages can be assigned a password by their originator. Only persons who are given permission are able to read or kill the message. Messages with password protection will show ⟨PROTECTED⟩ when scanned. Callers have no way of distinguishing messages to private individuals and to groups except by how they are addressed. Persons with SYSOP privileges can read all messages.

Security violations are logged to the CALLERS file. These include attempting to use functions without sufficient security clearance, and failure to give required passwords.

RBBS-PC's default configuration is that of an open system.

RBBS-PC's security system provides the SYSOP with several choices on how he wishes to run his RBBS. The chief ones are:

1. Change the BBS from an open system, available to anyone, or to a system available only to pre-registered users. To support this option, there is a function in the SYSOP's user maintenance option to ADD users.

2. A SYSOP can set up different *classes* of users by assigning different security levels to different users. Concurrently the SYSOP would have to assign different security levels to different commands. For example new callers might be permitted only to leave a comment, read bulletins, and list files that can be downloaded. Or there might be a group of files assigned a security level that only members of a special interest group can download.

3. The SYSOP can segregate the BBS functions into different groups based on a password. A specific file or group of files can be downloadable only to those who know the password. Similarly, messages can be made open to everyone knowing the password but closed to everyone else. This way there can be semi-private portions of the bulletin board.

Information is provided in the documentation to help those with the IBM PCjr to run RBBS-PC.

RBBS-PC can be readily downloaded from many bulletin boards. You can also order RBBS-PC from the Capital PC Users Group. For more information contact :

D. Thomas Mack
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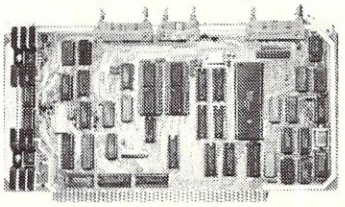

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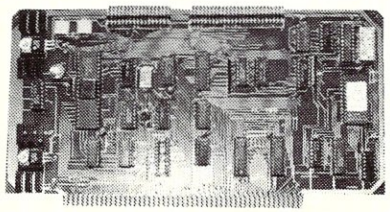

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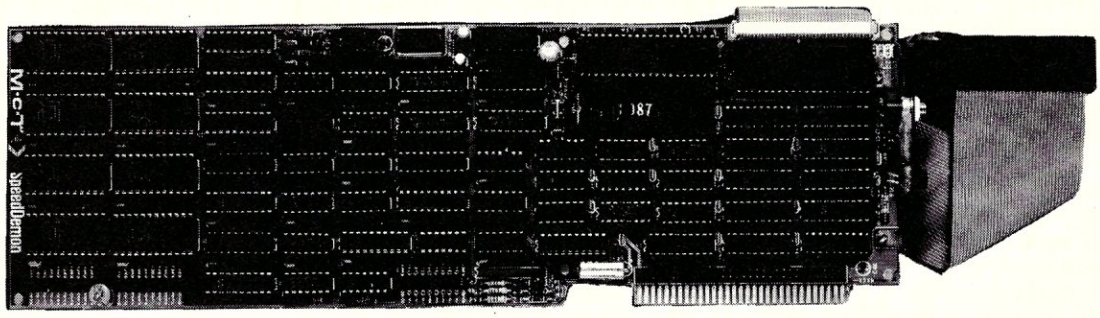

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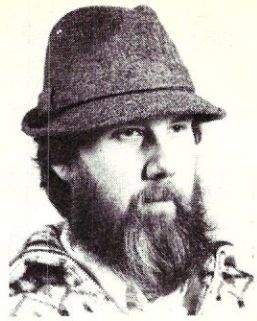


by David W. Carroll

This column features tips and techniques for using Turbo Pascal productively on MS/PC-DOS and CP/M microcomputer systems. It discusses typical problems and their solutions. Reader suggestions, comments, and questions are encouraged. Address them to: Turbo Pascal Corner, Box 699, Pine Grove CA 95665.

This month, we will discuss a problem often encountered by programmers — sorting data. There are many situations which require the data used by a program to be put in order for easy access or maximum efficiency. This is usually done by sorting the data in memory. If the data set is large, quick access to specific elements requires sorting of the data or at least the access key(s).

There are half a dozen or so sorting algorithms which can be used in a high level language like Turbo Pascal. They range from the well known and easily understood *bubble sort* to the more complex Shell-Metzner Sort and the Quicksort. Although many sort comparisons have been published in the pages of Microsystems and other journals, few have been done in Turbo Pascal.

We will take a look at these three algorithms from a performance standpoint and provide easy-to-use implementations of each sort. To insure valid comparisons, a random number file is generated and the same set of numbers is used for testing each sort method. The test program template will be shown in full for the bubble-sort with the two other replacement sort procedures.

In these examples, the *items* to be sorted are contained in an array of records. For small data sets (less than 10,000 elements) this is the easiest data structure to work with. The examples use an integer *key* value and the *item* record does not contain other data, but it could. Using an integer *key* (2 bytes), and 10,000 items, about 40K bytes are left in the stack/data segment for other variables and other elements in the *item* record. Sorting larger structures will require the use of pointers and the heap. These techniques will be discussed in the next issue.

RANDOM NUMBERS

A short program (Listing 1) is used to generate a file of N random integer numbers between 0 and 999 to use as our test data set *key* values.

Sorting With Turbo Pascal

TIMER ROUTINE

Each of the test programs uses a timer routine to clock the sorting time required. This routine is designed for MS-DOS. If you are using CP/M, you will need to provide your own clock routine or use manual timing. The timer routine is shown in Listing 2.

BUBBLE-SORT PROGRAM

The first program (Listing 3) is a simple bubble-sort which provides the *worst case* example for this comparison. The bubble-sort operates by repeatedly passing through the data set and exchanging any pair of elements which are out of order, and is sometimes called an exchange sort. This has the effect of forcing elements to *rise* to their correct ordered position in the file, thus the name *bubble* sort.

The display routine lists the key values and their position in the data set array. It is set up for listing the data in five columns, but this can be changed to suit the user.

The bubble-sort average speed factor is $K*(N^2)$. K is a constant linearly proportional to overhead operations. K for quicksort is usually smaller than for other methods.

SHELL-METZNER SORT

The Shell-Metzner sort (Listing 4) is much better than the bubble-sort. It offers more reasonable performance as the data set size increases. The Shell-Metzner sort average speed factor is K*N*log2(N). This sort is very consistant regardless of data set order.

QUICKSORT

The quicksort (Listing 5)is perhaps the best generally available memory sort routine. This version is recursive, so CP/M users may have problems with larger data sets. Also, in CP/M Turbo Pascal, the {$A+} compiler directive is required.

The quicksort algorithm speed factor is log2(N)+1. The quicksort is somewhat sensitive to data set order; random data sets work best.

RESULTS

These programs were run with Turbo Pascal 3.01a on a PC compatible with a 4.77 MHz clock. The timing shown (Table 1) should be representitive of any PC compatible.

As might be expected, the simplest routine (bubble-sort) was by far the slowest and should only be used for data sets of 100 items or less. Next in speed was the Shell-Metzner Sort, with the Quicksort coming in the fastest. The Quicksort is the fastest memory-based sorting algorithm in general use today.

Table 1. SORT TIMES
(Hrs:Min:Sec.Hunds)

Number of Items	Bubble	Shell-Metzner	Quicksort
100	0.77	0.28	0.11
1000	1:19.43	0:05.65	0:01.37
10000	2:13:32.09	2:08.36	0:17.36

REFERENCES

Grogono, P., ***Programming in Pascal***, Addison Wesley, 1978.

Knuth, D., ***The Art of Computer Programming*** Vol 2. "Sorting and Searching", Addison Wesley, 1973.

Sedgewick, R., ***Algorithms***, Addison Wesley, 1984.

Wirth, N., ***Algorithms + Data Structures = Programs***, Prentice Hall, 1977.

Terry, C., ***Is your Computer Out of Sorts***, S-100 Microsystems, Vol 1, No 3, May/June 1980, pp 35-47.

A library of some 600 Turbo Pascal public domain programs are available 24 hours a day for free downloading on the "High Sierra RBBS" system operated by the author at 209/296-3534.

David W. Carroll is a freelance writer and computer consultant living in the Sierra Nevada foothills near Sacramento, California. He is the author of Telecommunications with the IBM PCjr *co-published by Micro Text/Prentice Hall and* Programming with Turbo Pascal *co-published by Micro Text and McGraw-Hill.*

Listing 1.
Program To Generate Random Data

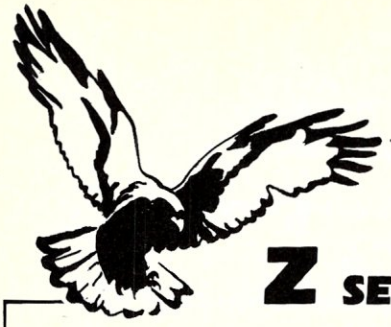
```
const
  n = 1000;

type

  item = record
         key : integer;
       end;
  index = 0..n;
  dataarray = array[1..n] of item;
var
  outfile : file of dataarray;
  a : dataarray;
  l : index;

begin
  for l := 1 to n do
    a[l].key := random(1000);
  assign(outfile,'sort.dat');
  rewrite(outfile);
  write(outfile,a);
  close(outfile);
end.
```

Listing 2.
Timer Routine

```
{ INCLUDE FILE TIMER.INC for MS-DOS }

var
  clock    : array[0..4,1..3] of integer;

procedure times(m:integer);
type
  registers = record
                ax,bx,cx,dx,bp,si,ds,es,flags: integer;
              end;
var
  regrec                : registers;
  cx , dx               : integer;
begin
  with regrec do
  begin
    ax := $2C shl 8;
  end;
  msdos(regrec);
  with regrec do
  begin
    clock[l,m] := cx shr 8;
    clock[2,m] := cx mod 256;
    clock[3,m] := dx shr 8;
    clock[4,m] := dx mod 256;
  end;
end;    {times}

procedure display_time(m:integer);
var
  time : string[11];
  hour,minute,
  second, hundredth : string[2];

begin
  str(clock[l,m],hour);
  str(clock[2,m],minute);
  str(clock[3,m],second);
  str(clock[4,m],hundredth);

  if length(hour) = 1 then insert(' ',hour  ,1);
  if length(minute) = 1 then insert('0',minute,1);
  if length(second) = 1 then insert('0',second,1);
  if length(hundredth) = 1 then insert('0',hundredth,1);
  time := hour + ':' + minute + ':' + second + '.' + hundredth;
  writeln(time);
end;   {display_time}

procedure calctime;
var
  carry, i : integer;

begin
  for i := 4 downto 1 do
  begin
    case i of
      1   : carry := 24;
      2,3 : carry := 60;
      4   : carry := 100;

    end;
    clock[i,3] := clock[i,2] - clock[i,1];
    if clock[i,3] < 0 then
    begin
      clock[i,3] := clock[i,3] + carry;
      clock[i-1,1] := clock[i-1,1] + 1;
    end;
  end;
end;   {calctime}


procedure timer2;
begin
  writeln;
  writeln;
  write('Start time:  ');
  display_tie(1);
  write('Stop time:   ');
  display_time(2);
  writeln;
  calctime;
  write('Total time:  ');
  display_time(3);
end;  {timer2}
```

Listing 3.
Bubble Sort

```
const
  n = 1000;

type
  item = record
         key : integer;
       end;
  index = 0..n;
  dataarray = array[1..n] of item;

var
  infile : file of dataarray;
  a : dataarray;

procedure bubsort;
var
  i,j : index;
  x   : item;
begin
  for i := 2 to n do
  begin
    for j := n downto i do
      if a[j-1].key > a[j].key then
      begin
        x:= a[j-1];
        a[j-1] := a[j];
        a[j] := x;
      end
  end
end;   {bubsort}

procedure display;
const
  num_col = 5;
var
  l : index;
  i, cnt : integer;

begin
  cnt := n div num_col;
  for l := 1 to cnt do
  begin
    for i := 0 to num_col-1 do
    begin
      write((l+cnt*i):3,': ');
      write(a[l+cnt*i].key:4);
      if i < num_col-1 then
        write('  ');
    end;
    writeln;
  end;
end;   {display}

{$I TIMER.INC }

begin   {main}
  assign(infile,'sort.dat');
  reset(infile);
  read(infile,a);
  close(infile);
  display;
  writeln;
  writeln('SORTING...');
  times(1);
  bubsort;        {change this call for each sort routine}
  times(2);
  clrscr;
  display;
  timer2;
end.  {main}
```



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Listing 4.
Shell-Metzner Sort

```
var
  i,j : index;
  inc : integer;
  x   : item;
  done : boolean;
begin
  inc := n;
  while inc > 1 do
  begin
    inc := inc div 2;
    repeat
      done := true;
      for i := 1 to n - inc do
      begin;
        j := i + inc;
        if a[i].key > a[j].key then
        begin
          x := a[i];
          a[i] := a[j];
          a[j] := x;
          done := false;
        end;
      end;
    until done;
  end;
end;
```

Listing 5.
Quicksort

```
procedure sort(l,r : index);
var
  i,j : index;
  x,w : item;

begin
  i := l;
  j := r;
  x := a[(l+r)div 2];
  repeat
    while a[i].key < x.key do i := i + 1;
    while x.key< a[j].key do j := j - 1;
    if i <= j then
    begin
      w := a[i];
      a[i] := a[j];
      a[j] := w;
      i := i + 1;
      j := j - 1;
    end
  until i > j;
  if l < j then sort(l,j);
  if i < r then sort(i,r)
end; {sort}

begin
  sort(1,n);
end;
```

Data Base Forum

continued from page 85

editor and then TYPE the program. The final test, of course, is when you run the program and see the desired screen display or report. This technique works equally well for PC compatible machines and versions of dBASE II that allow the use of the TEXT and ENDTEXT statements.

A final word of caution. Your printer may not allow you to produce just the characters that you desire, even though the correct characters do appear on the screen. On my printer, an Okidata Microline 84 with the IBM plug 'n play roms, some of the characters were correctly produced when the print-screen function was used, but were slightly changed both when the program and the output from the program were printed.

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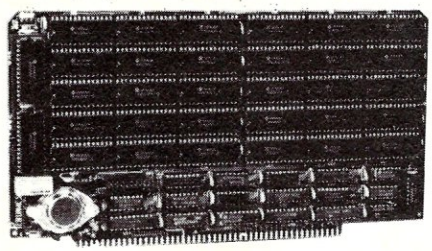

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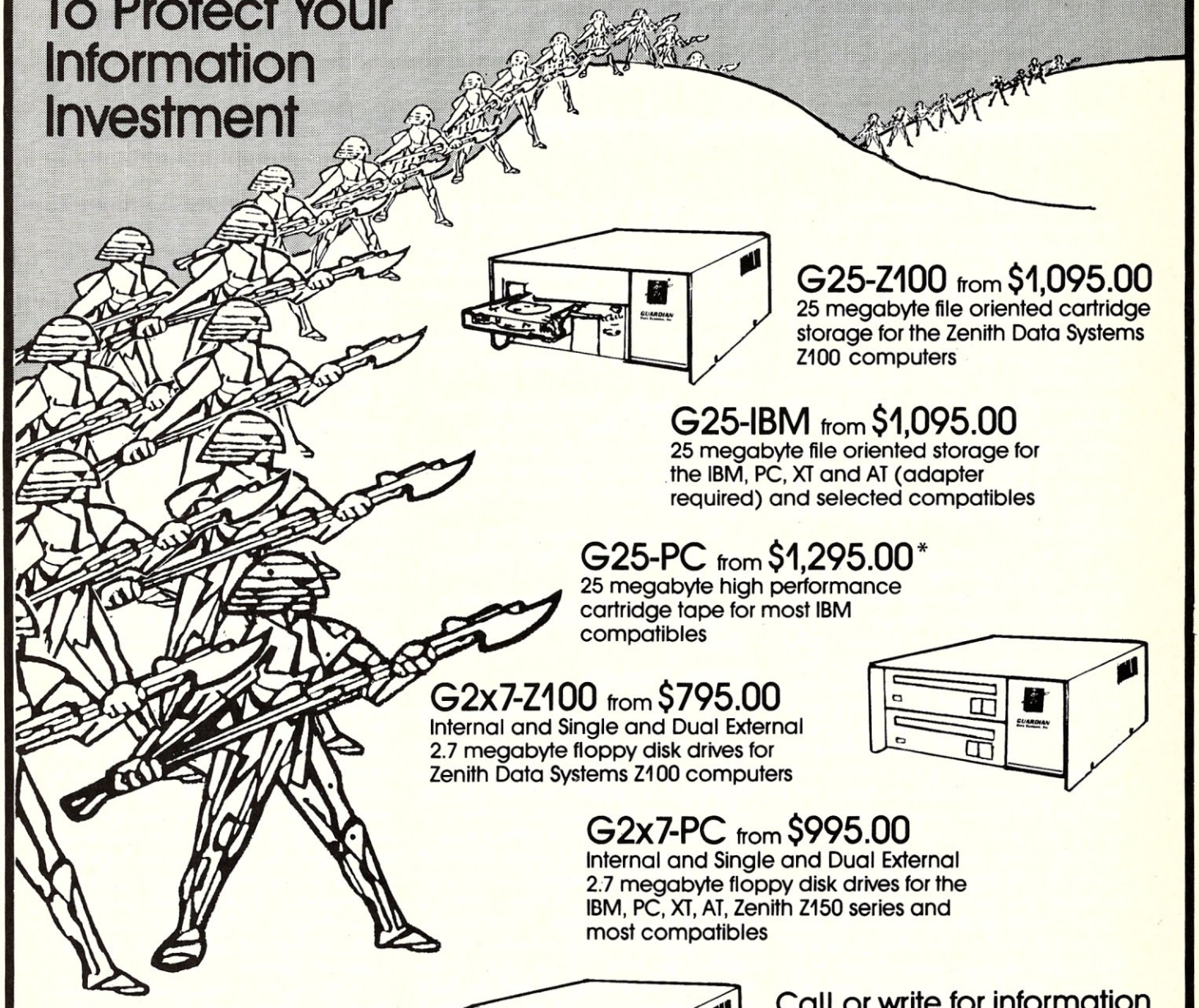

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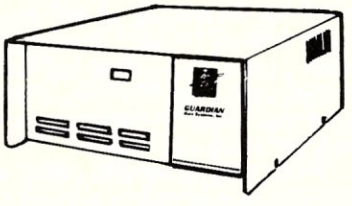

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Build An S-100 HD64180 CPU Card

by Roger T. Stevens

The HD64180 microprocessor is fully downward compatible with the Z-80, running the full Z-80 instruction set. It also has a number of added capabilities. These include memory management of 512K bytes, two DMA channels, one synchronous and two asynchronous serial I/O ports, two timers, and several new instructions including a hardware multiply instruction. This microprocessor seems to be a natural to upgrade S-100 systems. However, commercial boards thus far announced appear to be quite expensive. An alternate approach is needed that will permit experimentation with the advanced features of this microprocessor at modest cost.

My S-100 system makes use of processor, memory and floppy disk controller boards made by Computime (see the Computime ad in this issue). Because I was well pleased with the way my present system operated, it seemed to make sense to buy a Computime Z80 CPU board and attempt to modify it to use the HD64180. The principal problem was to develop a method of mating the HD64180 to the CPU board in a way that would be easy to debug and would permit simple evolution of system hardware from a working Z-80 system to an advanced system using the unique capabilities of the HD64180. I first tried two ways to do this: wiring the HD64180 socket to a 40 pin plug-in header and wiring a small piggy-back circuit board to the main board. Both approaches involved too many possibilites for broken wires and unintentional shorts. They also required such a large jump from the working Z-80 system to the HD64180 system that debugging was difficult, if not impossible.

The approach that proved successful used a 40 pin DIP with attached ribbon cable to connect a piggy-back board to the Z80 socket on the CPU board. A few additional connections were needed for the serial I/O port, system clock, and extended address lines. These were made with a 16 pin socket with attached ribbon cable wired to the piggy-back board and connected to an 8 pin header on the CPU board.

OVERVIEW

Many of the functions of the HD64180 are fully software directed through a set of 64 reserved I/O ports. Since the application of timers, DMA controllers, etc. is highly dependent upon the characteristics of an individual system, they will be reserved for a future article. The primary goals of this article are:

1. To get your S-100 system up and running with the Computime Z80 CPU board.
2. To replace the Z80 with an HD64180 and get all Z80 functions running.
3. To provide a tool for experimenting with running your system at the faster clock frequencies available with the HD64180.
4. To get one HD64180 serial I/O port up and running to replace the Computime I/O port.
5. To get the memory management circuitry running to permit banked memory control.

GETTING STARTED

The easiest way to avoid bogging down in the debugging process is to start by building the Z-80 processor board with a Z-80 according to Computime's instructions. In this way, the board can be fully debugged and tested with assurance that any faults are strictly construction errors rather than mistakes in configuring the added HD64180 and its associated components. The only added component not otherwise required is the Z-80 microprocessor, which is relatively cheap on the current market. In constructing the board, do not solder in the sockets for the 8251 serial I/O integrated circuit (U8) or the 8253 timer integrated circuit (U9) as these will be replaced with internal units in the HD64180. These circuits are not required in order to run and test the board in the Z80 mode.

The CPU board contains a ROM socket which can be jumpered for use with a 2708 or 2716 ROM for 1K or 2K of fixed memory and two 2114's to provide 1K of RAM. The ROM can be permanently a part of the system memory or can be phantomed out after initial start-up. The starting address for the internal RAM and the start-up address of the ROM, if it is permanent, or the jump address range for exiting the phantom mode are independently selected by DIP switches. The setting of these switches is described in the Computime instruction manual (Ref. 1) which you will receive with your Computime board. The RAM, and the ROM if it is permanent, override any other memory in the system and are thus always present, regardless of the setting of any extended address lines. They are, therefore, convenient locations for storing memory bank switching routines to make sure that the system does not get lost when a memory switching operation occurs. I chose to address my 1K of ROM at location FC00H and my 1K of RAM at 0000H. These seem to be good locations for running CP/M or ZCPR3. The ROM is above the operating system and contains memory switching and I/O routines. The RAM includes the area where the system pointers and stack occur. Figure 1 shows for a two bank system what may happen when bank switching takes place. If the program is running in the section of memory that is switched, it will suddenly encounter a totally different set of instructions, which may be disasterous. If the bank switching routine is in the non-switchable CPU ROM, the problem does not occur, because this portion of memory is never switched. Since the CPU memory areas override every bank of memory that is switched into the system, it is often desirable to keep them small, to minimize the amount of memory that is unusable because it is overridden. This may make it desirable to use a 2708 for the CPU ROM rather than a 2716, even though this chip is slow and somewhat obsolete.

At this point you should make any modifications needed in your software to make it compatible with the CPU board and to prepare it for eventual use with the memory management features of the enhanced system. In this and future steps you will need the HD64180 data book (Ref. 2) as a useful guide.

The HD64180 makes use of 64 I/O port addresses to interface with internal registers which control memory management, DMA, timers, and the serial I/O ports. These can be located beginning at any 40H boundary of the first 256 addresses. Upon initialization, the HD64180 sets these ports to be in the range from 0 to 3FH. Unless you have a very compelling reason for doing otherwise, you should leave the ports in this

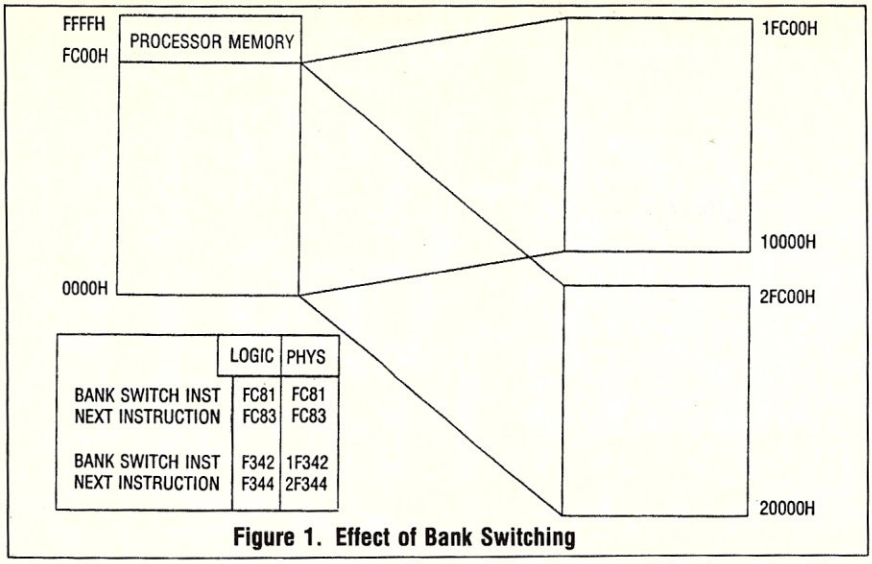

Figure 1. Effect of Bank Switching

range. If you *must* move them, you still must leave port address 3FH free, because this is the address where you send the command to move the internal port address range. You must also send this command when initializing, otherwise you will have address conflicts if you try to do anything involving I/O ports. If any of your I/O devices currently use ports in the range occupied by the internal port addresses, you should relocate them outside this range and modify your software accordingly.

PREPARING THE CPU BOARD FOR THE HD-64180

Once your system is working well with the new Z-80 CPU, you can begin the modification process. All of the HD64180 signals except those for the serial I/O port, the extended address lines, and the system clock, ϕ, are interfaced through the Z80 socket, U19, and require no modification of the CPU board. The remaining signals are interfaced through an 8 pin header which replaces pins 18 through 25 of the former serial I/O integrated circuit, U8. The following steps interface all remaining signals except the system clock:

1. Cut the connection from U8, pin 20 to U9, pin 15 on the front (component side) of the CPU board.
2. Cut the connection from U8, pin 21 to a feedthrough on the rear (foil side) of the CPU board.
3. Cut the connection from U8, pin 25 to U8, pin 9 on the front (component side) of the CPU board.
4. Solder an 8 pin right angle header to U8 pins 18-25.
5. Solder a jumper (no. 28 wire-wrap wire) from U8, pin 3 to U8, pin 20.
6. Solder a jumper from U8, pin 18 to P1 (S-100 connector), pin 16.
7. Solder a jumper from U8, pin 21 to P1, pin 17.
8. Solder a jumper from U8, pin 23 to P1, pin 15.
9. Solder a jumper from U8, pin 24 to U4, pin 8.

The above modifications should not have any effect on the operation of the Z80 CPU board. Check the board in your system to insure that you have not made any mistakes.

MAKING A Z-80 LOOK-ALIKE

You are now ready to construct the piggy-back board. Figure 2 shows the layout and assembly of this board. It includes the HD64180 microprocessor and a 74LS244 which provides three-state interfaces for the extended address lines. If you design your own board, note that the pins of the HD64180 are on 0.070 inch centers rather than the 0.100 inch centers common to other integrated circuits. Before mounting anything on your piggy-back board, place it in approximately the desired position on the CPU board (see Figure 3). Locate at least three places where there are no printed circuit wires on either board. Mark these on the CPU board and drill holes for mounting stand-offs. Then put the piggy-back board in its final position and use the CPU board as a template for marking the position of and drilling the mounting holes on the piggy-back board. The piggy-back board seems to work well without any by-pass capacitors, but to play safe, it's a good idea to solder a 0.1 uf by-pass capacitor between +5 volts and ground at each of the IC sockets.

Obtain one DIP assembly consisting of a 40 pin DIP plug attached to six inches of ribbon cable, and one 16 pin socket attached to ribbon cable. Tentatively position the piggy-back board, the 40 pin plug, the 16 pin socket, and their ribbon cables on the CPU board and clamp the ribbon cables to the piggy-back board with small strips of printed circuit board material screwed at each end. Cut off any excess lengths of ribbon cable as you are making connections to the piggy-back board. Connect the leads of the 40 conductor ribbon cable to the piggy-back board as shown in Figure 4. This is a bottom view which is what you will see as you look at the pins of the 40 pin DIP plug. Connect the eight leads that are used

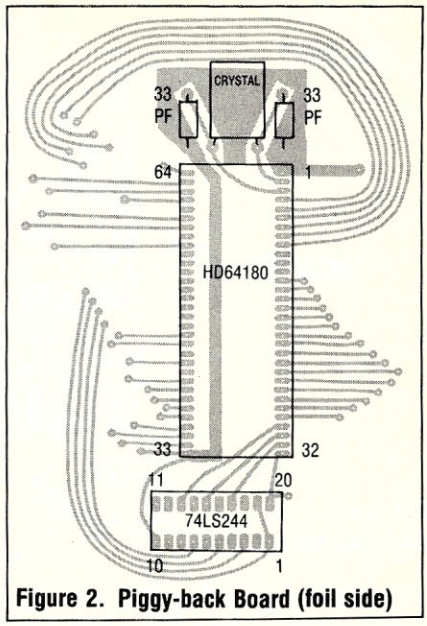

Figure 2. Piggy-back Board (foil side)

of the 16 conductor ribbon cable to the piggy-back board as shown in Figure 5. The easiest way to avoid mistakes (or solder bridges) is to make frequent checks between the socket pins of the two integrated circuit sockets on the piggy-back board and the pins of the DIP plug and 16 pin socket at the ends of the ribbon cables with an ohmmeter. Finally, solder the crystal and two capacitors in place on the piggy-back board as shown in Figure 2.

Insert the HD64180 into its socket. Do not mount a 74LS244 in the 20 pin socket at this time.

HD64180 SYSTEM TIMING

The system clock, ϕ, for the HD64180 is generated internally and output from pin 64, unlike the Z80, where ϕ is an input line. The HD64180 requires either a crystal or an external oscillator at twice the system clock frequency; for example, a 12 MHz oscillator or crystal results in a 6 MHz ϕ. Since ϕ is divided down to create baud rates for the internal serial I/O ports, it must be an exact multiple of the baud rate, namely 160, 480, 640, or 1920 times the highest baud rate. Suggested crystal frequencies are 6.144 MHz, 9.216 MHz, or 12.28 MHz, to give ϕ's of 3.072 MHz, 4.608 MHz, and 6.144 MHz respectively. It is recommended that the HD64180 first be tested with the 6.144 MHz crystal. Using this, the ϕ of 3.072 MHz should be fully compatible with any S-100 system which has been running at 4 MHz. Once the system is working well at this frequency, attempts at speeding it up can be tried.

Make the following changes to switch the system clock to that generated by the HD64180:

1. Cut the connection to U4, pin 3 on the rear (foil side) of the CPU board.
2. Connect U8, pin 25 to U4, pin 3.
3. Remove the jumper on the CPU board that selects 2 MHz or 4 Mhz.
4. Connect U4, pin 4 to U12, pin 15.

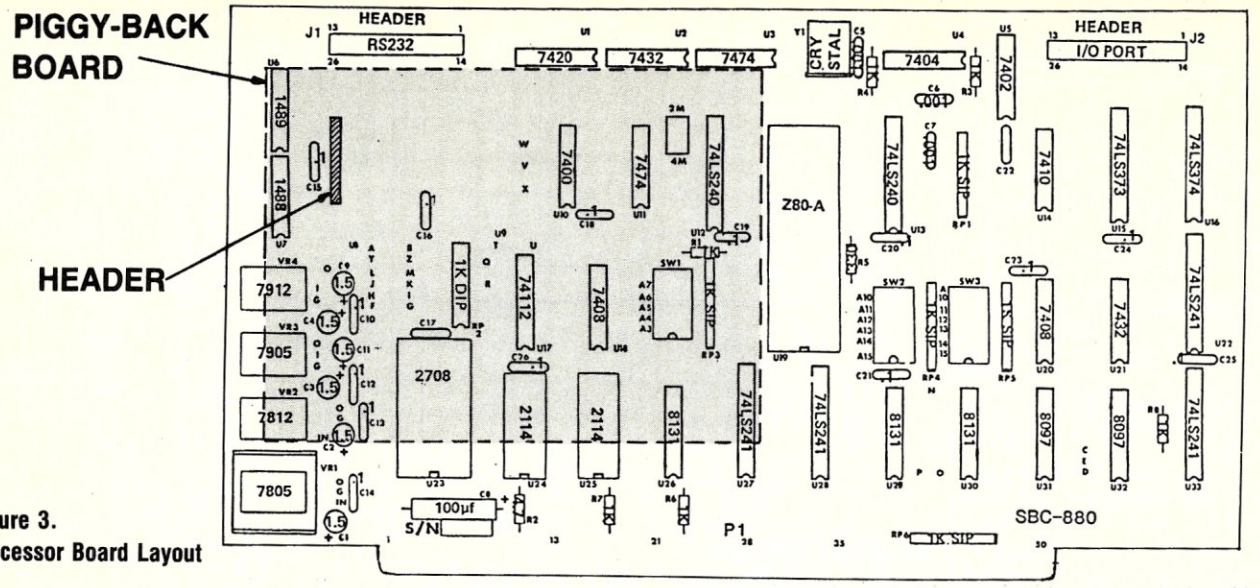

Figure 3.
Processor Board Layout

The Z80 runs with no wait states on memory access cycles and with one wait state on I/O access cycles. Other desired wait states must be generated by external hardware. Unlike the Z80, the HD64180 has the capability to insert wait states internally. Up to 3 wait states may be inserted in memory read/write operations and up to 4 wait states in I/O operations. When the HD64180 is reset, it will insert the maximum number of wait states. This is useful when first checking out a system at a faster clock rate, but normally should be avoided because it significantly slows down all operations. Wait states are controlled by the four most significant bits of internal register port 32H. The settings are as follows:

Bits 7 6	Memory Wait States
1 1	3
1 0	2
0 1	1
0 0	0

Bits 5 4	I/O Wait States
1 1	4
1 0	3
0 1	2
0 0	1

The following program, run during initialization, will set up the HD64180 for zero memory and one I/O wait states:

```
3E 00      MVI    A,00H
ED 39 32   OUTO   32H
```

Using the above program for initialization, and the 3.072 MHz system clock rate, you should now be able to plug in the piggyback board and run the HD64180 system in the same way that the Z80 system ran before. Once you have run some programs to assure yourself that this is the case, you may want to change the crystal and begin experimenting with faster system clock rates.

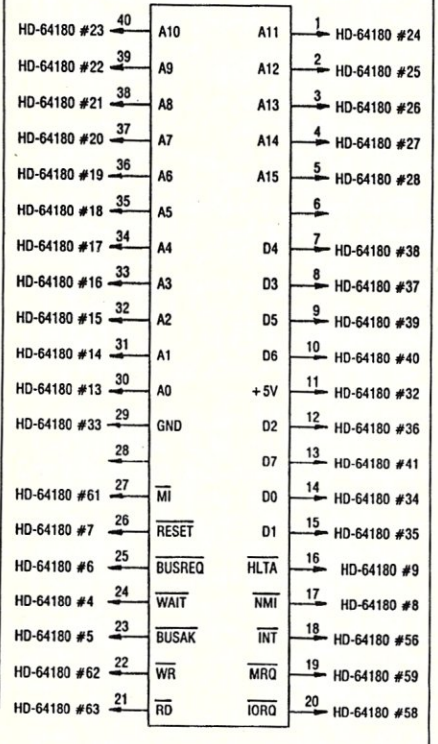

Figure 4. Connections for 40 Pin DIP Plug

No hard and fast rules can be given for speeding up operation of an S-100 system. If a system stops working when the system clock is sped up, the problem areas are usually the inherent speed of ROM and RAM memory chips, the inherent speed of I/O interface chips, and the transmission and reflection characteristics of bus lines. If your system runs satisfactorily when you speed up the system clock and reinitialize the HD64180 for the maximum number of wait states, this indicates that your motherboard and its associated bus lines are capable of handling the higher frequency. You can then decrease the number of wait states for memory and for I/O operation until you find the minimum number of wait states at which your memory and I/O are capable of operating reliably.

USING THE HD64180 INTERNAL PORTS

The internal ports at addresses 00H to 3FH are used to control the enhanced functions of the HD64180. When a Z-80 makes use of input or output instructions, the eight-

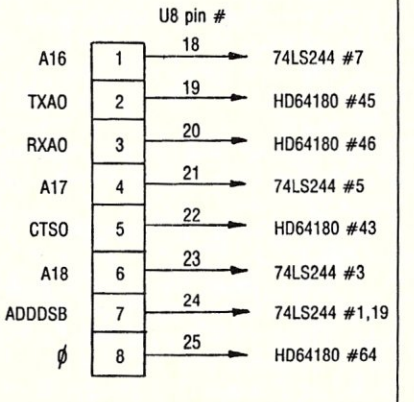

Figure 5. 16 Pin Socket
(Connect to 8 Pin Header)

bit port address is output on the eight lower address lines. The data word is output on the eight higher address lines in addition to the eight data lines. The HD64180 functions in the same manner. However, the internal port addressing scheme has been made compatible with a sixteen-bit port address. This means that any time that the I/O data is other than zero, the normal Z-80 I/O commands cannot be used to address the internal ports because the eight most significant bits of the port address will not be zero. The HD64180 gets around this difficulty by adding new I/O instructions which are similar to the old set except that they force the eight most significant bits of the address to be zero. These instructions are:

```
IN0 A    ED  38
IN0 B    ED  00
IN0 C    ED  08
IN0 D    ED  10
IN0 E    ED  18
IN0 H    ED  20
IN0 L    ED  28
OUT0 A   ED  39
OUT0 B   ED  01
OUT0 C   ED  09
OUT0 D   ED  11
OUT0 E   ED  19
OUT0 H   ED  21
OUT0 L   ED  29
OTIM     ED  83
OTDM     ED  8B
OTDMR    ED  9B
```

These commands must be used for addressing the internal ports; otherwise commands to the internal ports will only be accepted when the data content happens to be zero, resulting in erratic operation. Furthermore, you must be sure that you don't have an external port at the same address as one of the internal ports, since if you do, the internal port will be activated when the data sent to the external port address is zero, but not otherwise, resulting in rare, exasparating errors that are very difficult to debug.

MEMORY MANAGEMENT

The HD64180 contains a flexible memory management system. The logical 64K memory area is divided into three sections. The lowest addressed area, beginning at address 0000H, is called the Common 0 Area. The next area is called the Bank Area. The topmost area is called the Common 1 Area. The end of the Common 0 area and the beginning of the Bank Area is defined (to a 4K increment) by an address entered into the four least significant bits of register CBAR (I/O port address 3AH). The end of the Bank Area and the beginning of the Common 1 Area is defined (to a 4K increment) by an address entered into the four most significant bits of register CBAR. Figure 6 shows how the extended addressing is generated.

Figure 7 shows a typical memory arrangement. Common Area 0 is a true common area, because it always makes use of the physical memory area beginning at

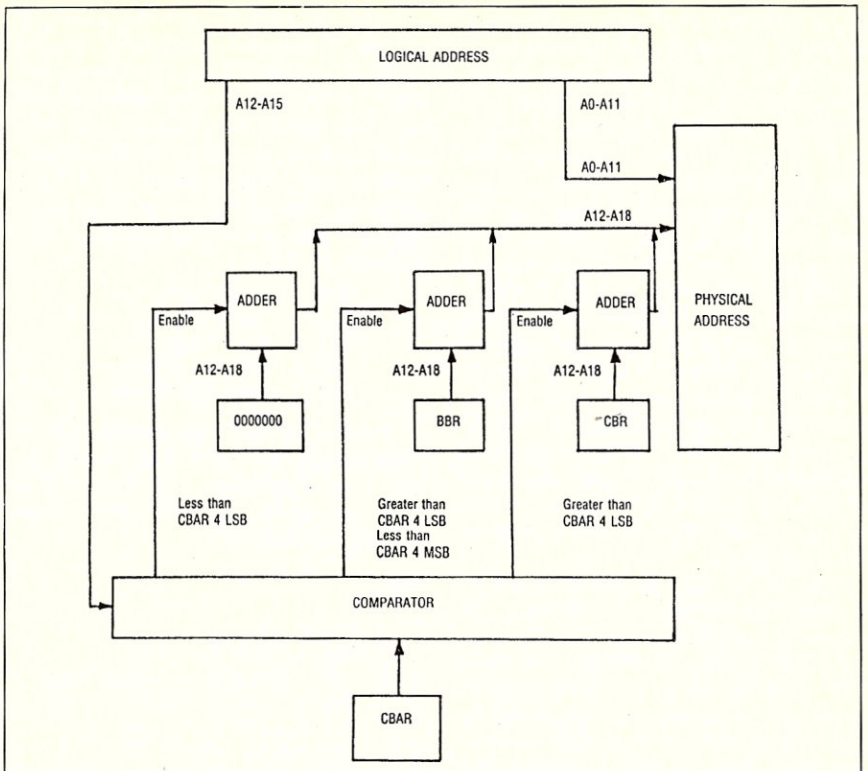

Figure 6. Extended Address Generation

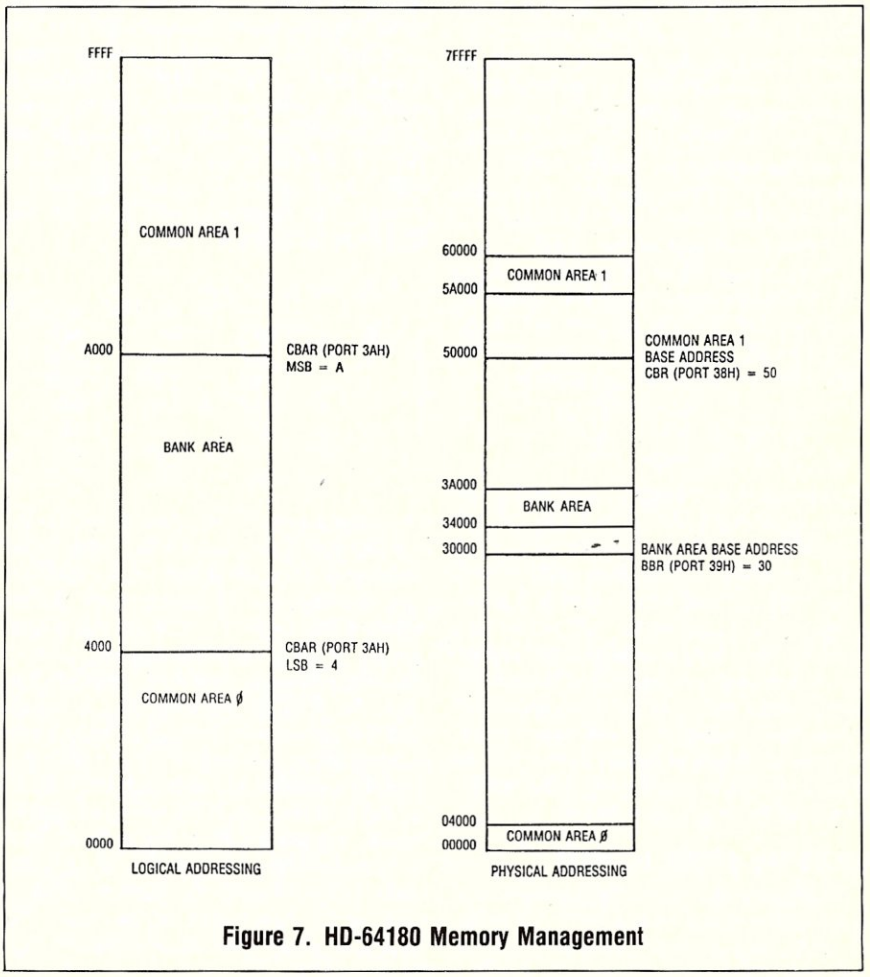

Figure 7. HD-64180 Memory Management

address 00000H, and is thus unchanged, regardless of whatever memory switching takes place. Register BBR (port address 38H) defines the start of the logical 64K memory for the Bank Area (to a 4K increment). Thus the actual beginning of the Bank Area in the 512K byte physical memory is the address given in BBR plus the beginning offset specified by the four least significant bits of CBAR. This assures that the Bank Area cannot overlap Common Area 0. Register CBR (port address 39H) defines the start of the logical 64K memory for Common Area 1 (to a 4K increment). The actual start of Common Area 1 in the 512K byte physical memory is the address given by CBR plus the beginning offset specified by the four most significant bits of CBAR. This assures that Common Area 1 cannot overlap either the Bank Area or Common Area 0.

The above scheme allows a lot of flexibility in memory management. To assure that everything is compatible with a basic Z-80 system, on RESET, registers BBR and CBR are set to zero and CBAR comes up with the four most significant bits set to one and the four least significant bits set to zero. Thus Common Area 0 does not exist, the Bank Area extends from 0000H to EFFFH, and Common Area 1 from F000H to FFFFH. The 64K byte logical memory is mapped to the first 64K of the 512K byte physical memory. In getting memory management working for the first time, it is easiest to leave CBAR at its initial setting and to program both BBR and CBR with the same number. If the four least significant bits of this number are always zero, bit 5 will represent address line A16, bit 6 will represent A17, and bit 7 will represent A18. Bit 8 is not used and has no effect.

The extended address lines A16 through A18 should all come up zero when the CPU board is reset. To test A16 through A18, write a small test program to send 70H to ports 38H and 39H. This program is:

```
3E 70      MVI   A,070H
ED 39 38   OUTI  38H
ED 39 39   OUTI  39H
```

This program will output 1's from the address lines A16, A17, and A18 of the HD64180. These are +5 volt pulses timed to be synchronous with other address outputs. They must be observed with a logic probe or an oscilloscope. All of the extended address lines should be tested before any attempt is made to activate the memory management function. If the signals all appear to be correct, you can modify your software as needed to handle memory management and then plug the 74LS244 into its socket on the piggy-back board.

USING THE SERIAL I/O PORT

Although the HD64180 contains one synchronous and two asynchronous serial I/O ports, only one was used in this application with a single hand-shaking line. This maintains the same serial output connector and pin connections used in the original Computime board. However, Computime didn't use all sections of its 1488 and 1489 serial interface IC's nor were all pins on the connector used, so a more ambitious modification could add additional serial I/O capability. The asynchronous serial interface used is device 0, which occupies port addresses as follows:

00H	Control Register A
02H	Control Register B
04H	Status Register
06H	Transmit Data Register
08H	Receive Data Register

For the mode of operation used here, Control Register A should be set with the five most significant bits, 01100. The three least significant bits set the mode of operation as follows:

Bits 2 1 0	
0 0 0	Start + 7 data bits + 1 stop
0 0 1	Start + 7 data bits + 2 stop
0 1 0	Start + 7 data bits + parity + 1 stop
0 1 1	Start + 7 data bits + parity + 2 stop
1 0 0	Start + 8 data bits + 1 stop
1 0 1	Start + 8 data bits + 2 stop
1 1 0	Start + 8 data bits + parity + 1 stop
1 1 1	Start + 8 data bits + parity + 2 stop

For this application, Control Register B should have the two most significant bits set to 00. The next bit (bit 5) should be set to 1 if the 9.216 MHz. crystal is used and to 0 if the 6.144 MHz. or 12.28 MHz. crystals are used. Bit 4 sets parity even if set to 1 and parity odd if set to 0. Bit 3 (DR) is the divide ratio. It should be set to 1 for the 12.28 MHz. crystal and to 0 for the 9.216 MHz. crystal. The remaining bits then set the Baud rate as follows:

Bit 2	Bit 1	Bit 0	Baud Rate $\phi = 6.144$	$\phi = 4.608$	$\phi = 3.072$
0	0	0	9600	9600	4800
0	0	1	4800	4800	2400
0	1	0	2400	2400	1200
0	1	1	1200	1200	600
1	0	0	600	600	300
1	0	1	300	300	150
1	1	0	150	150	75

Once the serial I/O interface is set up by sending initializing signals to the two control registers the serial port can be used for transmitting and receiving data at the selected Baud rate. Prior to sending a data byte to the Transmit Data Register, bit 1 of the Status Register should be checked. If it is 1, the Transmit Data Register is empty and is ready to receive data. Similarly while reading incoming data, bit 7 of the status register should first be checked. If it is set to 1, the Receive Data Register is full, and is ready to provide data to the system. This information should be adequate to program serial I/O interface 0. For further information on the capabilities of the serial I/O channels, refer to the Hitachi HD64180 data book (Ref. 2).

SUMMING UP

You should now have a working HD64180 CPU board which performs memory management and serial I/O functions and runs at whatever faster speed you have chosen to implement as your system clock rate. Figures 8 and 9 show the schematic diagram for the Computime CPU board as modified to work with the HD64180. You can now continue to experiment with the additional features of the HD64180. Two good ones to try first are the timers and the DMA channels. Both these functions are fully software controlled and do not require any modifications to your HD64180 hardware.

References:

1. *Z80 Single Board Computer SBC880 Reference Manual*, Computime, Inc.
2. *Hitachi HD64180 8-Bit High Integration CMOS Microprocessor Data Book*, #U77, Hitachi America Ltd.

SOURCES:

Z80 CPU Board ($65.00)
Computime
8614 Hamilton Ave.
Huntington Beach, CA 92646

6.144 MHz, 9.216 MHz, and 12.28 MHz crystals ($0.95 each)
Hughes Crystals, Inc.
709 N. Memorial Parkway
Sta G
Huntsville, AL 35801

Piggy-back PC Board for HD64180 ($25.00)
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9717 Regal Ridge N.E.
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HD64180 Integrated Circuit ($22.06) **& Augat Z364AG30D socket for HD64180** ($6.27)
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Roger T. Stevens is a Systems Engineer with The MITRE Corporation in Albuquerque, New Mexico. He has a PhD in Electrical Engineering from California Western University and an M Eng degree in Systems Engineering from Virginia Polytechnic Institute and State University. He has been working with S-100 systems since 1977.

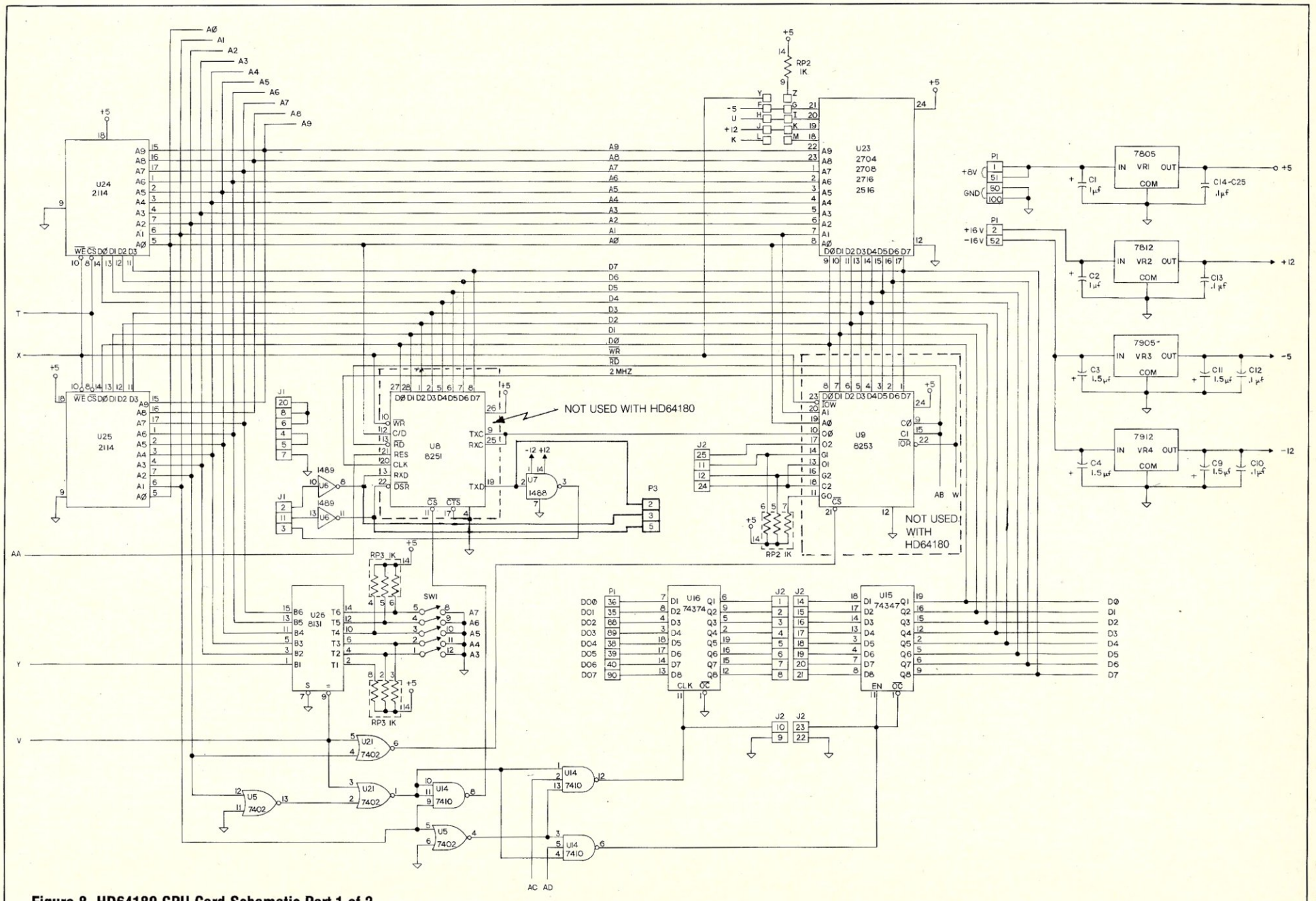

Figure 8. HD64180 CPU Card Schematic Part 1 of 2.

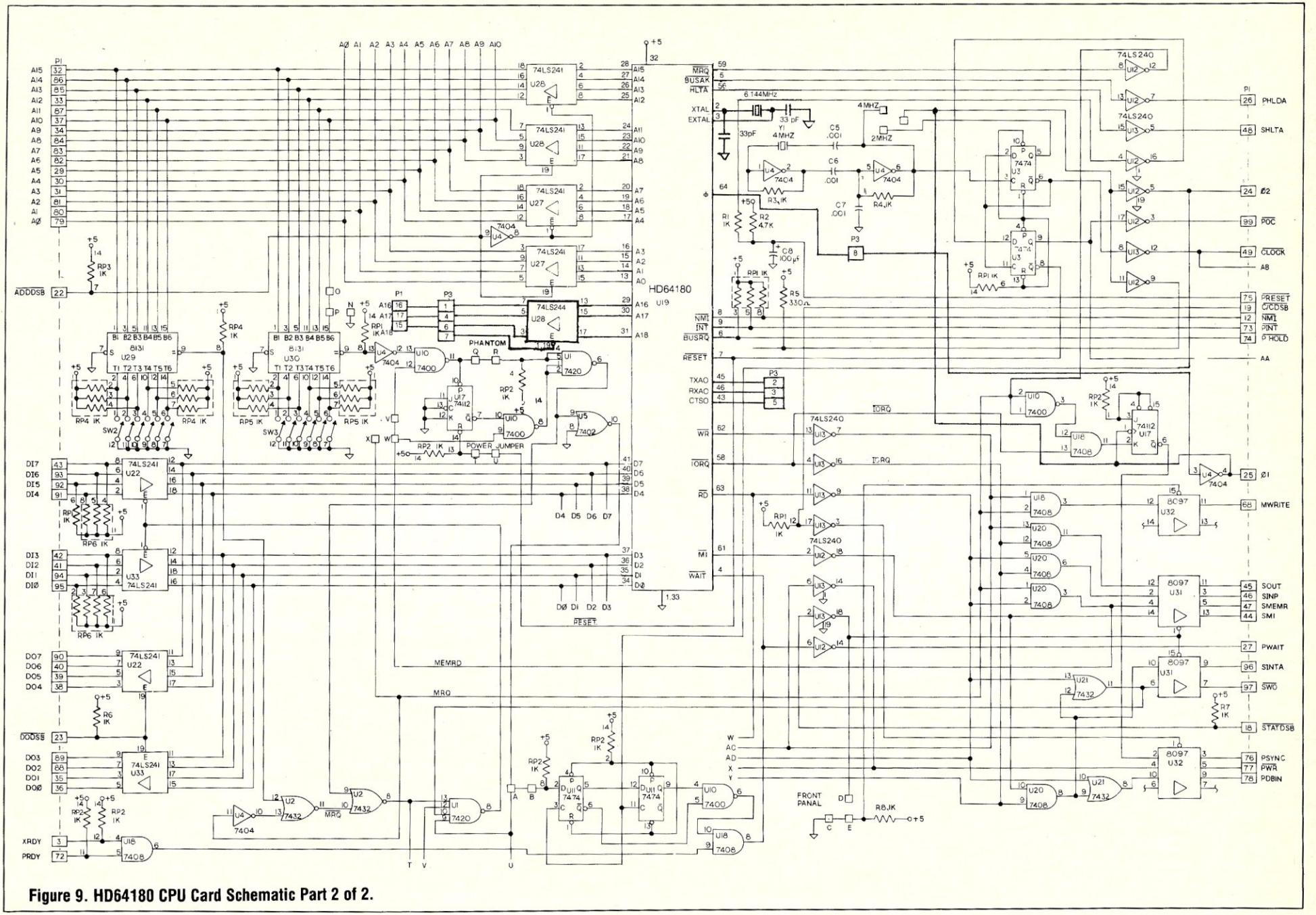

Figure 9. HD64180 CPU Card Schematic Part 2 of 2.

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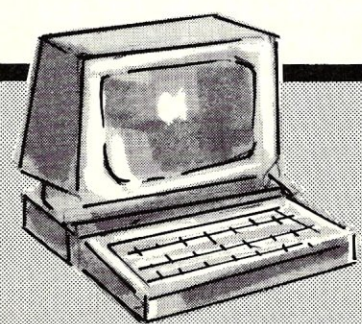

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Configuring MS-DOS

by Sol Libes

Microsoft provides a facility in MS-DOS (Version 2.0 and later) which makes it very easy for a user to configure a system. This is done via an ASCII file called CONFIG.SYS. Each time MS-DOS is started it checks the root directory for this ASCII file and then, if found, reads it to determine how the system is to be configured. If the file is not found, default configuration values are invoked.

CREATING A CONFIG.SYS FILE

Since CONFIG.SYS is an ASCII file, it can be created with any editor or with the MS-DOS COPY function. For example, a typical CONFIG.SYS file could be created by typing the following at the keyboard:

```
COPY CON:CONFIG.SYS ⟨enter⟩
DEVICE = ANSI.SYS ⟨enter⟩
FILES = 20 ⟨enter⟩
BUFFERS = 16 ⟨enter⟩
BREAK = OFF ⟨ctrl-Z⟩⟨enter⟩
```

The first line commands the system to copy the following keyboard input to the CONFIG.SYS file as ASCII characters. The next four lines activate a device driver, set the maximum number of files that can be opened concurrently, set the size of the disk buffers in memory, and check for a control break only when a program requests a function to be performed. I will go into each of these in more detail below.

DEVICE DRIVERS

I recommend readers consult Bill Wong's articles (an installment of which is in this magazine) on device drivers for particulars on how they work.

In the above example, the DEVICE statement activates a device driver file called ANSI.SYS. The ANSI.SYS device driver file is provided with all versions of MS-DOS Version 2.0 and later. It allows programs to send sequences of control codes to the display as if the display were an ANSI-standard terminal. If the ANSI.SYS device driver is not active, MS-DOS simply writes information to the next display location. In other words, MS-DOS displays characters on the screen as if it were a dumb terminal.

CREATING A VIRTUAL DISK

Beginning with Version 3.0, MS-DOS also includes the VDISK.SYS driver which installs a *virtual* disk (RAM disk) in memory. Using a virtual disk, instead of a real floppy or hard disk, will considerably speed up the operation of compilers, data base managers and any program that has to make a large number of disk accesses. It also cuts down on wear-and-tear of the disk and drive.

Working With The CONFIG.SYS File.

The virtual disk is set up with the statement:

```
DEVICE = VDISK.SYSbbbsssddd/E:m
```

when *bbb* is the virtual disk's memory size (1K to maximum available memory), *sss* is the sector size (128, 256, or 512) and *ddd* is the number of allowable directory entries (files) that the virtual disk may contain (2 to 512). If these values are not specified, MS-DOS assigns default values of 64K memory size, 128 byte sector size, and 64 files. The following is an example statement which will create a 160Kbyte virtual disk with 512 sectors and 64 directories:

```
DEVICE = VDISK.SYS 160 512 64
```

If the */E* parameter is used, VDISK will use extended memory at, or above, 1Mbyte. The *m* parameter can be used to define the maximum number of sectors VDISK transfers at one time (1 to 8, default = 8).

THE FILES STATEMENT

The FILES statement sets the maximum number of files that may be opened simultaneously. The default value is 8 (which is also the minimum) and 255 is the maximum. For example, you might be running WordStar in the foreground (this opens WS.COM, WSMSGS.OVR, WSOVRLY.OVR and your text file), while in the background you might be running Sidekick (SK.COM, SK.HLP, NOTES), SuperKey (KEY.COM, KEY-.HLP) and a print spooler program (two more files). That's eleven open files. In our first example above, FILES was set to

UNDOCUMENTED OPTIONS

I have learned that there two SHELL options (/E and /P) that they are undocumented. The /E option allows you to increase the *environment* space. The environment space, in memory, is the space set aside to store DOS options and variable assignments such as PATH, PROMPT and SHELL. If you have very long values, or a lot of variables, it is possible to run out of the small default environment space. The default is 10 (the minimum number of paragraphs). The maximum is 62 paragraphs.

The /P option makes the SHELL changes permanent. If the command interpreter ever needs to be reloaded (for example, after a particularly large program), all of the options that were set on the SHELL line (such as /E) will be lost unless the /P (for Permanent) is used. This is because the CONFIG.SYS file is only read at boot time, and not every time COMMAND.COM is reloaded.

A typical line would look like this:

```
SHELL = C:\DOS\COMMAND.COM C:\DOS /P /E:20
```

It causes the COMMAND.COM file to be initially loaded from the DOS directory, then to be reloaded from the same directory, to make these changes permanent and to allocate 20 paragraphs for the environment memory space.

There is also an undocumented (and unsupported) config.sys SWITCHAR function in MS-DOS 2.x. It will not work in version 3.x. It allows you to change the file/directory separator and option character. The standard file/directory character is "\" and the option character is "/".

The UNIX operating system uses the "/" character to separate directories and the "-" character to indicate options. Microsoft provided the SWITCHAR function to allow users to change this character. Thus:

```
SWITCHCAR = -
```

changes the separator character to a hyphen, or

```
SWITCHAR = /
```

changes it to a slash. You can set the character to be whatever you want it to be.

This function will not work in MS-DOS 3.x. There are some public domain programs around to provide this function. Here is a bare bones one:

```
MOV   DL,'character   ;setup new switchar
MOV   AX,3701H        ;setup switchar DOS call
INT   21H             ;perform call
```

Note that this change can cause problems with some software. For example, the Lattice C and Turbo Pascal compilers, when calling COMMAND.COM, append a "/c string" (pass the string and then exit back to the primary command processor) to the command and do not check or set the switch character. The result is that MS-DOS will not be able to parse the option and will return an error message.

a value of 20. This takes up only 468 more bytes of memory than the default.

You will have to increase the FILES value if you ever encounter an *insufficient handles* error message or a program telling you to change your CONFIG.SYS FILES statement.

HOW ABOUT BUFFERS?

BUFFERS sets the number of disk buffers in memory (from 1 to 99, default = 2, 3 for the AT). Each buffer holds 528 bytes. When MS-DOS does subsequent reads from a file, it first checks the buffer to see if the file data is there (in memory). If it is, it loads from the buffer rather than from the disk, considerably speeding up disk read operations.

A default value of 2 creates a disk buffer of only 1,056 bytes and thus the likelihood of finding the data in the buffer is considerably less likely then if the buffer size were set to 20 (10,560 bytes), as in the example given earlier. For example, a word processor accessing sequential characters, would benefit considerably from a larger buffer size. On the other hand, a data base manager accessing data from widely separated locations in a file might see very little speed improvement from a larger buffer size. If your system has plenty of extra memory, I recommend setting BUFFERS = 32 or even 64.

However, if your database manager or word processing program does its own internal buffering (and many do), increasing the number of buffers decreases the memory space usable by the database or word processor, and may lower its performance.

BREAK ON OR OFF?

If BREAK = ON, MS-DOS will check for a Ctrl-C or Ctrl-Break keystroke sequence before performing any MS-DOS function. Thus you can break out of a program at any time (e.g. if a compiler loop or error is encountered). Turning *Break* off means that Ctrl-C or Ctrl-Break will only be recognized during standard input, output, print, or auxillary operations. The default is *off*.

THE SHELL STATEMENT

The SHELL command allows you to replace the standard command processor (COMMAND.COM) with another command processor of your own creation. SHELL allows you to define the location and name of your command processor file. This command does not affect BASIC's SHELL command.

WHICH COUNTRY?

The COUNTRY statement allows the user to specify the date and time formats for a given country as well as the currency symbol and decimal separator.

continued on page 54

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CONFIG.SYS STATEMENTS

Statement	Function	Range	Default
BREAK=state	Check for control break	ON/OFF	OFF
BUFFERS=n	Number of 528-byte	1 to 99	2
COUNTRY=xxx	Specifies country	001 United States 031 Netherlands 032 Belgium 033 France 034 Spain 039 Italy 041 Switzerland 044 United Kingdom 045 Denmark 046 Sweden 047 Norway 049 Germany 061 Australia 358 Finland 972 Israel	001
DEVICE=filename	Load specified Device Driver File	none	none
FCBS=m,n	m=max. number of files to open. n=max. number opened simultaneously	m: 1 to 255 n: 0 to 255	4 0
FILES=x	Max. number of file handles opened simultaneously	8-255	8
LASTDRIVE=x	Max. number of drives to access	A-Z	E
SHELL=filename	Name and location of COMMAND.COM replacement	none	COMMAND.COM

Program Interfacing To MS-DOS

by William G. Wong

Part VII
Device Drivers, Structures

The previous article described the general nature of device drivers in MS-DOS. This article examines the details of building the actual drivers. The next article will provide an example. Remember that these articles refer to device drivers for MS-DOS V2.x and later since V1.x did not support loadable device drivers.

Device drivers are loaded by MS-DOS upon initialization of the system. This is performed only once. MS-DOS reads a file named CONFIG.SYS which is a text file. Device drivers are specified there using the following syntax:

```
DEVICE=DEMO.SYS
```

Multiple device drivers may be loaded. The order of the drivers listed in the CONFIG.SYS file does not affect character devices but it will affect the logical device names for block devices such as disk drives. Block device names are allocated sequentially. Assume ALPHA.SYS and BETA.SYS are two device drivers which support one device each. Placing ALPHA.SYS before BETA.SYS in CONFIG.SYS will cause BETA.SYS to have the device name after ALPHA.SYS, for example, D: and E:. Reversing the order in CONFIG.SYS also reverses the name of the devices for the associated drivers.

This order within CONFIG.SYS and having the associated hardware installed for a device driver is all that is required for those using an installable device driver. For those interested in building the driver itself, read on.

DEVICE TYPES

Device drivers are divided into two catagories: character devices and block devices. Character devices are designed to be read or written on a character basis and sequentially. Block devices have a larger granularity, typically 512 bytes, with random access. In addition, block devices have a directory and file allocation table associated with them.

Character device drivers may support only one device per device handler but it is possible to share device driver code between multiple devices since a loadable device driver file may contain multiple device handlers. Character devices also have unique names (up to 8 characters) associated with each device. A device is accessed by opening a file with the device name.

One special character device exists by the name of CLOCK$. This is an optional real time clock device driver. Although the driver is character based, each transfer should be 6 bytes. The current time and date are obtained by reading from the device. Set the time by writing to the device. All operations except the two just mentioned should return an error.

Multiple block devices may be supported by a single driver. The number of drives supported by a device driver is specified by first byte of the device driver's name field. More than one block device drivers can be in the same loadable device driver file.

Block devices are more flexible than character devices and have the ability of supporting either a single type of media on a device or various media, one at a time of course. The latter is referred to as a *smart* device driver which will determine the characteristics of the media used at the time of access.

In theory, it is possible to include custom drivers which may act like conventional device drivers but which respond to special function codes or operate differently on defined function codes. The purpose of such drivers is to provide a consistent interface to special applications designed in conjunction with the driver. Such drivers will not be discussed here.

FILE FORMAT AND PROGRAM LIMITATIONS

Device driver files have a format which is similar to an executable file with a .COM extension. The major difference is that the device driver file, usually with a .SYS extension, must be linked such that the start of the file is at offset 0 instead of 100 hex for the .COM file. Also, the device driver file starts with a special table called a device header instead of executable code found in the .COM file.

This format does set some limitations although they tend to be minor. The first limitation is that the combined size of program data and code cannot exceed 64 Kbytes. Device drivers tend to be significantly smaller than this limit. The second limitation is the same limitation found in .COM based programs. It seems that MS-DOS only resolves long pointer references within a program if it is loaded as a .EXE file and not a .COM file. Typically device drivers do not have to access code past the end of the driver file so the short pointer references suffice. Any references to code or data outside this area tend to be rather limited and references are normally given to the driver as in buffer addresses.

The placement of information within a device driver file is not critical except for the first device header block which must be the first item in the file. Multiple device driver headers may appear within the file and are linked sequentially from the initial header. The format for the device header is:

Offset	Size	Description
0	2	Offset to next device driver
2	2	Segment of next device driver
4	2	Driver attribute
6	2	Offset to device strategy code
8	2	Offset to device interrupt code
10	8	Character device name or number of block devices

All offsets are from the start of the device driver file. The offset to the next device driver is -1 for the last device header in the file. The segment value is filled in by MS-DOS when the file is loaded. The device name pertains to character devices and the field must be all ASCII. Trailing spaces are valid. Block devices use only the first byte of the field. Its value is the number of block devices supported by the device driver associated with the device header. This value is also obtained by MS-DOS when the driver is initialized. The remaining seven bytes are not used.

The device attribute was described in the previous article and will be listed here too. Each bit in the word designates a particular attribute as shown in the following table.

Bit	Description
0	1 if current standard input device 0 if not
1	1 if current standard output device 0 if not
2	1 if current NUL device 0 if not
3	1 if current clock device 0 if not

Bit	Description
4-12	Reserved
13	1 if non-MS-DOS format block device 0 if MS-DOS format block device or character device
14	1 if IOCTL supported 0 if IOCTL not supported
15	1 for a character device 0 for a block device

The strategy and interrupt routines are the body of the device driver. The strategy routine is accessed first using a long call with a pointer to a Request Header block in the ES:BX registers. The strategy routine must save this address where it can be accessed by the interrupt routine. The strategy routine then returns to MS-DOS.

MS-DOS then calls the interrupt routine with no parameters. The strategy routine will always be called first. The stack used when calling the two routines contains sufficient space to save all the registers except the stack pointer and segment register. An additional stack should be used if more space is required.

The request header contains a fixed size block followed by a variable length block based upon a function code in the fixed portion. The following table describes the fixed portion of the request header.

Request Header

Offset	Size	Description
0	1	Size of request block, (fixed plus variable)
1	1	Unit code for block device
2	1	Function code
3	2	Status code
5	8	Reserved for MS-DOS

The unit code for block devices is a value from 0 to the number of devices supported minus one. The status code is described in the following table.

Bit	Description
0-7	Error code
8	Done
9	Busy
10-14	Reserved
15	Error

The Done bit should be set when the interrupt routine exits. The Error bit indicates that an error occurred and the error code field is valid. The error code field values are:

Value	Description
00	Write to a write protected device
01	Unknown unit number
02	Device not ready
03	Unknown function code
04	CRC error
05	Request Structure Length is incorrect for selected drive
06	Seek error
07	Unknown media type
08	Sector not found
09	Printer out of paper
0A	Write error
0B	Read error
0C	General error

The Busy bit is used in conjunction with the input and output status functions. If the Busy bit is set to 1 by an output device driver then a write request would wait for the device to become not busy while a value of 0 indicates that a write of one byte will return immediately. A write of more than one byte *may* return immediately. Input devices work in a similar fashion where a Busy bit value of 1 indicates that no data is available and a read request would have to wait for data. A value of 0 indicates that some data, at least one byte, is available. MS-DOS assumes an input buffer is internal to the device driver to support type-ahead.

DEVICE DRIVER FUNCTION CODES

The device driver function code is specified in the request header. Invalid or unsupported functions should return a function code error. The following is a list of defined function codes:

Code	Description
00	Initialize
01	Media Check
02	Build BIOS Parameter Block
03	IOCTL Read
04	Device Read
05	Non-destructive Device Read
06	Device Input Status
07	Flush Device Input Buffer
08	Device Write
09	Device Write with verify
0A	Device Output Status
0B	Flush Device Output Buffer
0C	IOCTL Write

Function: 00 Initialize

This function is called once when the driver is first loaded. The driver should perform any initialization required by the hardware at this time. The values after the request header are:

Bytes	Field
1	Number of units (Block devices only)
4	Last address of driver
4	Pointer to BPB Array (Block devices only)

Initialization code can occur after the last address of the driver since it is only used once. Conversely, the last address of the driver can extend past the physical end of the driver it additional buffer space is required. The two Block device only fields do not need to be set by character device drivers. The number of units specifies the number of drives supported by the driver. The BPB array entries are word values which are offsets from the start of the device driver segment. The structures referenced by these offsets are BPB's described in the following Build BIOS Parameter Block (BPB) section. There is one entry per unit supported.

The BPB's referenced by the BPB array should all define the largest media specification for the associated unit, i.e. the largest sector size. This restriction is imposed because some drivers are capable of supporting different media types per unit (one at a time, of course).

Function: 01 Media Check (Block devices only)

This function allows drives with removable media to signal MS-DOS that a new disk may be in the drive. The values after the request header are:

Bytes	Description
1	Media Descriptor Byte
1	Media Status -1 Media has changed 0 Media may have changed 1 Media has not changed

The Media Descriptor Byte is the one in the BPB as described in the next section. It is up to the driver to determine the media status. MS-DOS will call the Build BIOS Parameter Block function, described next, if the Media Status is not 1.

Function: 02 Build BIOS Parameter Block (Block devices only)

The BIOS Parameter Block (BPB) contains information about a particular disk. The parameters after the request header are:

Bytes	Description
1	Media Descriptor from MS-DOS
4	Buffer Address from MS-DOS
4	BPB Address from driver

The BPB is described in the following table:

Bytes	Description
2	Bytes/Sector
1	Sectors/Cluster (must be a power of 2)
2	Reserved Sectors
1	Number of FAT's
2	Entries in root directory
2	Total number of sectors
1	Media Descriptor Byte
2	Size of FAT in sectors

The Media Descriptor Byte is described in the following table:

Bits	Description
0	1 = 2 sided
1	1 = 8 sectors/track
2	1 = removable media
3-7	set to 1

Defined Media Descriptor Byte values are:

Value	Description
F8	Fixed disk
FC	1 side , 9 sectors
FD	2 sides, 9 sectors
FE	1 side , 8 sectors
FF	2 sides, 8 sectors

MS-DOS compatible media have a boot sector immediately followed by the FAT's. The boot sector contains the BPB as shown in the following table:

Bytes	Description
3	Jump to boot program
8	OEM name and version
13	BIOS Parameter Block
2	Sectors/track
2	Number of heads
2	Number of hidden sectors

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Drivers which support more than one type of media should determine the proper BPB for the media currently associated with the device. This can be done in a number of ways and is driver dependent. More specifically, the device compatability (MS-DOS or not) may determine how the media is to be recognized. The buffer address will contain the first sector of the File Allocation Table (FAT) if the device is MS-DOS compatible. This sector is read by MS-DOS *before* calling this function. The first byte of the first sector of the first FAT contains the Media Descriptor byte. This information can be used to determine the type of media if the determination has not already been made.

Function: 03 IOCTL Read (Optional)

The I/O Control (IOCTL) functions are available for controlling a device in a semi-standard fashion. It can also be used to obtain device specific information without resorting to direct hardware access by applications. The transfer operations are identical to the normal Device Read and Write functions.

The following 9-byte parameter block is provided after the request header.

Bytes	Description
1	Media Descriptor Byte (Block devices only)
4	Buffer Address
2	Transfer Size
2	Starting Sector (Block devices only)

The transfer size field should be altered to reflect the actual transfer size. Reading less information than specified may not be an error, especially on character oriented devices. The transfer size is in sectors for block devices and bytes for character devices. The transfer size can be interpreted differently for IOCTL functions if necessary since they are device specific and not used by MS-DOS.

Function: 04 Device Read

The Device Read function transfers data from the device to the specified buffer. The parameter block is identical to the IOCTL Read function. The transfer size should be set to the actual amount of information read. The status word in the request header indicates whether the transfer was successful.

Function: 05 Non-destructive Device Read (Character devices only)

This function is identical to the Device Input Status function described next except that the byte after the request header will be set to the first byte in the input buffer if the Busy bit is 1. This allows MS-DOS to examine the first character of the input buffer without performing a read operation. The character will not be removed from the input buffer by this function.

Function: 06 Device Input Status (Character devices only)

The function has no parameters after the request header. The driver should set the Busy bit to 0 if one or more characters are available for reading and 1 if there is no data.

Function: 07 Flush Device Input Buffer (Character devices only)

This function has no parameters after the request header. Any internal buffer and hardware buffer should be flushed so no input data is pending.

Function: 08 Device Write

This function has the same parameter list as the Device Read function. Data transfer is from the specified buffer to the device. The transfer size is in bytes for character devices and sectors for block devices. The transfer size should be altered to the actual amount of data written even if an error occurs. Errors or success should be specified in the result word within the request header.

Function: 09 Device Write with verify

This function is identical to the Device Write function except that it should read the data just written and compare it with the output data to verify that the two are the same. An error is signalled if the data does not match. Retries are optional.

Function: 0A Device Output Status (Character devices only)

The device output status is returned by setting the Busy bit in the status word to the proper value. There are no additional parameters after the request header. Setting the Busy bit to 0 means that data may be written to the output device.

Function: 0B Flush Device Output Buffer (Character devices only)

This function has no parameters after the request header. Any pending output should be thrown away.

Function: 0C IOCTL Write (Optional)

This function is identical to the normal Device Write except that the data is directed to the IOCTL section which is device dependent.

SUMMARY

For the most part, writing a device driver is mainly a matter of getting the proper tables and front end routines setup and merging them with tested device interface routines. First, the two parts are tested separately to make sure they are implemented properly. The next article will present a simple memory disk driver which is divided into the two sections.

Bill Wong is the President of Logic Fusion, Inc., 1333 Moon Drive, Yardley, PA 19067, a systems software development firm.

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```
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      IF NAM'?2.A1","1A.E WRITE "PLEASE ENTER AS LAST, FIRST MI",! GO RD
TEL   READ "TEL #  ",TEL,!  IF TEL'?3N1"-"4N WRITE "NNN-NNNN PLEASE",! GO TEL
      SET ^DATA(NAM)=TEL GO RD
PRT   WRITE "    NAME",?20,"TELEPHONE #",!  SET NAM=""
LP    SET NAM=$ORDER(^DATA(NAM))  QUIT:NAM=""   WRITE NAM,?20,^DATA(NAM),!  GO LP
```

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Concurrent CP/M

by Alex K.H. Soya

For the past few months the hot topic among many computer users and programmers is the latest operating system from Digital Research, namely Concurrent CP/M (C CP/M). CCP/M is also known by the names *Concurrent DOS*, and *Concurrent PC-DOS* depending on the implementation chosen.

As the name(s) implies CCP/M is a multi-user and multi-tasking operating system. CCP/M is available on several Intel 8086/8 and 80286 based systems such as the CompuPro S-100 systems and the IBM-PC, -XT, and -AT as well as many of the IBM clones.Many of the imported computers also run CCP/M as their operating system. Even one of the Nixdorf microcomputers uses CCP/M. Early versions of CCP/M were compatible with CP/M86 (DRI 's single user operating system) and MP/M86, the forerunner to CCP/M. As DRI felt the pressure from the Microsoft MS-DOS operating system, support for MS-DOS 1.1 was also available under CCP/M 3.1. The latest version of CCP/M (Concurrent PC-DOS 4.1) is not only compatible with CP/M and MP/M, but also has support for MS-DOS 2.0 application programs. This includes subdirectories on MS-DOS media and graphics support. One of the nicest features of CCP/M is the ability to have virtual consoles and dynamic windows. The user can perform several tasks on the same physical console by switching virtual consoles or observing the progress of multiple tasks in windows. CCP/M is one of the most sophisticated and versatile operating systems available for microcomputers today.

Not only is CCP/M very useful to the more sophisticated home computer user, but it is a vast improvement to any previous micro computer operating system in a business environment. Together with the DRI network package, DR-NET, a network of computers can be set up, making CCP/M valuable in a medium sized office environment.

In this article I will briefly present the differences between CCP/M and CP/M-86 from the user's point of view and then discuss the structure of CCP/M for the programmer who is use to the CP/M-80 or CP/M-86 environment. I will also show how to access many of the internal data structures and new function calls of CCP/M allowing programmers to make use of its sophisticated features.

Part 1 - Features Architecture & Common Problems

FROM THE USER'S POINT OF VIEW

Those familiar with the 8-bit CP/M-Plus (CP/M Vers 3.0) will feel immediately at home with CCP/M commands. The CP/M-plus commands served as a model for the man-machine interface in CCP/M. The file system allows date and time stamping as well as password protection on individual files, just as under CP/M-Plus, and most of the CP/M-plus commands are identical under CCP/M.

USER AREAS AND SUBDIRECTORIES

The first thing one notices when sitting in front of a computer running CCP/M is the prompt.It contains not only the drive letter, but also the current user number. As under CP/M-80 and CP/M-86, each logical drive is divided into 16 user areas (0-15). Concurrent PC-DOS 4.1 allows the user to format a floppy disk as either CP/M media or DOS media. A drive that is formatted as DOS media contains subdirectories as under MS-DOS 2.0 rather than user numbers. A hard disk may be divided into two logical drives or partitions, allowing part of the hard disk to act as CP/M media and part as DOS media. Executable files (CP/M CMD and MSDOS COM and EXE files) may be kept on both types of formats. The only immediate difference to the user is that CP/M media uses user numbers and DOS media uses subdirectories to divide a drive into several logical areas.

Another useful feature of CCP/M is the ability to assign a drive to be the SYSTEM DISK. Any executable commands (CMD, EXE, COM, or BAT files) may be placed on the SYSTEM DISK in user area 0 with the SYS attribute set.Such commands are executable from any drive, user area, and subdirectory. No longer is it necessary to keep a copy of all the commands to be executed on every drive, or to prefix the commands with the drive letter containing the programs to be executed. The system disk may be modified with the SYSDISK command. Concurrent PC-DOS 4.1 allows not only the drive to be assigned to be a SYSTEM DISK, but also a subdirectory on DOS media can be used to keep all globally executable commands.

FLOATING DRIVES

As mentioned, Concurrent PC-DOS 4.1 supports subdirectories on DOS media. To copy files from one subdirectory to another subdirectory it is necessary to assign one of the subdirectories to what DRI calls a *Floating Drive*. A Floating Drive is not a physical drive. Rather, it is a *dynamically assignable* logical drive which allows the user to access a subdirectory as if it were a drive. Concurrent PC-DOS uses the drive letters N and O to represent the floating drives.

To copy files, one copies from the source drive to the floating drive. This has the effect of copying the files into the subdirectory. This is rather awkward and unusual for an operator who is use to MS-DOS subdirectory formats, but is only required for the copying task. The familiar MS-DOS commands CD (Change Directory), MD (Make Directory), and RD (Remove Directory) exist and work as expected. The floating drives are in my opinion a kludge which DRI implemented without rewriting the BDOS in a re-entrant manner; I certainly hope this arrangement will be corrected in future releases.

NEW COMMANDS

Many of the well known CP/M-80 commands remain, such as DIR, ERA, TYPE, and REN. However, some have been replaced and new commands added. Under Concurrent PC-DOS 4.1, familar command names from CP/M-80, CP/M-86, and MP/M now behave similar to the MS-DOS equivalents. The new commands under CCP/M 3.1 are ABORT, DATE, INITDIR, PRINT, PRINTER, SDIR, SET, SHOW, SPOOL and VCMODE.

With Concurrent PC-DOS 4.1, many new commands were added, too numerous to list in this article. ABORT and SPOOL were replaced by STOP and PRINTMGR, and the VCMODE command was deleted. The old ED line editor was replaced with DREDIX, a full screen editor.

4.1 comes with many utility programs such as: a screen oriented file manager

which allows you to manipulate files, execute commands, and set system parameters using the cursor keys to point to the desired action and files; Cardfile, which stores and retrieve names, addresses, phone number and comments; DRTALK, a communications program which looks identical to the popular public domain PCTALK program for MS-DOS; BACKREST, a very useful utility for hard disk backup and restore operations.

Other items added under Concurrent PC-DOS 4.1 include a menu generator and editor. Also, the user is provided with about 50 different commands. Unfortunately, neither assembler, linker, or loader are provided. This is an understandable,though regrettable, move by DRI. Concurrent PC-DOS will find its home in many business environments where it is not essential to have an assembler. DRI does offer the *Concurrent PC-DOS Programmers Pak* separately for program development work.

VIRTUAL CONSOLES AND WINDOWS

The most unique feature of CCP/M is the virtual console and window support. Using virtual consoles, a physical terminal can act as if it were several terminals at once. The user can switch virtual consoles by hitting a function key. This feature allows several processes to run on one console concurrently. In a business environment virtual consoles are extremely useful to obtain information from the computer while running a program without the need to wait for it to complete its current task.

In a software development environment, this feature is also extremely useful. A programmer can assemble or compile at the same time as he is editing a file. Under Concurrent CCP/M 3.1, a console could have two modes: Buffered and Dynamic. In the buffered mode, all output to the console is routed to a temporary file while the virtual console is in the background. When the operator switches the virtual console to the foreground, the buffered output is displayed on the console. In the dynamic mode, all output is buffered in internal memory as a screen representation, that is, a memory image of the current screen is kept and updated as the application program sends output to the console. When a dynamic virtual console is switched to the foreground, the current screen image is displayed immediately without a replay of all activities since the console was switched to the background.

With the introduction of Concurrent PC-DOS 4.1 the buffered mode is no longer available, only the dynamic mode is active. In addition to virtual consoles, windows can be set up on the screen to show more than one virtual console at a time. Thus, the user can directly observe the activity of programs running on virtual consoles in the background. Concurrent CCP/M provides the commands WINDOW and WMENU to set up windows. The WINDOW command is parameter driven, i.e. the operator specifies the size, location, color, and modes of windows. The WMENU command allows the operator to set up windows using the cursor and control keys on the fly.

The addition of windows is totally transparent to application programs and does not interfere with applications in any way. Programs may be written to control window management directly, if desired, however a program does not need to be aware of the window facilities.

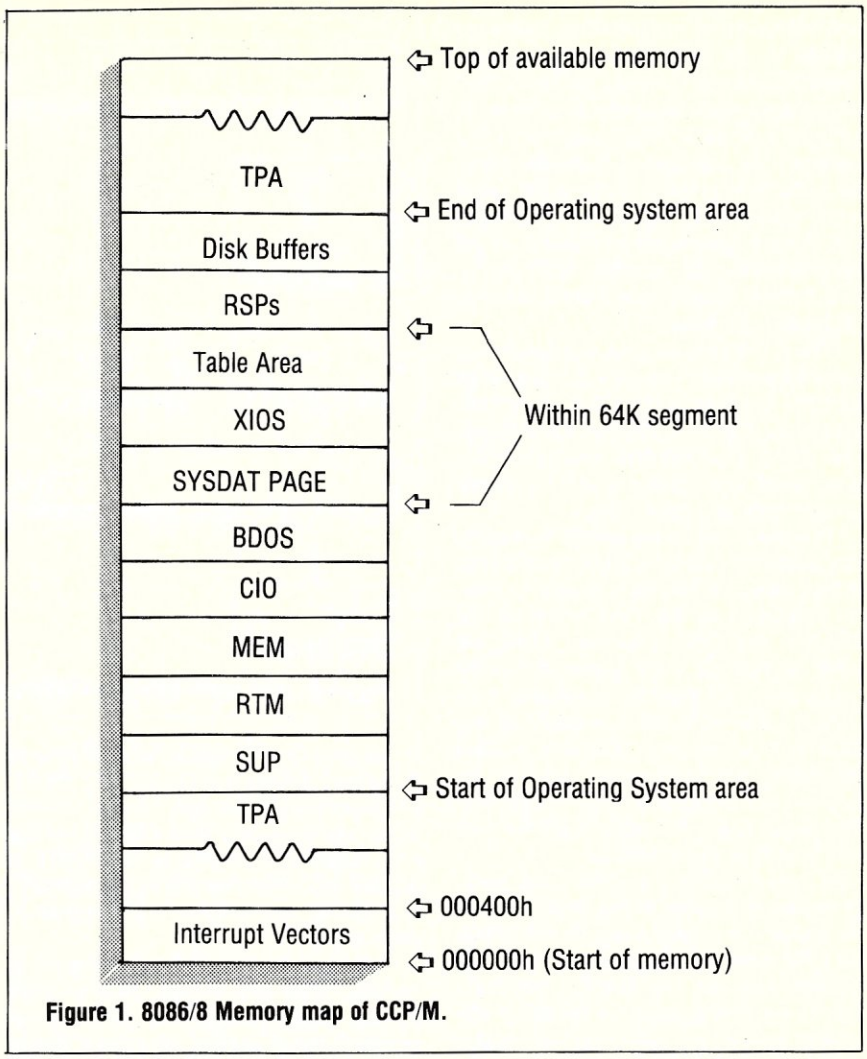

Figure 1. 8086/8 Memory map of CCP/M.

CONCURRENT CCP/M INTERNALS

As we have seen, from the users point of view, CCP/M is a very flexible, yet familiar looking, operating system.The CCP/M's internals are very different from a CP/M-80 or CP/M-86 environment. Under CP/M-80 and CP/M-86 three basic modules made up the operating system: The BDOS (Basic Disk Operating System), the CCP (Console Command Processor), and the BIOS (Basic Input Output Routines). The only module which looks familiar in CCP/M is the BDOS, although it has been modified to support shared file access and record locking.

THE SUP

Figure 1 shows a memory map of CCP/M. CP/M80 programmers will notice that the operating system no longer resides in the upper portion of memory. The Concurrent CCP/M operating system can reside anywhere in memory, with the exception of the interrupt vector area. The run time memory location is determined at system generation time. Each module is responsible for handling its share of the available system function calls. Function calls are made by using a software interrupt from the application program, rather than a CALL to an absolute memory location. Interrupt number 224 points to the SUP (Supervisor) which routes the function calls to the proper modules. The supervisor also handles several function calls itself.

THE RTM

The next module is the RTM (Real-Time Monitor). The RTM is what is com-

monly known in multi-tasking operating systems as the kernel. The main purpose of the RTM is to dispatch processes running in the system according to their priority and resource requirements. CPU resources are transferred from one process to the next process on the ready list at every system tick. In the U.S. a system tick occurs approximately every 16.67 msec (60 times per second), while in Europe a tick is usually issued every 20 msec (50 times per second).

The RTM must see to it that the current state of a process about to be released from the CPU is saved in the UDA (User Data Area) and the PD (Process Descriptor). The RTM also handles function calls associated with process states, queue management, and device flags.

Processes are represented as entries on various lists reflecting the current state of the process. A currently executing process is placed in the first entry on the READY list. Other processes which are ready to run are kept as the following entries on the READY list in order of their priority. The dispatcher module in the RTM will assign the CPU to a process depending on the process priority by means of a Round Robin scheduling algorithm. Thus, processes with the best priority will be selected first.

If two processes have the same priority and are both ready to run, then the process which has waited longest will obtain the CPU next. A dispatch will occur for various reasons. A running process, which is not requesting or releasing any system resources, will execute until a system time out interrupt (tick) occurs. If a process requests a resource (such as a queue, a console, or a list device) and the requested resource is not immediately available, then a dispatch occurs causing the process to be placed on a list representing the resource for which the process is waiting. Dispatches may also occur when a process must wait for an I/O event to occur or a requested delay to expire.

As CCP/M uses a priority driven scheduler, it causes processes with a high priority to be preferenced for execution. If a high priority process is CPU bound, then the lower priority tasks may never, or rarely, obtain the CPU. Processes which are CPU bound should be given a lower priority to prevent the system performance from degrading.

THE MEM

As a program is loaded and prepared to execute, the operating system must assign memory areas to the program depending on the process' requirements. The MEM (Memory Management Module) keeps track of which process is assigned to particular memory areas. To fulfill its job, the MEM maintains a list of occupied memory

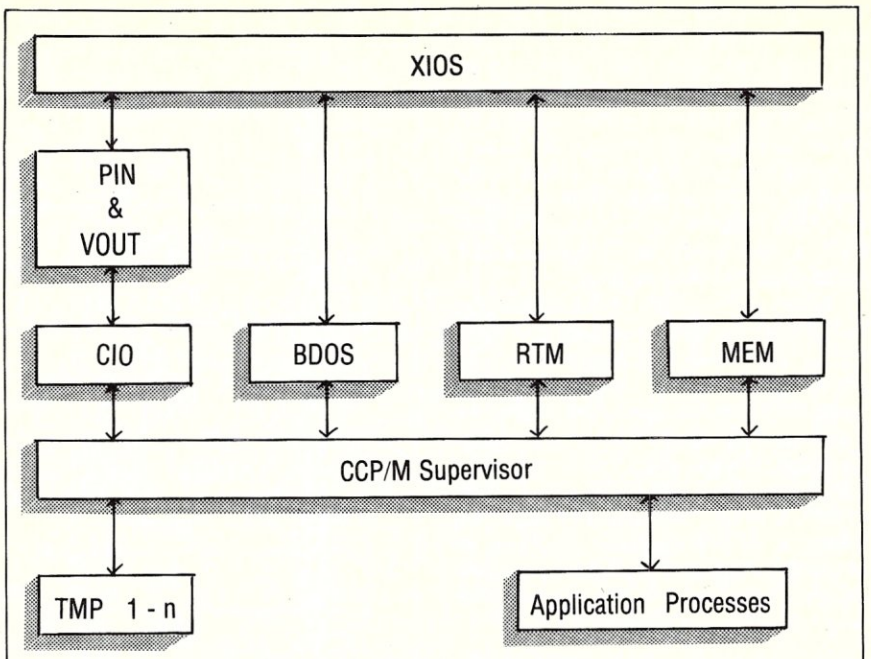

Figure 2. Interaction between CCP/M modules.

in structures called the MSD (Memory Segment Descriptor) and the MAU (Memory Allocation Unit). These structures are arranged in a linked list and are created and deleted by the MEM as needed. All of the function calls handled by the MEM are memory management associated.

Memory is assigned to processes in chunks. The size of the chunks varies among implementations as this is a parameter which may be specified during generation time. Typically, a chunk occupies about 16K of contiguous memory. Depending on the size and memory requirements of the program, one or more chunks of memory are allocated to a process. As the Intel 8086 series of CPU's is of a segmented architecture, allocation of memory does not have to be contiguous. The Code, Data, Stack, and Extra segments may be located in separate areas of memory.

Generally, the most common problems associated with memory management are wastage and fragmentation. If a task requires only a small amount of memory, let's say 1K, it will still be allocated on entire chunk of memory, in this case 16K; the remaining 15K is wasted. Fragmentation occurs when many processes enter and exit the system at different times and in random order. As processes exit the system, holes or unoccupied memory chunks are left behind. If these holes are not contiguous chunks of memory, then a new process may not be able to obtain any memory to execute, even though the sum of the holes may be large enough to satisfy the task's requirements. In this case the new process must wait until more contiguous chunks are released.

Under CCP/M wastage may be reduced by choosing smaller chunk sizes, though the problem of wastage can never be entirely avoided. Fragmentation is partially overcome by the segmented architecture ofthe 8086 processor. However, in a situation where no hole is large enough to fit one of the task's segments, the process cannot be loaded until another program releases some memory. Usually wastage and fragmentation problems are not noticed in general usage of the CCP/M based systems. Only in heavily loaded environments, or in a system with little memory, may such a situation occur. Designers of large mainframe operating systems have battled wastage and fragmentation problems for a long time. Many approaches such as compaction, mapping, and relocation have been implemented though each has its own set of problems.

THE CIO

All character I/O from a user's process is routed through the CIO (Input Output module). The CIO itself talks to the VOUT Virtual OUTput process) and PIN (Physical INput process) (Figure 2). Characters received by the XIOS are read by the PIN. The PIN determines, by looking at the CCBs (Character Control Blocks), which virtual console is currently in the foreground and then obtains the address of the VINQ (Virtual INput Queue) from the CCB. The PIN scans the incoming character from the XIOS for special control keys, such as CTRL-C, CTRL-S, CTRL-Q, CTRL-P, and CTRL-O, and performs the relevant actions associated with the control keys. If the incoming character is not special in any way, the

character is written to the VINQ for the console in the foreground. The VINQ thus acts as an input buffer. Whenever a process requests a character, the CIO will read the next character from the VINQ and return it to the calling process.

Character output is handled in a similar manner depending on the version of CCP/M. Under version 3.1, the CIO sends output characters to either the VOUTQ (Virtual OUTput Queue) or XIOS depending on the console mode. If the console is in the background and in buffered mode, the characters are sent to the VOUTQ. The VOUT process reads the VOUTQ and sends characters to a temporary file on disk. Once the console is switched back to the foreground, the tempory file is purged out to the console.If the virtual console, from which the process requesting output is running is in the foreground, or in dynamic mode, the characters are sent directly to the console via the XIOS.

In dynamic mode and backgound operation the character is sent to the XIOS which in turn updates a memory map of the screen as it would look if the screen was in the foreground. This means the XIOS must be aware of terminal escape sequences in order to emulate terminal functions such as clear screen, position cursor, etc.

With the release of Concurrent PC-DOS 4.1 the VOUT process was deleted and no longer is there any support for buffered virtual consoles. All virtual consoles are in Dynamic mode at all times. In this case the CIO will send the character directly to the XIOS. The XIOS will look at the CCB to determine the foreground/background state of the console and update an internal memory image of the screen. If the console is in the foreground, the XIOS will also send the character to the console.

THE BDOS

The modules discussed so far are all new to the CP/M-80 and CP/M-86 programmer. Here is an old one: The BDOS (Basic Disk Operating System). As expected, all file handling is performed by the BDOS. The CCP/M BDOS accommodates multiple processes. When a file is opened a copy of the FCB is kept in an internal FCB table. This way the BDOS can check if a file is already accessed by another process. By default, only one process can open the same file. Should another process attempt to open the file, the BDOS will return an error stating the file is opened by another process. Other modes of access to files are supported. It is possible for more than one process to access the same file. Individual records may be locked and unlocked by processes as needed.

If multiple processes perform shared file access, it is the responsibility of the application programs to set up semaphores to avoid dead lock (deadly embrace). CCP/M does not perform any dead lock detection. Semaphores can be set up using the CCP/M queue system by means of mutual exclusion queues. A future part to this series will present detailed examples on how to share files, lock records, and avoid dead locks.

WHAT TO WATCH OUT FOR

The most common problems with software from CP/M-86 or programs that were translated from CP/M-80 to CP/M-86 and CCP/M are file handling bugs. These bugs never showed up under CP/M-86 and CP/M-80 as they are only evident in multi-tasking operating systems. A *good programming habit* is to always close files after an operation on the file is completed. Unfortunately under CP/M-80 and CP/M-86 this *rule* was not followed very closely by many programmers. For example, a popular word processor I use regularly requires overlay files be read in order to configure itself for terminal escape sequences and to read-in subroutines. Unfortunately the overlay files are not closed after reading and thus are not accessible to the word processor running on another console. This problem is a minor one, as DRI has provided for such a case by means of setting certain file

continued on page 50

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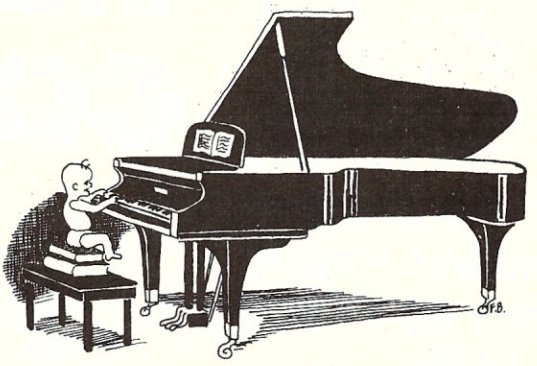

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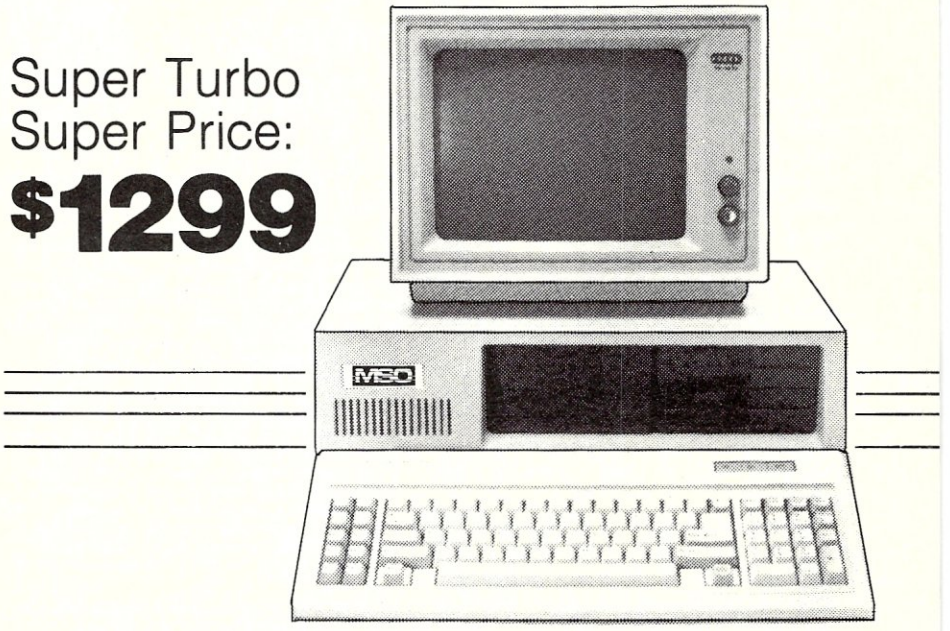

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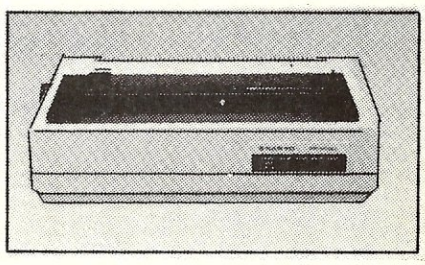

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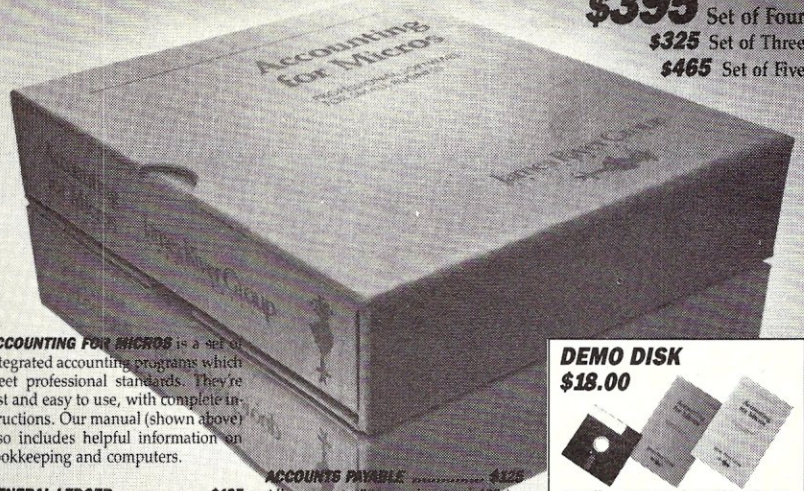

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attributes. Setting attribute F1 on the executable CMD file, allows the word processor to access the overlay from multiple terminals.

A more serious problem associated with not closing files is the FCB table space. As mentioned earlier, the BDOS keeps a copy of each FCB internally. The space to keep FCBs is limited since CCP/M restricts the number of files a single process may open at once and how many open files may be contained in the entire system. The exact limits are set at system generation time. Typical values are 32 open files per process, 32 locked records per process, and 60 system wide open files and locked records. These values vary among implementations and installations.

Programs which open many files will often crash with the BDOS error message "OPEN FILE LIMIT EXCEEDED". This commonly occurs in file copy programs where files are opened to read and copy to the destination. However, the source files are never closed after completing the read cycle. Under CP/M-80 and CP/M-86 this presents no problem as files which are only read could remain in an open state even after completing the read from the file. So *watch out* and *close your files* even if you only read them!

Another common problem which only occurs with the CCP/M BDOS is opening the same file more than once. This happens especially when creating a new file. Often the F_MAKE (Make a file) function call is executed to create a new file in the disk directory if the file does not already exist. Many programs follow the F_MAKE call by a F_OPEN call (Open file). The problem is that the F_MAKE call already has opened the file for output. The BDOS will keep track of the number of times you open the same file, and expects a close operation for each time the file was opened. Most programs, however, will only close the file once and thus the file is really still in an open state and not accessible from other processes. There is no need to open a file after the F_MAKE call, and this should be fixed when translating CP/M-80 programs to run under CP/M-86 and CCP/M.

THE XIOS

The XIOS (eXtended Input Output System) is similar the BIOS under CP/M-80 and CP/M-86. The XIOS contains all the device drivers which interface the operating system to a particular hardware configuration. The quality of a system can greatly depend on how well the device drivers are written. As under any multitasking operating system, the character and block devices should be interrupt-driven and buffered. Also a general interface between the character devices and application programs can be included in the XIOS. CPM currently does not provide any function calls to set comunication parameters such as baud rate and handshake protocol on serial ports. A well written XIOS will include entry points for user programs to perform these functions properly. A carefully and well designed XIOS can make a big difference on how the computer performs under severe loads.

WHAT ELSE

What else is there to talk about? Lots! So far we have only covered the obvious differences between the single-user and single-tasking CP/M-80 and CP/M-86 operating systems compared to CCP/M. We have also looked at some of the logical modules that make up the operating system. In the next part of this article I will discuss the remaining modules and also present some of the internal data structures in CCP/M such as the SYSDAT page, CCBs, PDs, and UDAs. I will include some programing examples making use of the fields in the above structures.

Alex Soya has been involved with CP/M for over 8 years. He is currently a computer science senior at Florida Institute of Technology. His interests include Operating Systems, Data Communications, System Utilities, Real Time and Scientific Programming.

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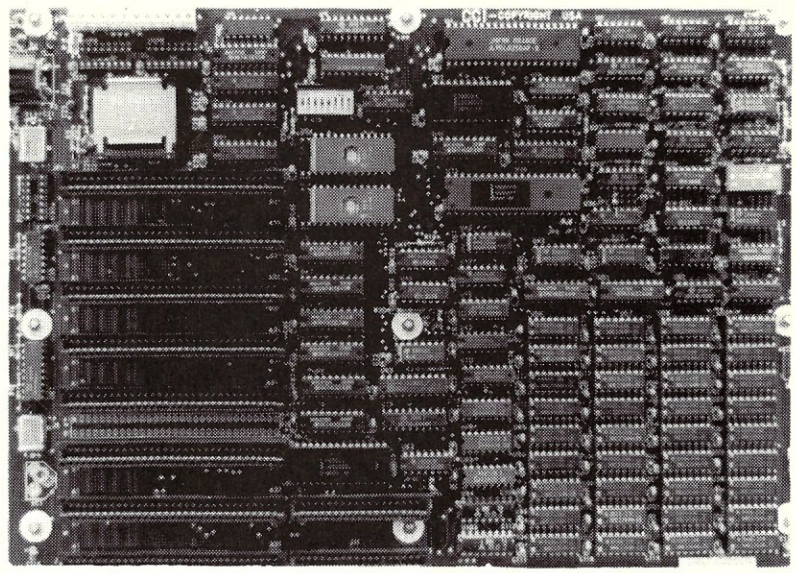

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MEX-PC

A Modem Program For The Advanced PC User

by Dennis N. Quinn

In the beginning, there was Ward Christensen's MODEM2 written for CP/M systems, and capable of file transfers over telephone lines at speeds up to 1200 baud. A protocol known as XMODEM, it permitted file transfers with a certainty approaching 99%, thanks to an error checking technique known as *sum-checking*.

Over the years, MODEM2 became MDM7, and many users added features that made it more reliable, including a better error-checking technique known as cyclic redundancy checking (CRC). MDM7 was not the only telecommunications software in the world; there was YAM (Yet Another Modem), written in C, which had a small but enthusiastic following; there were a number of commercial products; there were a number of home-grown programs, largely attempting to duplicate (with varying degrees of success) the capabilities of MDM7. But virtually everyone used MDM7.

Then came Ron Fowler. Rumors began to appear on bulletin boards that he was writing a new telecommunications program, called MEX, and that it was to be the *next generation* of telecommunications programs. When it became available, I downloaded MEX100.LBR from Dave Hardy's Technical Bulletin Board System in Detroit. It was a big library, containing lot's of documentation and, for the first time, in a public domain telecommunications program, an on-line help facility.

I followed the installation instructions, and in about an hour MEX was up and flying on my KayPro. It took some getting used to (the command structure was totally different from that of MDM7), but the on-line help facility really helped. After a few hours behind the wheel of MEX, I vowed I would never go back to MDM7. And I haven't.

I didn't use all of Mex's features. I didn't use the CIS (Compuserve Information Systems) file transfer protocol supported by MEX, because I don't have a Compuserve membership. I didn't use the READ command other than to do some off-line initialization for the various environments. I had no confidence in my ability to set up a READ file for automatic login at a remote system, and I didn't (and still don't) see the need.

THINGS I LIKED

I liked the feature in MEX which allowed multiple telephone libraries that could be loaded dynamically. One set for local bulletin boards, one set for long-distance, one set for commercial systems, etc. I used my KayPro at work as well as at home, and so I had a telephone library for work which included the *dial 9* prefix that was required, and I had a library for home which had some of the same systems plus some others, minus the *9* prefix. That was really nice.

I really liked the CLONE command, permitting the user to make changes to the various switches and flags and then save an executable version of MEX having all those changes built in.

I liked the STAT command, which permitted the user to customize MEX to the way he or she preferred to use it, then make changes without reassembling in the event the selected options didn't work out.

MEX, unlike MDM7, was a program you could *play with* until you got it right, and you didn't need the source.

Prior to the release of MEX, about 95% of all telecommunications users used the MDM7 program; two years later the user base is split, about 60% for MEX and 35% for MDM7.

ENTER THE IBM-PC

As more and more people began converting from CP/M to PC/MS-DOS based systems, a vacuum formed. MDM7 was not available for the PC and compatibles until 1984, and MEX was initially targeted for the CP/M systems. Programs appeared, mostly written in BASIC, to fill the gap. Early in 1985, Ron finally released a commercial version of MEX for the PC, translated from 8080 to 8088 assembler language by Al Jewer, the sysop (system operator) of the Fort Fone File Folder system. MEX-PC, as the product is called, comes with a user's guide professionally printed and shrink-packed in plastic for insertion into one of those down-sized three-ring binders IBM made popular. The User's Guide, written by Rob Fixmer, replaced the document file accompanying the public-domain version of MEX and contains considerably more information.

MEX-PC is roughly equivalent to the public-domain version of MEX, with some added features. Most need lots of memory. Users familiar with the public-domain version of MEX will be able to use MEX-PC (though not to its fullest extent) immediately.

INSTALLATION

Installation involves two steps: First, backup the MEX-PC files or copy them to a hard disk; a batch file is provided for this. Second, install the overlay for the modem you will be using. Overlays are provided for the Hayes Smartmodem, Novation Smartcat, Racal-Vadic VA212 and VA3451, CTS Companion, PCjr internal modem, Racal-Vadic Maxwell, and Cemetek/Infomate 212 modems.

In addition, the Smartmodem overlay source is included, so if your modem doesn't appear in the list above, and if you have experience writing 8088 assembler code and have access to the IBM macro assembler and link editor, you can build the overlay for your modem. That seems like quite a few if's to me, but then again I never cease to be amazed about the expertise out there.

Anyway, the procedure for building a MEX-PC version for your modem is simplicity in action: just run the distribution version of MEX-PC, use the LOAD command to load the overlay of your choice, and the CLONE command to save your tailored version of MEX-PC. It comes, by the way, preconfigured for use with the Hayes Smartmodem.

There is also a version of MEX-PC called *MEX-86* which does not have terminal, keyboard, or modem overlays installed. The source modules for the IBM-PC terminal controller and the keyboard controller are included, and can be modified to suit your system if it is different enough from the IBM-PC to warrant it. Note, however, that only so much difference will be tolerated; MEX-PC makes direct BIOS calls for a number of things, and if your computer does not have a similar BIOS, you're out of luck.

OPERATION

Operation of MEX-PC begins by connecting your modem to your telephone line and to the COM1 port of your computer. A *straight through* modem cable should be

used. If your modem will be more than six feet from your computer, use a shielded cable rather than one of the less expensive ribbon-type cables. This becomes more important if you will be running at the higher speeds, especially 2400 bps.

Once your modem is connected, bring up MEX-PC by typing *MEX-PC*. You will immediately see the prompt

[MEX] A:⟩⟩

The information inside the square brackets (*MEX*) can be changed with the *ID* command, and if you are using subdirectories, the full path will appear after the disk identification (unless you turn that feature off with the STAT PATH command). The double greater-than signs are used within MEX-PC to indicate that it's your turn to type.

Now tailor MEX-PC to your own personal preference. Use the STAT command to change the various flags, triggers, and so forth that control the operation of MEX-PC. Use the TSET command to control the way the terminal overlay handles output to your monitor, and the SET command to control the way the modem overlay handles output to your modem. The manual is pretty useful, but you will also need to refer to the READ.ME file, included on the distribution disk, for changes since the manual was printed. Unfortunately, neither the manual nor the READ.ME file is organized for easy reference to these commands. While the organization of the manual is pretty good, it is not complete because MEX-PC has been enhanced several times since the manual was printed, so be prepared for a lot of searching and reading before you are ready to go.

There are two ways you can tailor MEX-PC:

1. You can change variables using the STAT, TSET, and SET commands and use the CLONE command to save the object program with the changes intact, or
2. You can put the commands to customize MEX-PC into the INI.MEX file. The CLONE command is used only once; you turn INITFILE on with the STAT command and CLONE MEX-PC. From then on, when you execute MEX-PC it reads your INI.MEX file and applies the customization commands.

I prefer the second approach, mainly because I can text-edit INI.MEX and see just how far my running version of MEX-PC is from the distribution version; that way, if I upgrade to the next revision, I don't have to sit down with the manual again to figure out what my selected options should be.

MAKING A CALL

MEX-PC supports a telephone library. Each telephone library entry consists of the system name, the system telephone number, the baud rate, and a comment. The baud rate and the comment are optional. Unlike the public-domain version of MEX, MEX-PC appears to allocate memory for the telephone library dynamically, permitting you to have a very large number of entries.

After you build your telephone directory, save it with the SAVE command, specifying the name of the directory (your choice) with the extension .PHN (required). Even if you use the CLONE command to save your customized version of MEX-PC, always save your telephone library also; that way, if you ever have to return to the distribution version of MEX-PC you won't have to look up all those telephone numbers again.

You place a call in one of three ways,

1. By system name in your telephone directory: MEX-PC looks up the number, sets the baud rate (if one is specified), and issues the appropriate command to your modem to dial the number. In addition, MEX-PC displays the telephone number and your comment (if one is specified) on the monitor screen.

2. By telephone number: In this case, you specify the number which you wish to call. You would do this if the number is not in your directory and you don't anticipate calling it frequently enough to justify entering it. MEX-PC displays the telephone number and issues the appropriate command to your modem to dial the number. No change to the baud rate is made automatically; you must use the SET command to change the baud rate if it needs to be changed.

3. Manually: In this case, you place MEX-PC into the terminal mode, dial the number on your telephone, and when the remote system answers, issue the command to your modem to pick up the line. MEX-PC is not even involved in this type of call. Note that this is the only procedure which may be used for modems which do not have autodial capabilities.

MEX-PC has provisions for two special entries in your telephone library which contain the telephone numbers of alternate long distance services. By prefacing the number you are calling with the symbol representing the desired alternate long distance service, MEX-PC will string the two telephone numbers together when it sends the dial command to your modem. As with MDM7 and the public-domain MEX, MEX-PC uses the symbols "⟨" and "⟩" to represent the two alternate long distance service telephone library entries. If you only use one such service, you may choose either of the symbols to represent your alternate long distance service in your telephone library.

DEFINING FUNCTION KEYS

MEX-PC allows you to attach alphanumeric strings (including control characters) to the ten IBM-PC function keys and to most of the alphabetic character keys. Only the unshifted variants of the function keys may be used (the function keys when used with the Shift, Control, and Alternate keys are treated as if they were unshifted by MEX-PC), and only the Alternate variants of the alphabetic character keys may be used.

MEX-PC also retains a holdover from the public-domain version of MEX, although no mention of this is made in either the documentation or the READ.ME file. There is a STAT variable called ESC which may be set to a *trigger* character. The distribution version of MEX-PC has this variable set to *none*, but you can set it to a seldom used character (such as ⟨tab⟩ or ⟨escape⟩). When this trigger character has been defined, you can assign strings to nearly any key on the keyboard, even the *special* keys like the square brackets, curly braces, shifted numeric keys, and other punctuation keys. (You cannot assign strings to the cursor movement keys; nor can you assign strings to the unshifted numeric keys because MEX-PC will treat the numeric keys as if they were the function keys.)

After you build your function key library, save it with the SAVE command, specifying the name of the library (your choice) with the extension .KEY (required). Even if you use the CLONE command to save your customized version of MEX-PC, always save your function key library also.

You may use your function keys either in the command mode or in the terminal mode. In the command mode, MEX-PC executes the string associated with the function key (it should be a valid MEX-PC command), and in the terminal mode, MEX-PC transmits the string associated with the function key to the remote system.

WHEN YOU'RE ONLINE

MEX-PC has three modes of terminal communications:

1. It expects the remote system to echo the characters you type back over the telephone line, where it receives them and displays them on your monitor screen. This is the normal arrangement when you dial in to a bulletin board system or a host mainframe system.
2. It echoes the characters you type on your display screen and expects the remote system to do likewise. This is the arrangement normally used when two people connect their computers together over the telephone line and both have similar terminal communications programs.
3. It echoes the characters you type on your display screen, and it echoes the

characters typed by the person at the remote back over the telephone line. This is the arrangement normally used when the person at the remote is using a *dumb* terminal.

MEX-PC permits you to access a remote system over the telephone line just as if you were using a terminal connected directly to the remote system. Most of its features are designed to make this access easier. MEX-PC does not perform terminal emulation, in which the control keys, cursor movement sequences, etc, of certain popular *dumb* terminals (like the DEC VT-100, the Lear-Siegler ADM3A, etc) are simulated. If you are dialing in to a mainframe computer which expects the remote terminal to be one of these *dumb* terminals, you should look into a commercial communications package which provides terminal emulation. MEX-PC won't help you.

FILE TRANSFERS

MEX-PC provides file transfers using two protocols: The *XMODEM* protocol used by most bulletin board systems, and the *CIS* protocol used by Compuserve. No variation of the CIS protocol is provided, but because of the variety found among the various bulletin board systems around the continent, MEX-PC allows the following variations on the XMODEM protocol:

1. CRC or Checksum. You may select either of these methods for verifying that each block of a file transfer arrived correctly. The CRC method is more popular because it is more reliable than the Checksum method, but some bulletin board systems cannot use the CRC method.
2. Block size. You may select either the standard 128-byte block size or the new 1024-byte block size for file transfers. The 1024-byte block size is very new and not all bulletin board systems can handle it. If you use the 1024-byte block size, you can expect a decrease in file transfer time. At 300 baud, the decrease is less than 1%, but at 2400 baud, the decrease is over 7%.

MEX-PC also permits batch file transfers, in which many files can be transferred with a single command. Currently, this is only usable when there are humans on both sides of the connection; bulletin board systems using the XMODEM program are not capable of taking advantage of this feature.

With the XMODEM and CIS protocols, any type of file (including object programs) can be transmitted. This is because both of these protocols make use of all eight bits of each character, relying on other error checking mechanisms to verify that the data arrived correctly.

OTHER FEATURES

MEX-PC has many other features, all designed to make telecommunications easier. These include:

- Any DOS command or program may be executed within MEX-PC with control returning to MEX-PC.
- Text files may be displayed on the screen pausing at the end of each page while you look over the page.
- Sophisticated script files may be constructed which will lead MEX-PC through virtually any operation, including logging on to a system, checking for mail addressed to you, collecting the mail in a file on your computer, transferring files, etc.
- Files can be deleted, renamed, copied, and printed.
- The dialog between you and a remote system can be captured in a file or on your printer.
- The full directory capabilities of MS-DOS are supported.

CONCLUSIONS

While MEX-PC is not really the *next generation* in terminal communication programs, it does represent a major advance over its predecesor, MDM7. A few things are lacking, but I feel certain those things will eventually appear. They include:

- Background file transfers. While your computer and the remote system are involved in a file transfer, all you can do is twiddle your thumbs. It would really be nice if MEX-PC would return to the command mode during a file transfer, allowing the user to do other things. This would, I admit, involve considerable programming, including interrupt-driven communications routines, but I predict that MEX-PC will have this feature very soon.
- Terminal emulation. As mentioned above, MEX-PC does not have the capability of emulating a *dumb terminal*. But provisions exist within the program to install a terminal overlay, so this feature, too, could be offered.
- Remote access. It would be really nice if you could leave your home computer turned on while you are at work, then dial in to your home computer from your work computer and transfer files. I received a preliminary version of just such a module, called the *remote operation module*. A lot of work needs to be done on the module, but it's on the right track.

A flyer included with the review package indicated that terminal emulation would be available soon, and a price of $29.95 had even been established for the terminal emulation package. According to the flyer, "overlays will soon be available for emulation of other terminals, beginning with the DEC VT-52," and the package "gives your computer the flexibility to emulate most functions of other popular terminals such as VT-52, VT-100, TV-920, ADM-3A, and others." The package was supposed to be available "in May, 1985." I do not have any further information.

Would I recommend the purchase of MEX-PC? Absolutely. First of all, it's the only telecommunications package for the PC with so many features at under $100. Secondly, it is the only package that supports the CRC error-checking capabilities of the XMODEM protocol, and it is the only package that supports the new 1K-byte block length. Finally, it does what it does quite well; and if you know how to use the public-domain version of MEX, you will be able to pick up MEX-PC and run it with a minimum of training. Good job, Mr. Fowler, good job.

AS WE GO TO PRESS

NightOwl Software has informed us of several added features to MEX (now version 1.6) since this review was prepared. They are: On-line help, Optional menu-driven operation with built-in help window, Kermit protocol, YMODEM batch protocol support, MS-DOS path support, expanded file transfer screens (details #Kbytes and % transferred, time remaining and full error and status reporting), real-time clock support, color support, and script file programming language enhanced.

An optional MexPack ($99.95) is now available adding: Terminal emulation (DEC VT 100, Televideo 925, ADM3 and Data General Dasher D100/D200), access computer from a remote location with password protection, and ability to run *well-behaved* MS-DOS programs remotely via SHELL function.

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A program may thus query MS-DOS to determine which country the computer is being used in, and adjust formats accordingly. By itself the COUNTRY statement does nothing.

A three character number specifies the country (e.g. United States = 001).

THE FCBS & LASTDRIVE STATEMENTS

FCBS allows you to specify the number of File Control Blocks (FCBs) that can be opened concurrently.

LASTDRIVE sets the name of the last drive and hence the maximum number of drives you may access. The default is *E* and the range is A through Z.

IN CONCLUSION

The CONFIG.SYS file facility of MS-DOS allows users to easily reconfigure many system features. This is a considerable improvement over CP/M which required considerable assembler level programming skill to make comparable system configuration changes.

What you see is what you get . . . and send!

```
Transfer Protocol: Modem7/CRC Packet Size:   128   Files:     1

| Block # | of  | Kbytes | %  | Time Remaining | Errors Consec | Errors File | Errors Total | Total Kbytes |
|---------|-----|--------|----|----------------|---------------|-------------|--------------|--------------|
|      31 | 522 |      3 |  5 |           5:06 |             0 |           0 |            0 |            3 |

Errors:
Status: Transfer in progress
----[MEX File Transfer]----------[CTL-C to abort]----
Sending:  >ANYFILE.AQC
```

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ConIX & ConIX Tools

by Steven D. Kapplin

A CP/M CCP Replacement With UNIX-like Features

INTRODUCTION

ConIX (Console Input Executive Ver. 22.11f) is a Console Command Processor (CCP) replacement for CP/M. It is similar to products such as Microshell (TM), C/NIX (TM), CLIP (TM), and ZCPR3 (partially in the public domain), each of which replaces CP/M's CCP. ConIX differs from these other products because it provides more features and a better implementation at a lower cost.

ConIX, along with its tools, provide the following:

1. 36 resident commands (CP/M provides 6), including multiple commands on the command line, and a type-ahead buffer. (Additional commands are available in the latest revision.)
2. UNIX-like I/O redirection and pipes.
3. A programming environment which includes a programming language somewhat like C having control and branching structures and 31 resident programming functions.
4. A Memory Management system to allow the user to control the amount of memory ConIX uses and, conversely, to control the amount of memory available to transient programs.
5. A print spooler using either memory or disk.
6. Extended disk and user area support. Provides a virtual disk facility and supports all 32 user areas available under CP/M.
7. Disk-based variables which can be used to store frequently used strings as function keys for systems which do not support function keys.
8. A user interface which can be used by assembly-language programmers for development of utilities needed to interface with the ConIX environment.
9. A set of transient utilities to provide library archiving, compilation of programs written with the ConIX language, an on-line help facility, and more.
10. A facility to alter the ConIX environment to the user's specification either on a permanent or temporary basis, either in memory or through the command line.
11. A pull-down menu system and complete on-line manual (help) system.
12. A set of 25 library utilities which provide named directories, named directory manipulation, file manipulation, a debugger, and more.

ConIX has been around since November 1983, so the product has had an opportunity to be fine-tuned. The version I reviewed is 22.11f (which refers to CP/M 2.2, ConIX version 1.1f.) The latest version is 22.12a.

INSTALLATION

Installation is very easy. Minimum system requirements are CP/M 2.2 and 48K memory. An installation program is supplied with the ConIX file in relocatable form. The installation program prompts the user for all input with an explanation of what is required. ConIX can be installed at a target address anywhere within the system's memory, if the user so directs. Unless told to do otherwise, ConIX will install itself directly below BDOS. Once the target address is set, the installation program produces a relocated image called CONIX.COM. When this program is executed it installs ConIX at the designated target address.

During the installation, the user may select certain ConIX features. These include the virtual disk (called ExpanDisk) capability, patching BDOS error vectors, and patching the BIOS addresses to implement I/O redirection through BIOS calls. If you have a non-standard implementation of CP/M, you may not be able to patch BDOS and/or BIOS. If you cannot patch the BDOS error vectors, the virtual disk capability will be lost. The BIOS patches are required for I/O redirection from programs which use the BIOS for I/O instead of BDOS.

When executed, ConIX calls a startup program called PROFILE.COM. PROFILE.COM takes input from PROFILE.SET. If PROFILE.SET does not exist on the default drive, then PROFILE.COM creates a file containing a simple sign-on greeting. Normally, the user would create a PROFILE.SET through ConIX's pull-down menu facility or by using an editor. PROFILE.SET contains a list of commands recognized by ConIX which are used to set up the desired ConIX environment.

Setting up a ConIX environment involves using the built-in command OPT. There are currently 42 options which can be set by the user. If the desired option settings are included in PROFILE.SET, then upon cold boot those will be the default settings. As an example, my PROFILE.SET contains the following option settings:

```
opt +sa              ;enable auto search
                     ; of archive for
                     ; command
opt +sl 24           ;sets screen paging
                     ; at 24 lines
opt +cs ^Z           ;sets clear screen
                     ; code to ^Z
opt +xs .ovr .txt ;enable auto search
                     ; for files with ex-
                     ; tents .ovr & .txt
opt +sp :0           ;set initial search
                     ;  path to A0
opt +pf g:0          ;place all temp files
                     ; on drive G (my RAM
                     ; disk)
```

These options can also be set or reset directly from the command line.

INPUT/OUTPUT REDIRECTION

ConIX supports UNIX-like redirection from the command line using standard UNIX symbols. Pipes are implemented as redirected output from one program to a temporary file, then as redirected input from the temporary file to the next program in the pipeline. ConIX does not automatically erase temporary files after they're used. Pipe files can be written to memory or to a disk file. A ConIX option lets the user select where pipe files will be written. I/O can be redirected to files, devices, or memory. All

the standard CP/M devices are recognized, including a NULL: device for use as a bit bucket. ConIX also provides for user definable input and output device drivers. Options are available to control the number of lines or characters read (or written), filter special characters, expand tabs, etc. during I/O redirection.

The redirection facility is sufficiently extensive to permit virtually any permutations the user may need for efficient use of ConIX, and it ties in well with the programming language.

THE PROGRAMMING LANGUAGE

ConIX features a powerful programming language called XCC. Unlike most other products which also provide some type of programming environment, XCC is a compiled, structured language, similar to CBASIC. Source code is compiled using ConIX's compiler, XCC.COM. The compiled code is quite compact, thus saving disk space. Unfortunately, the compiled programs only run under ConIX.

All of ConIX's built-in commands can be used, and there are additional functions provided for performing string comparisons, number tests, number conversions, system-status tests, etc. The language provides control and branching instructions like IF-THEN-ELSE-ENDIF, WHILE-DO-ENDW, SWITCH/CASE, GOTO, and GOSUB. Error trapping and recovery commands are also provided.

The language syntax is a bit unusual, because there are no named variables (named variables are now provided in the latest release of ConIX.) Rather, variable contents are simply stored in or retrieved from memory addresses. Below is a sample program fragment to send commands to a printer.

```
#Program to send control sequences
# to the printer
#Command syntax:  SETPTR <opt>

if scmp "$1" "=" ""; then
    exit
endif
substr 0 1 " U$1" > @1000
switch "$@1000"
    case "D"
        #Draft mode - esc[0y
        echo ~ ^[~[0\y\\ > :lst
        exit
        sbrk
    case "C"
        #Correspondence mode - esc[1y
        echo~ ^[~[1\y\\ > :lst
        exit
        sbrk
    default
        echo "Option Error -- Aborting"
        exit
endsw
```

The program first tests the command line variable, $1, to see if it contains any characters. (Although this program fragment only uses one command-line variable, ConIX allows up to 255 command-line variables.) If not, then exit the program. Otherwise the program takes the first character of the $1 variable (this would be a command line option), converts it to uppercase (_U$1) and redirects output to memory address 1000H. The case structure then tests the value stored at 1000H and branches according to the test. If an incorrect parameter is entered as a command-line option, the default case prints a simple error message and exits the program.

The '~' is a special ConIX symbol which causes the next sequence to be accepted as a control character (^[). The '\' backslash causes literal interpretation of the next character. The '\\' truncates the <crlf> sequence sent after a normal "echo".

The language is certainly powerful enough for any ordinary string or integer-related problems. The drawbacks of the language are its unusual syntax for handling variables and its speed. In comparisons of looping benchmarks , the language is between 10 to 20 times slower than interpreted BASIC.

MEMORY MANAGEMENT

This feature is unique to ConIX. ConIX provides the ability to tailor the amount of space ConIX uses (with corresponding changes in available ConIX features). Normally, ConIX requires about 28K of memory, (occupied from the top of memory and extending downwards towards the base of CP/M) leaving the user with 28K of TPA in a standard 64K CP/M (assuming 8K for CP/M). Of course that isn't large enough for many programs, such as Wordstar. Because Wordstar doesn't need all of ConIX's features in order to operate, most of ConIX can be "managed out" to provide memory space. This is accomplished through Con-

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IX's memory management facility.

There are eight levels of ConIX, each of which can be successively managed out. Level 1 is all of ConIX, while Level 8 is only a 1/2K system loader. As each successive level of ConIX is managed out, more memory is freed and fewer ConIX features are available. A handy utility called FREE is supplied on the distribution disk for determining the amount of free space currently available. Memory can be managed on a permanent basis using the OPT mm command, which sets the memory level until it is reset with OPT. However, memory can also be managed temporarily for an individual command using a command line options (there are currently 19 command line options.) The command line, "[m=6] ws <cr>", sets memory to level 6 and executes Wordstar. When Wordstar finishes executing, ConIX will reload that part of itself which was managed out by the [m=6] portion of the command line.

PRINT SPOOLING

The print spooler is implemented either in memory or using disk resident storage. The spooler can be as large as 8 megabytes. A RAM disk provides quick spooling (it takes only a few seconds to write a 64K file to the spooler), however, it would take somewhat longer to write output to a floppy disk. The spooler's size and location can be set using the ConIX OPT command. The spooler itself is probably worth the entire cost of the ConIX system!

Prices

ConIX - $79.95 plus
Basic ConIX - $49.95 plus
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LIBRARIES

ConIX implements library archives as an integral part of the operating system. However, ConIX libraries are not compatible with those created by the public domain programs LU and NULU. ConIX archiving utilities can store text or binary files and include reserved space for keeping the date, time, and a description of each entry. Like the public-domain programs, ConIX can execute a .COM file which is stored in a library. ConIX also implements automatic searching for an archive. A system option allows the user to designate the name of a default library. If a .COM file cannot be found in the search path, then ConIX will look for it in the default archive. By entering a special command-line option, the user can ask ConIX to search libraries other than the default library.

The ConIX archiver (ARM) is quite versatile, but is not as convenient to use as the public-domain NULU. I would urge the ConIX author to consider adopting the NULU approach to library manipulation.

EXPANDISK

The ExpanDisk feature permits attachment of any physical drives, such as A: and B:, to any logical drive identifiers up to the maximum number allowed under CP/M. Therefore, if you attempt to log into a non-existent drive, ConIX will ask you to insert a disk in the currently-logged physical drive. Further, if you get a disk-full error while trying to save a file, you can simply resave the file to the ExpanDisk logical drive, and ConIX will prompt you to put a fresh disk in the logged physical drive. You can now swap disks and save the file without losing your work. The ExpanDisk feature can be a real life saver for people working with WordStar or MBASIC when they run out of space on a disk. The fear of disk-full errors can be totally forgotten!

SYSTEM PROGRAMMER INTERFACE

ConIX includes extended BDOS calls which permit the user to write programs for directly interfacing with the ConIX system. Thus, ConIX provides an important feature

which only ZCPR3 provides — a means for the programmer to take direct advantage of the extended facilities of the new operating system. If ConIX had been around before CP/M gave way to MS/DOS, many commercial programs could have been enhanced through use of this operating system because of its far greater flexibility.

MISCELLANEOUS FEATURES

In addition to the features previously discussed, ConIX provides extended user-area support (all 32 user areas are accessible), automatic path and file extent searching, shell variables (52 variables) stored on disk, special character and function keys, upper and lower case characters on the command line, command interrupt and abort mechanisms, unlimited memory variables, environment-status variables, an integer-expression analyzer, command memory relocation, programmable machine-port I/O devices. Commands are also available for setting and getting file attributes, to login and reset drives, examine, change, copy, move memory, and much more.

CONIX TOOLS

This is a set of more than 20 utilities, written in the ConIX language (source is supplied). The utilities are divided into five groups. The first implements named user areas.

The second group implements hierarchical directories similar to Unix and ZCPR3. It includes two utilities, D and DSH (directory shell), which facilitate the use of named directories with programs that do not recognize named directories in the command line. They work very well, but are quite slow in operation.

The third group of utilities are for directory and file manipulation. These include MV (move), CP (copy), and LS (list directory) commands, utilities to recover erased files and review files for deletion, a link command, LN, which links files together for execution, and CHMOD for setting file attributes.

The fourth group of utilities provide tools to count lines in a file, strip hi-bits, expand tabs, split files into smaller files, type files, and print files.

Finally, there is a hard-disk backup utility, an interactive debugger, and a utility for processing multiple arguments (that repeats a command for all files on a disk).

A second library is promised which will provide tools to enable development of data-management programs using the XCC programming language.

FINAL COMMENTS

User support has been excellent. I have called the author several times and received excellent service together with a willingness to provide any assistance I might need. Computer Helper Industries, Inc. provides a one-year support package if you send in the licensing agreement supplied with the distribution package. The license is not unlike that found in most software packages today. Updates are provided during the one-year period at a nominal cost to the user plus shipping and handling. Further, purchasers are offered additional discounts on new ConIX products.

Documentation consists of two typeset manuals. The first covers the basic elements of ConIX including installation, commands, etc. The second provides a detailed discussion of the ConIX programming language. A summary page at the end of each chapter acts as a quick reference guide.

In summary, ConIX is a superb product at a reasonable price. I am not one who usually buys expensive software. At the current price, ConIX is is a bargain. Simplicity of installation, extensive command structure, total compatibility with CP/M, an excellent programming language, and the uncomplicated provision of many desirable features of UNIX and ZCPR3, , along with excellent documentation and a low price recommend its purchase.

Steve Kapplin is Associate Professor of Real Estate and Finance at the University of South Florida. He has been an active "hacker" since 1981. He can be reached via CompuServe ID 70055,1021 or through the Finance Department at the University.

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FirsTime for C & Turbo Pascal

by Stephen Davis

It has become unusual to see new ideas in screen editors. I am not talking about *to mouse or not to mouse* or menu vs. command driven, but a really new and different approach. Spruce Technology has taken such a bold step in its series of FirsTime, context-sensitive language editors.

FirsTime is not a general-purpose word processor; it has no word-processing capability at all. It is not even a generic program-entry editor. Each FirsTime editor is built for one language and one language only. But by specializing, FirsTime attempts to guide you past syntactical errors (which make up the majority of all programming errors) by simply not allowing you to type the wrong thing. If you do trick FirsTime into letting you type in some illegal construct, and it isn't easy, FirsTime will scold you with an immediate warning as soon as you complete the statement and attempt to procede.

FirsTime also offers the promise of accelerating program entry by providing function key-macros. Each time the cursor is moved, Firstime analyzes the resulting cursor position. Knowing the syntax of the language being used, Firstime decides on what are all the possible legal statement types. Firstime then associates each of the function keys with a different legal construct, then places these labels at the bottom of the display. Select one of the constructs by depressing the appropriate function key and Firstime builds a template at the current cursor position ready to be filled in.

WHAT YOU GET

FirsTime comes in a soft cover, three-ring binder, close enough in size to the standard MS-DOS documentation that they fit comfortably in the bookshelf together. Although FirsTime is prominently emblazoned on the outside, the binder is generic, being the same for all of the editors. There is no way to tell which language a version is for, which could be a problem if you owned more than one. Inside is a shrink-wrapped stack of pages and a separate set of chapter dividers ready for you to open and thread into the binder.

Context-Sensitive Editors With Some Rough Edges

Also contained within the pockets of the binder is the license agreement and registration forms. This license agreement, although similar in form to other "shrink-wrapped" agreements, is worse than most. Although most users would never notice, Spruce Technology only licenses the user to make one backup copy of the master diskette. I am not sure why the people at Spruce care how many backups I keep of my software.

The registration card is standard fare: name, rank, and serial number; however, the accent here is a little friendlier than some. Throughout the registration card, and later in the manual, the owner is encouraged to call the good people at Spruce, not only with problems, but with suggestions, encouragement, or just like to chat. This is very welcome. Many owners are afraid to contact the makers of their software packages with problems, not realizing that a certain amount of customer support is built into the purchase price.

The manual is quite good. The first chapter covers the mundane, but necessary things, like how to backup the master disk and how to install FirsTime on a hard disk. This is covered in such detail that all should be able to understand. Very refreshing was a list of all the files that should be on the master disk. No checksum program was included to make sure the files were intact, however. The introductory chapter also explained what FirsTime is and how you enter the editor.

The next two chapters are a tutorial. I am as guilty as the next hacker of throwing the tutorial aside, bringing up the program and "playing with it". In this case, that would be a mistake. The tutorial is accurate and educational. After having gone through it, I was able to remember the commands remarkably well. For those times when your memory does fail you, a plastic Quick Reference card is thoughtfully included. When that is not enough, the final chapter of the manual contains a detailed description of each command with handy examples. Each command begins a new page and sufficient room is left for user annotations after each explanation.

The manual's appendices contain: 1) a glossary of terms and concepts used throughout the manual, 2) a list of every error message and warning together with an explanation of why each would arise and what each means, and 3) a set of suggestions which the manual calls: Fine Points. This is all followed up by an index for quick reference.

The diskette stored within the inner sleeve of the notebook contains the editor, a configuration utility, and some example source files. Some of the example programs are necessary to run the tutorial contained in Chapters 2 and 3 of the manual. The master disk is not copy protected, welcome news for hard-disk owners.

The configurator utility is provided so the operator can configure FirsTime for his particular equipment and tastes. The program allows redefining all of the key commands and some system parameters.

Normally this option is very useful, allowing the user to redefine the keys to commands with which he is already comfortable. In this case, I question the usefulness. Since FirsTime is so different from other editors, there is no direct correlation between its commands and those of other editors. However, the program is well done, allowing you to go backwards and forwards through the key definitions until satisfied that all is as desired. Upon exiting the keyboard section, a check is made and, if there are any conflicting definitions, a warning is printed listing the offending definitions.

The system section of the reconfigurator

allows FirsTime to access the display screen either directly, through BIOS calls or through MS-DOS calls. Direct-screen accesses offer the greatest speed, but require absolutely IBM-PC-compatible hardware; MS-DOS calls offer the highest compatibility, but at the cost of speed. BIOS calls are a compromise between MS-DOS calls and direct screen access, both in terms of compatibility and speed. Apparently, however, Spruce Technology has not yet implemented direct-screen writes, since selecting either direct-screen I/O or BIOS-screen I/O both resembled exactly the appearance of the BIOS calls.

THE EDITOR

Although offering great promise, the editor does not completely live up to its potential. Once a file is read in for editing, the cursor is homed and the entire program is "selected", being the highest-level block. Depressing the right-arrow key selects the first subblock which can be edited. Subsequent right arrows select ever smaller subblocks until the smallest subblock has been selected, at which point the next block at the current level is selected.

The main problem is that each and every time the cursor is moved, FirsTime must undertake an analysis of the program to decide what the next block is. Having decided, it highlights the entire block (which may take up the entire screen) by placing it in inverse video. It must then decide what all the different legal statement types are and write their names in the function-key definitions at the bottom of the screen.

All of this is just too much for a 8088 processor to handle every time an arrow key is depressed. Add the time to rewrite sometimes as much as the entire screen. When instructed by the configurator to use MS-DOS calls only for screen output, moving the cursor even one position may take several seconds. This is entirely too long to allow any serious program entry.

Even when using the much faster BIOS calls, the first time I tapped on the right-arrow key four or five times rapidly, I thought that the editor had died. It is unfortunate that Spruce Technology did not immediately implement direct-screen output. Past experience has shown this type of output to be *virtually instantaneous*.

This slowness of response to cursor-movement keys largely nullifies the potential for speed improvement in program entry for all except those still unfamiliar with the language (for novices, the command templates provided at the bottom of the screen would be a great help). Response on a faster clone or compatible, such as the AT, Deskpro, or one of the 8Mhz clones, might be more acceptable.

This problem might have been lessened had Spruce analyzed some of its predecessors, like MicroPro, more closely. One of the nicer features of WordStar is that, if it is beginning to write the screen and you scroll or page, WordStar immediately stops writing the old information to the screen and starts over with the new. FirsTime does not look forward before rewriting the selected block to see if you have already moved on. Depressing an arrow key multiple times rapidly causes each subsequent block to first be rewritten in inverse video and then be re-rewritten back into normal video. This type of behavior is no longer acceptable in a program editor.

The edit commands are all of the control key variety (à la WordStar). Most of the key selections are logical, such as Control-A for append, Control-C for copy, etc. I did find the Control-G for abort a less than obvious choice. Almost unforgivably, FirsTime does not intercept Control-Break. Instinctively entering the Control-Break key at the sign of trouble summarily ejects you from the editor back to the DOS prompt with no chance of saving any edits already made.

One of promises of the FirsTime editor is a parse command combined with a "jump to next error" command. This command pair offers the potential for quick isolation and correction of syntax errors. Unfortunately, as of Version 1.05, neither of these commands had been implemented.

Some program parsing is done. Variables used, but not defined, are clearly marked in inverse video, for example. Upon reading or writing a program, a check for syntax errors is made and, if any are found, a warning is posted; however, there is no indication of where or what the error might be. Without the commands mentioned, this message is more of a taunt than an aid.

FirsTime can read in programs written by other editors, if they don't contain compile errors. When writing a file back to disk, FirsTime keeps the original in the form of a .BAK file. It also asks if it might create two new files: a relatively tiny .INT file and a .FT? (where ? depends on the language) file. These files apparently contain structural information about the file just edited. Unfortunately, the .FT? file can be much larger than the original file being edited! For example, after editing a .PAS file containing 3737 bytes, a .INT file containing 274 bytes was created as well as a .FTP containing 14336 bytes.

CONCLUSION

Spruce Technology has put much effort into assembling a comprehensive package containing documentation, configuration utility, and an the editor. The approach taken in the editor is a unique one with much promise. This early edition has a few rough edges in desparate need of smoothing. But most importantly, Spruce Technology will need to find a way of speeding up the editor before FirsTime will find a permanent home in my system.

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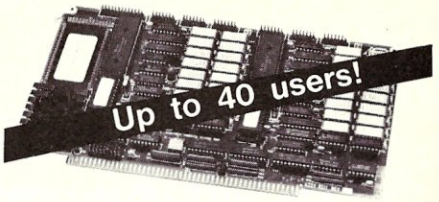

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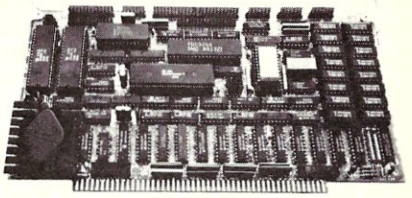

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Building an AT Clone

by Leon Suchard

Experiences Assembling An AutoCad System

I recently assembled an AT clone system for an architect who is a heavy user of AutoCad™. He had an IBM-PC but needed a faster machine and all the slots in his PC were taken. We could have chosen an XT clone with a faster coprocessor card, but rather opted for an AT clone thinking of future uses and capabilities. Also, I had no experience with "turbo accelerator" boards, and the speed improvement when changing at an 80286-based processor seemed guaranteed.

ASSEMBLY

Assembling an AT clone is not a very complex task; it's comparable to assembling an XT clone, with a few exceptions. I purchased the case, motherboard, power supply, and keyboard from Atlaz Computer Supply. No assembly instructions were provided. I looked at an IBM-AT for guidance as to how to assemble the clone, particularly the locations of connectors on the motherboard. Installation required that I wire up the front panel and lock switch LED's, mount the motherboard, power supply, disk drives, and install the plug-in cards. An experienced XT clone builder will have little trouble putting this AT clone together, though mishaps can occur. Here are some helpful hints:

1. Be sure to use the plastic snap-in standoffs, provided, to mount the motherboard in the case. Don't use metal screws.
2. Make a small hole in the back of the battery holder, and attach it, with a screw and nut, to the back of the case.
3. The disk drives slide into the cabinet compartments on rails, which come with the case. Attach the rails to the sides of the drives, and slide the drives into their locations. Then install the small screw-fastened drive-holding plates.
4. The power supply connectors are numbered and should be installed as follows:
   - 8 & 9 - motherboard
   - 10 - floppy drive A
   - 11 - floppy drive B
   - 12 - hard disk drive

The critical connection is the last (number 12), since it has the same shape as numbers 10 and 11, and will therefore fit the floppy drives as well. Should you install it on a floppy, you'll hear loud *protest noises* when you try to boot, since the power supply sends out a series of power pulses meant for the hard disk drive only.

I bought a 360K floppy and a 30 Mb hard disk drives, from PC Source. I took a deliberate gamble with the hard disk drive and installed a CMI model 6640, to get the best access speed available. We know that the CMI drives, which were the initial IBM-AT hard disk drives, have a reputation of poor reliability. I am counting heavily on the fact that AutoCad uses the disk drives sparingly. (I also have a one year guarantee for the drive.) If I am right, we've got a very fast drive (average access time of 36msec.) at a cost of only $649.

I purchased the operating system software (PC-DOS 3.1) and the IBM Avanced Diagnostics Disk from an IBM-PC dealer. I booted the system from the PC-DOS floppy disk. The hard disk came from PC Source already initialized so all I had to do was format it. This was done with the *Set-up* program from the IBM Advanced Diagnostics Disk. The CMI 6640 was set-up by answering "1" to the question regarding the type of hard disk drive installed. I set up the floppy as drive A and the hard disk as drive C. Standard floppy disk drives can be used with an AT if you cut off (or cover with a piece of tape) the last pin on the drive's logic connector which is the pin furthest from the keyway notch.

IMPROVING THE VIDEO DISPLAY

I began using a standard color graphics card and a standard RGB color monitor. But the end user indicated he wanted better resoution and more colors. This combination gave him only three usuable colors with AutoCad. So, I started looking for an economical solution.

Against all advice, I ordered a Tecmar Graphic Master card, with a color resolution of 640x400 pixels interlaced. Again, I took a gamble and ordered a 14″ high persistence phosphor color monitor from Bright Up Industries, capable of a resolution higher than 700x400.

It turned out to be a winning combination; the resolution is excellent with no flicker. The resolution is so good that the user can *pick up* the inside corner of a wall drawn on the screen, draw a line from it to another, and when zooming in (magnifying) the corner, the point of origin of the line is exactly where the user wants it. The colors are brilliant and fifteen colors can be used within AuatoCad.

The only weak point of the Bright Up monitor is the control adjustments. These have to be accessed with a screwdriver through small holes on the rear of the unit. I nearly destroyed one of the adjusting knobs. I had to open the monitor case to straighten this up. By the way, the monitor turned out to be a Kimtron, model SCC-LP.

I installed a Digitronics input/output card containing serial, parallel, and game ports. The serial port, contrary to IBM-AT practice, and to my delight, is a standard 25-pin RS-232 connector.

IMPROVING THE AT CLONES'S SPEED

The user's old system used an 8088 processor, to which we later added an 8087 math co-processor. It helped, since AutoCad recognizes the 8087 and takes advantage of it. The most *annoying* pause, when using AutoCad, is the time you have to wait for it to redraw complex drawings, after zoom-in or zoom-out operations. The drawing vectors exist in the machine's memory, and the CPU has to translate them to lines, colors, etc. until the entire drawing (*previous* image) is back on the screen.

I installed an 80287 math co-processor and a faster crystal in the AT clone. The 80287, like the 8087, comes in various versions. I selected the 80287-3, said to function properly at up to 8MHz CPU speed. I used a switch with two crystals from Megahertz Corp. instead of the old clock crystal. One provides the IBM standard 6MHz clock rate and the other an 8MHz rate. The 6MHz clock is needed for certain programs. The switch and crystals are sealed in epoxy and mounted on the back of the unit. A very short pair of wires connects it to the former crystal socket. A backplane slot is consumed even though no plug-in board is involved. The system must be powered down to change clock rates or the system locks up.

We timed a zoom-out operation. The results were as follows:

IBM-PC with 8087 . . . . . 40 seconds
AT Clone (6MHz) . . . . . 40 seconds
AT Clone with 80287 (6MHz). 20 seconds
AT Clone with 80287 (8MHz). 15 seconds

CONCLUSION

We think we have obtained a state of the art combination at a reasonable cost. I am planning to experiment further with higher crystal speeds and new graphic input and output devices. If I get a chance, I'll describe these in a later article.

BENCHMARK TESTING PC, XT & AT SYSTEMS by Sol & Don Libes

We currently have at M/SJ an old IBM-PC, a Taiwan XT clone, an IBM-AT and a PC's Limited AT-clone. We thought it would be interesting to run some benchmark tests on these systems.

First, we wanted to determine if we could improve the performance of our old PC by adding a NEC V20 chip and second by changing the motherboard to a *Turbo XT* (dual clock speed) unit. Further, we wanted to compare the AT clone to a standard IBM-AT.

Here are our findings and some of the things we learned about these various systems and about benchmark testing.

THE SYSTEMS WE TESTED

Our IBM-PC is one of the first ever made and still contains one of the original 16K-64K boards. It was made back in the early days when IBM was trying to copy the Apple II, feature-for-feature. When we bought the unit it came with only 16K of RAM, no disk drives (IBM thought users were going to use an audio cassette machine for data storage), 5 bus slots and a BIOS which could not boot from a hard disk (I don't think IBM, at the time, conceived that anyone would put a hard disk on a PC).

Over the years we upgraded the unit with dual floppies and a 10Mb Microscience hard disk, boosted the RAM to 640K, added clock/calendar, etc. With every slot filled, the nuisance of booting the hard disk off a floppy and the slow clock speed, we were attracted to scraping our old motherboard for a new turbo board. For under $200 we could go from 5 to 8 bus slots, a new BIOS ROM with hard disk boot, 640K on the board and a dual-speed CPU clock. Atlaz Computer lent us a *Turbo XT* motherboard to test in order to determine if this was worth the expense. The board manufacturer claims a 40% speed improvement, in the higher speed mode. The manufacturer called this the *Ultra* mode.

Our conclusion is *yes* it is worth the expense if you have one of the old PC motherboards. However, if you already own an XT motherboard with 8 slots and 640K of RAM, all you will get is a speed improvement and you may not consider this worth the cost.

Our tests indicated that only CPU intensive operations improved. Disk intensive operations were identical in standard and ultra modes. Generally, the Turbo motherboard was marginally faster than a PC even in the standard mode and in the ultra mode provides a 30-50% speed improvement for CPU intensive operations.

We also tried an NEC V20 replacement for our 8088 on our PC motherboard. This provided speed improvements of 1 to 15%. Considering the low cost of this upgrade the NEC chip appears to be a worthwhile change for a standard PC motherboard. When we tried the NEC chip on the Turbo board we found operation to be unreliable.

It is interesting to note that some of the disk operations actually slowed down in the turbo mode. We think this is because the disk controller code is optimized for a 4.77Mhz clock to provide the proper sector skewing. And, when the clock is increased, the code is no longer operating at its optimum skewing causing disk access to actually become slower. This was particularly true for the IBM-AT.

IBM rates their 20Mb hard disk for 10msec for contiguous sector access and 40msec for random access. Note that both the IBM-AT and the AT-clone turned in performances better than the IBM specs. In fact, the AT clone's random access was over 30% faster than IBM's specs.

We found the performance of the AT and AT-clone to be significantly better than the PC and the Turbo XT, even with their enhancements. Not only that, the AT clone turned in better times, generally, than the IBM-AT.....typically it was about 10% faster than the IBM-AT. Note that PC's Limited now furnishes both 12 and 16Mhz clock crystals with their AT clone.

THE TESTS

For our tests we used several benchmark programs that had been developed by PC magazine and which have been released into the public domain (PC Blue Volume 135).

We found these tests to be fairly good benchmarks. The disk access tests appear to be very good. The Basic program tests use a clock which we found to be unreliable and hence we had to resort to using a stopwatch for these tests. Times shown in Table 1. are in *minutes:seconds.tenths* of seconds.

Table 1.

	PC		TURBO XT		AT		AT CLONE	
test	8088	V20	std	Ultra	6Mhz	8Mhz	6Mhz	8Mhz
1	:35	:34	:39	:29	:15	:11	:11	:09
2	:33.9	:33.9	:33.8	:33.8	:05.7	:06	:09.4	:09.4
3	:72.4	:72.4	:72.4	:72.4	:20.4	:20.5	:18.6	:18.6
4	1:47.9	1:47.9	1:48.1	1:48.1	:34.2	:34.4	:27.5	:27.5
5	:52	:45	:47	:34	:20	:15	:18	:13
6	:42	:35	:37	:27	:16	:12	:14	:10
7	2:00	1:38	1:45	1:09	:43	:34	:40	:29
8	1:35	1:27	1:30	:59	:33	:27	:35	:26
9	2:11	1:59	2:04	1:22	:47	:38	:48	:36
10	:10	:09	:09	:08	:05	:03	:03	:02
11	1:36	1:44	1:47	1:31	:26	:24	:47	:33

Tests:
1. Prime Number Calculation - compiled Basic
2. Disk Access - Contiguous reads/writes
3. Disk Access - Random & contiguous reads/writes
4. Disk Access - Random reads/writes
5. Basic Program - integer addition #1
6. Basic Program - integer addition #2
7. Basic Program - Floating Point arithmetic
8. Basic Program - String Calculation
9. Basic Program - Data Look Up
10. Basic Program - Empty Loop
11. Basic Program - File Update

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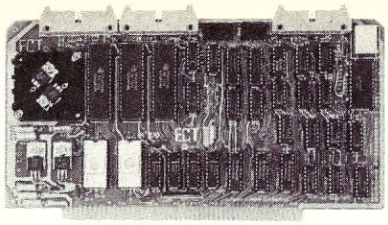

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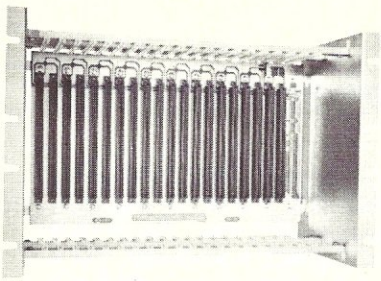

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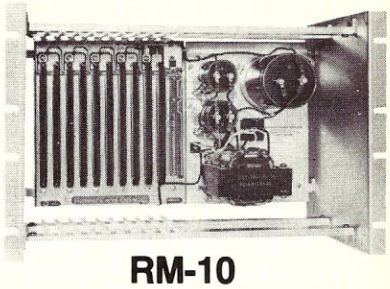

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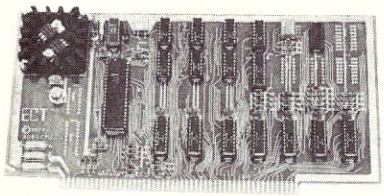

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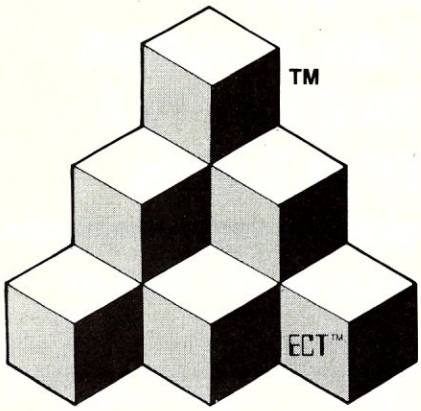

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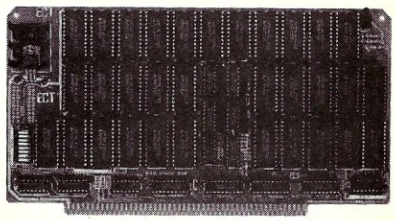

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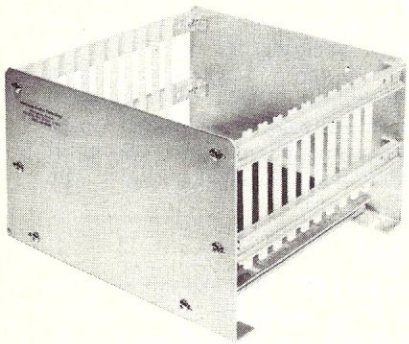

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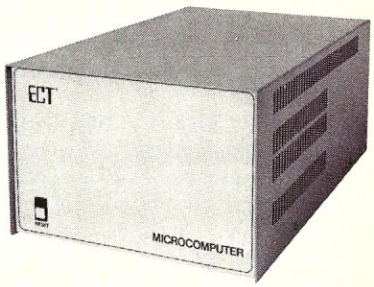

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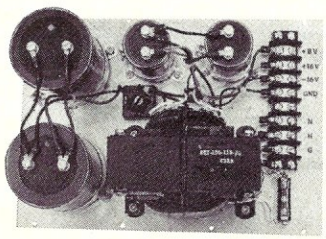

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Run Without Floppies

by Howard Peters

A RAM disk is a valuble addition to a system. Its advantages are speed, reliability, quiet operation, and reduced wear and tear on disks and drives.

It is possible to configure the system to run with mechanical disk drives turned off, as described in this article. The disadvantages are that data is lost when power is turned off (though some units allow the use of a battery backup), and with some products, the user is required to run several setup programs before using the disk. Furthermore, until recently, RAM disks have generally been rather expensive.

Adding A Fully Integrated RAM Disk To A CP/M System

AN INEXPENSIVE RAM DISK

The "Lightspeed" LS-100 board (L drive) by Digital Research Computers, Box 461565, Garland TX 75046 (DRC) is a relatively inexpensive S-100 RAM disk available in kit form. When introduced the price was $399. When the price was cut to $229, I knew it was time to put one in my CompuPro system. Further price reductions have made it currently available for $149.

The L drive is a 256K unit and up to eight boards (giving 2 Mbytes of storage) may be run at the same base port. A battery backup may also be connected. The board is IEEE-696 compatible except that there is a jumper option using three NDEF bus lines, pins 21, 65, and 66, to bring an external refresh signal to the DRAMs on the board. This is for use with older CPU boards which can put the refresh signal on the bus.

DRC offers a good warranty. Parts are guaranteed for 90 days after purchase and DRC will repair or replace any board during that period, assuming that reasonable care has been used to assemble it.

CONSTRUCTION

The kit arrived about three weeks after placing the order. The circuit board appeared to be of high quality and all chips are socketed. There were no missing parts. Construction took about five hours. The board worked perfectly the first time and has continued to be completely reliable.

DOCUMENTATION & SOFTWARE

A mimeographed manual is supplied. Construction instructions are adequate for anyone who already knows something of electronics. (The board is now available assembled and tested, for an additional $50.) The directions for setting up the board switches and jumpers are complete and generally clear. All possibilities seem to be covered. Also, a theory of operation is presented, which might aid in troubleshooting should the board need repair.

Software and other documentation were enclosed on an 8" SSSD disk. Several CP/M 2.2 programs are provided (FMAT, DIAG, and INSTALL). Well commented source code is included and the programs are easy to modify. DIAG is a memory diagnostic test program. I used it to burn in my newly-assembled board. The program will run continuously and keeps a chip map indicating any faults found during the entire session. I just let it go for several hours.

FMAT formats the L drive. It must be run once at the beginning of each computing session. INSTALL modifies the BIOS jump table and relocates an overlay below the BIOS and CCP which contains routines to run the board. If used, it must be run once per cold boot. Unfortunately, the CCP cannot then be overwritten; this cuts available TPA. Another version of INSTALL is also included which relocates above the BIOS. You must reassemble your BIOS leaving enough space for it, probably losing TPA.

The DIAG and FMAT worked perfectly, but INSTALL would not work with my CompuPro CP/M 2.2. The program appeared to run then locked the system. I had to press RESET to recover and the L drive was not accessible. The manual states that INSTALL is supplied to give a quick way to get the board operational; however, it "may cause problems with some BIOS routines that support density changes in the warm boot routine." DRC suggests that the L drive routines be integrated into the BIOS, and supply some directions and routines in the manual. I found this part of the manual to be incomplete and vague. In the read sector routine supplied, an INX H instruction was missing, which caused a problem reading from the L drive.

A READ.ME file, with manual updates, was on the supplied disk; it did not mention the missing instruction. Also, the integration directions fail to mention modification of both the Select Disk and Set Track routines. In fairness to DRC, it should be noted that the instructions and routines are supplied as examples to aid in BIOS integration. I feel a better job could have been done here; and in the next section of this article I present a complete set of routines to fully integrate the L drive with CP/M.

SUPPORT

I called DRC. They did not know the source of my problems, but courteously promised to give my name and phone number to the board designer, who, I was assured, could help me out. About ten days later I received a call from Rob Appleman. By that time I had figured out the solution on my own. Mr. Appleman was very cordial; he expressed regret about the BIOS integration section errors and omissions. He talked to me for about 15 minutes and detailed some of his experiences in designing the L drive, writing the software, and so forth. He also explained the algorithm in the DIAG program, and expressed interest in my computer system and BIOS modifications. He promised to see what he could do to fix future versions of the manual. He mentioned that he is running his boards on a Seattle Gazelle 10MHz 8086 system with no added wait states!

BIOS INTEGRATION

The system should be completely user-transparent; that is, the RAM disk should be available upon power up, formatted and ready to go, as drive L, without having to run special programs. Naturally, files must be preserved when hitting the RESET button. Also, one should be able to run the system with the floppy drives turned off. Floppy drives, especially 8", create lots of noise and heat. As they are mechanical devices, needed repairs tend to increase in direct proportion to the amount of use. Thus, CP/M must be put on the board and the boot routines modified.

In addition, one should be able to run the RAM disk as drive A in the system, for the following reasons. First, CP/M's System Reset and Reset Disk System BDOS calls and jumps to boot always access drive A. Second, many transient programs assume drive A and must be told if running on any other drive. Third, some transient programs start out all right on any drive but manage to access drive A in some way. Finally, SUBMIT only works on drive A; thus, logical drive swapping must be incorporated in the BIOS.

The final objective is to make it as easy as possible to add boards to the system. All L drive parameters should be reduced to a set of formulas and tables so that only two equates need be changed to add more storage to the drive.

GENERAL CONSIDERATIONS

Since one is starting with a working piece of software, care must be taken to insure that all regular floppy (and hard) disk routines are not modified in any way. Thus, all L drive routines must bypass the regular disk routines completely.

Always regenerate a BIOS using the original operating system and floppy disks which are known to be reliable. The new BIOS must be carefully and thoroughly tested before being put into general use, so that no data or programs are corrupted.

ADDING A NEW DRIVE

I found that the following routines in the CompuPro CBIOS had to be modified: Select Disk, Home, Read Sector, Write Sector, Translate Sector, and Set Track. Generally, the modifications test at the very beginning of the routine to see if the new drive is being accessed. When true, the program branches to the new drive's routine for that function.

In addition, a Disk Parameter Header, Disk Parameter Block, Sector Translation Table, and Allocation and Directory Check storage must be added. Actually, L drive does not require either sector translation or directory check space; however, for consistency with the CP/M Alteration Guide, these are shown in the code (as DS 0 which uses no space in the assembled BIOS). If integrating the L drive into a BIOS other than CompuPro, check carefully to insure that the Set Sector routine does nothing other than set the currently selected sector into its appropriate memory location. If this routine also does something else, you will have to add a conditional return, true only when L drive is being accessed, and placed before any other code is executed. L drive requires the use of only three of the BIOS variables: currently selected disk, track, and sector. These are the values set by the respective BIOS functions. In the CompuPro BIOS these are named SEKDSK, SEKTRK, and SAVSEC. For clarity I changed these to DISK, TRACK, and SECTOR in my BIOS. All other variables relating to a disk, track, or sector are for mechanical disk sector blocking and deblocking and must not be changed by any L drive routines.

DRIVE SWAPPING AND RAM BOOT

The Select Disk function must be further modified. When swapping is in effect, logical values are replaced by physical values at the beginning of this routine.

To boot from L drive, the Boot function must be modified. If the board is not formatted, a routine for that purpose must be be called before any other use. L drive must not be reformatted by successive cold boots. When CP/M is not present on L drive, it must be read from memory and written onto the tracks reserved for that purpose. When CP/M is on L, it is booted from there. In the event of an error, the system should boot in the regular way.

CODE

All code necessary to modify a CompuPro CP/M 2.2 BIOS is shown in Listing 1, extracted from my operational BIOS. Each code segment includes an explanation of the logical point at which it must be inserted. I commented the code to make it easy to modify any other CBIOS. All code is in 8080 assembly language.

Enter all the code in the appropriate places. Change the equates as necessary or desired. Regenerate your system as explained in the CP/M Alteration Guide, placing the new system on a scratch disk. Also enter program SWAP (Listing 2) and assemble it. Load it onto the scratch disk.

TESTING THE NEW SYSTEM

Put your scratch disk in floppy drive A and boot your new system by pressing RESET. Ideally, you have made no errors in entering code and A⟩ comes up. At this point, execute a STAT L:DSK: to see if you are getting valid drive characteristics, as shown in Table 1. This table shows characteristics for one and two boards, with checksums. Type L: to make sure that you get L⟩.

Now PIP a text file to L. Make sure you can read it back and that nothing is being dropped. PIP it back to the floppy as a temporary file and use a file compare utility to be sure that it hasn't been changed in any way.

Table 1. Results of STAT L:DSK:

	1 Board	2 Boards
128 Byte Record Capacity	1984	4016
Kilobyte Drive Capacity	248	502
32 Byte Directory Entries	64	128
Checked Directory Entries	0	0
Records/ Extent	128	256
Records/ Block	8	16
Sectors/ Track	8	16
Reserved Tracks	8	5

Execute SWAP. At this point, L drive is logical drive A, and is not selectable as L. Floppy drives A and B are now logical drives B and C. Hopefully, you are able to place a reminder message that drives are swapped on a status line of your console. Now try executing control-C. The floppy system should not be accessed. PIP a transient program to A and run it. At its end, A⟩ should come up again without the floppy system being accessed, indicating that CP/M is being read in successfully from the RAM disk.

PIP your text editor and another text file to A. Make sure that you can load, edit, and resave the file without problems. Finally, execute SWAP again. At this point, your old system should be restored. The RAM disk is now drive L again and floppies are once more A and B. The reminder message is erased. Try a cold boot to insure that your board is not being reformatted (the same files are still present). Devise some more tests. With this sort of BIOS modification, there is nothing quite like being certain everything is OK! If you experience problems, carefully check the code you have entered. If not getting valid drive characteristics from STAT L:DSK: make sure no zeroes have been dropped from the Disk Parameter Header and Disk Parameter Block. If getting the message "BDOS Err on L: Bad Sector", the drive is probably either not being formatted, read, or written to correctly. Use all your best debugging techniques to trace the point at which errors and hangups are occurring. Once everything works correctly, you have created a new system which will run without floppies.

SYSTEM OPERATION

Upon power up, PIP all desired files to L and execute SWAP. Doors may now be opened, and the drives turned off, assuming that your programs are not going to use them. When desiring to save a permanent copy of the work in progress, turn on floppy drives, insert disks, close doors, execute control-C or reset and save the files. Don't forget that your floppies are now called by their logical names. The floppy drives may again be turned off. If merely desiring to read the directory or a file, the control-C or reset may be eliminated.

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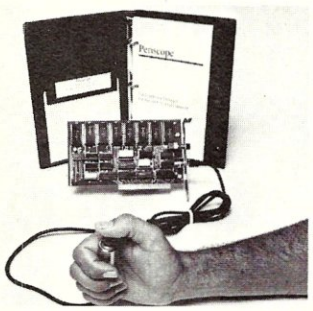

Models I and II are the same except Model I includes a write-protected RAM board. If you buy Model II, then find you need the board's protection, you can trade up to Model I. Both models include the break-out switch.

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A few cautions are in order. Be careful not to run disk-specific programs such as COPY, FORMAT, or SYSGEN with the L drive as destination. Strange and possibly disastrous results might occur.

Save your work often. A power failure is always possible, though a short one will not affect a well-designed S-100 box. I have had brief power interruptions which caused my terminal screen to blank out temporarily and my printer to turn off and on again. No L drive files were lost, and the program kept on running without any problems.

I have shown how to eliminate checksums on L drive. However, it is recommended that you do not do this unless BIOS space is at an absolute premium, and you are fully confident of the reliability of the memory chips on the board. Rob Appleman told me that some of the 4164 chips exhibit bit pattern sensitivity and that his DIAG program will detect only 95% of these. I have run extensively both with and without checksums and have not verified any read or write errors in either case. However, I decided to use the checksums in my permanent system just to be safe.

Finally, when programming in assembly language, don't forget to ORG your program at 100H. Failure to do this will wipe out the L drive flags stored in the bioram (40H to 4FH) and will create a general mess.

SUGGESTED ENHANCEMENTS

Add a battery backup to the L drive board. You'll have to write a short program to write protect the disk, which must be run before turning the system off. Or, add circuitry to detect power failure and activate an interrupt on the system, then put code in the BIOS to write a JMP instruction in the appropriate interrupt destination address, and a routine to write protect the disk. (Write protection is needed so that no garbage is written to the L drive during power up. This is explained further in the L drive manual.) If you want to go even further, put your BIOS on the RAM disk and rewrite your ROM boot to read from the L drive on a cold boot. When using a battery backup, set the *autoformat* equate to false.

If not using a battery backup, modify the DIAG program to automatically test all the boards in the system and use this as an autoexecuting program upon power up. After diagnosis, the board(s) must be reformatted. Don't forget to use a flag in the bioram to keep from retesting after following cold boots. Set the *cpmok* flag to zero to force a new write of CP/M to L drive.

You can also write a routine which automatically detects the number of boards in the system and modify the other routines to use this information. You won't have to change equates or regenerate your BIOS, just plug in the new board. However, this will take a lot of precious BIOS space, and time.

Table 2. SPEED COMPARISON (Results informal)

File Operation	Size	Floppy	L Drive
PIP file to TEMP on same drive	52K	:21	:02
Save file with text editor	14K	:06	:02
Compile BASIC program	24K	4:07	:37
Link BASIC program	24K	:22	:05
Run SUBMIT file	2:52	1:22	

CONCLUSION

I consider the DRC LS-100 an excellent value at $149. For around $300, two free bus slots, and a few hours work, you can have a completely integrated 512K RAM disk.

During the writing of this article, I ordered and assembled a second kit, with no problems. I noted that approximately three months after notifying Mr. Appleman of the missing machine language instruction, the manual and the READ.ME file still had not been updated. I wonder how many people have spent many hours beating their heads against this problem.

This has been a terrific enhancement for my system. Programs load and execute almost instantly and return to the CCP is lightning-fast. Disk-intensive programs run up to ten times faster (see Table 2 for a few informal test results). I love being able to compute without my 8" drives running. There is much less distraction from noise, and my disk drives are not getting hot, wearing out, or experiencing power line faults.

In addition, if a runaway stack or other program foulup occurs, and one returns to the disk to find all files renamed "." then no permanent damage has been done.

Applications for which this type of system would be ideal would be bulletin boards, laboratory experiment control and data acquisition, business inventory systems, home security and control, or any other system which must run for long periods of time. Naturally, you'd want to use an uninterruptible power supply for such applications.

The general logic supplied in the code should be easily applicable to most other RAM disks. You would have to modify and/or eliminate the routines in the utility subroutine section as each manufacturer's track and sector scheme and other board requirements will doubtless differ greatly. Disk Parameter Block and Disk Parameter Header will also probably require modification.

It should also be easy to adapt the logic to any other operating system requiring a disk access to load code residing on reserved tracks or for system resets.

In terms of speed and ease of use, this system enhancement is as good as a ROM based operating system. In terms of modifiability, it is clearly superior.

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Listing 1. - BIOS Modification Code

```
; Insert the following equates in the equate section at the beginning
; of your BIOS.
;               ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
; -------> Modify the following equates when adding boards
lboards     equ   1             ;number of boards in system
moreboards  equ   false         ;flag to set data block size
                                ;set false for 1 board and
                                ;true for more than 1 board
;               ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

ldrive      equ   'L'-'A'       ;L drive selection value
                                ;change if desiring to use a
                                ;different letter to designate
                                ;the RAM disk
lspt        equ   lboards*8     ;sectors per track
lbase       equ   0d0h          ;base port of L drive  - change
                                ;as necessary in your system
ldat        equ   lbase         ;data register
lsec        equ   lbase+1       ;sector register
ltrk        equ   lbase+2       ;track register
lpos        equ   lbase+3       ;position within sector
checksum    equ   true          ;checksums in L drive?
autoformat  equ   true          ;auto format on power up?
cpmsectors  equ   44            ;CP/M 2.2 occupies 22 256 byte
                                ;pages of memory, or 44 128
                                ;byte sectors on L drive
cpmtracks   equ   cpmsectors/lspt+1
                                ;tracks occupied by CP/M on
                                ;L drive
;bioram     equ   40h           ;this line is already present in
                                ;the CompuPro CBIOS.  The bioram is
                                ;an area of memory from 40H to 4FH
                                ;which is not overwritten by CP/M
                                ;or normal transient programs.
                                ;Your CBIOS may use some portion of
                                ;bioram to pass system information.
                                ;Adjust all bioram values to match
                                ;your system.
lfmtok      equ   bioram+1      ;save format through cold boot
swapok      equ   bioram+2      ;drives swapped?

            if checksum
loffset     equ   2+cpmtracks   ;checksums occupy 2 tracks
            endif
            if not checksum
loffset     equ   cpmtracks
            endif
            if not moreboards
ldsm        equ   256-loffset-1
                                ;for 1 board, a data block size of
                                ;1024 bytes is used for maximum
                                ;storage efficiency
            endif
            if moreboards
ldsm        equ   (lboards*(256-loffset)/2)-1
                                ;for 2 or more boards, a data block
                                ;size of 2048 bytes is used
            endif
ldir        equ   64*lboards-1  ;64 directory entries per board
lalvs       equ   ldsm/8+1      ;allocation vector space
lcsvs       equ   0             ;directory check space
;***************************************************************
; Insert the following code at the very beginning of the Select Disk
; routine, immediately following the label.
            if checksum
            lda   diskboot      ;load flag
            cpi   1             ;if 1, an error was detected
            jnz   swapcheck
            xra   a             ;A = 0
            sta   diskboot      ;reset flag
            jmp   seldsk2       ;go to regular select routine
                                ;If an error was detected in
                                ;reading CP/M from L drive,
                                ;a regular boot is forced.
swapcheck:
            endif
            lda   swapok        ;is system under SWAP?
            cpi   'S'           ;if not under SWAP then
            jnz   seldsk1       ;proceed normally
            mov   a,c
            cpi   0             ;if drive A is selected,
            jz    lselect       ;then select L drive
            cpi   ldrive        ;Drive L is not selectable
            jz    seldsk2       ;under SWAP
```

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```
            dcr   c             ;logical drives B and C are
                                ;redirected to physical drives
                                ;A and B
seldsk1:
            mov   a,c           ;check for L drive
            cpi   ldrive
            jz    lselect
seldsk2:

;**************************************************************
; Insert this code at the beginning of the Home routine.
            call  lcheck
            jz    lhome

;**************************************************************
; Insert the following code in the Set Track routine.  It goes just
; after the track is stored in its appropriate memory location.
            call  lcheck
            rz

;**************************************************************
; Insert the following code at the beginning of the Translate Sector
; routine
            call  lcheck
            jz    ltran

;**************************************************************
; Insert the following code in the CBOOT routine just after the
; printing of the SIGNON message.
            xra   a
            sta   swapok        ;force end of SWAP
;           lxi   h,clear       ;here, insert some code to wipe out
;           call  print         ;the SWAP message if you have put
                                ;one on your screen
            mvi   a,lboards     ;number of boards
            cpi   1             ;if more than 1 board, then
            cnz   lfixfcb       ;patch correct values in file
                                ;control block
            if autoformat
            lda   lfmtok        ;is L drive formatted?
            cpi   'F'
            cnz   lformat       ;if not, format it
            endif

;**************************************************************
; Insert the following code in the WBOOT routine.  It should go just
; before the call or inline code which causes a new read of CP/M.
            lda   cpmok         ;is CP/M on L drive?
            cpi   'T'
            jnz   rboot         ;if not, get it the regular way
            call  lboot         ;if it is, get it from L drive
            if checksum
            lda   cpmok         ;was an error detected in lboot?
            cpi   'T'
            jz    booted        ;if no error
            jmp   wboot         ;if error, then force regular boot
            endif
            if not checksum
            jmp   booted
            endif
rboot:

;**************************************************************
; Insert the following label in WBOOT where a regular boot has
; been completed.  This may be after a subroutine call or some
; inline code.  If after a call, there may also be a JNZ WBOOT
; instruction and this label should follow that.
booted:

;**************************************************************
; Insert this code in the WBOOT routine just after the code which
; sets up the BDOS and BOOT jumps in low memory.
            lda   cpmok         ;is CP/M on L drive?
            cpi   'T'
            cnz   lputcpm       ;if not, put it there

;**************************************************************
; Insert the following code at the beginning of the code which
; boots CP/M from the regular disk, just before the Select Disk
; routine is called.  This sets up a flag to bypass the SWAP code
; in the Select Disk routine; it is necessary only in case an error
; in reading CP/M from L drive has been detected and if SWAP is in
; effect at that time.  This will be an extremely rare event.
            if checksum
            mvi   a,1
            sta   diskboot
            endif
```

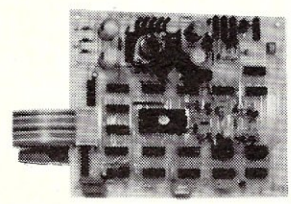
```
;*****************************************************************
; Insert the following code at the beginning of the Read Sector
; routine
            call  lcheck
            jz    lread

;*****************************************************************
; Insert this code at the beginning of the Write Sector routine.
            call  lcheck
            jz    lwrite

;*****************************************************************
; Somewhere in your BIOS there is probably a place where the current
; drive is set into an error message which will be displayed if that
; drive is not ready.  In the CompuPro CBIOS this is in the module
; TREAD.  Look for an  ADI  'A' instruction and change it to read
            adi   '1'
; The purpose is to avoid confusion between logical and physical
; drives.  When the message "Drive 1 not ready" is displayed, it
; indicates the first floppy drive in the system (known as drive
; A before drive swapping was added.)

;*****************************************************************
; Insert this code near the end of the BIOS, before the data storage
; area.  Change 'disk', 'track', and 'sector' to the names used by
; your BIOS for the memory locations storing the requested disk,
; track, and sector.  Perhaps you will also have to change
; 'dirbuf' and 'dmaadr'.

;                   L drive tables

ldph:                           ;Disk Parameter Header
            dw    lxlt          ;translation table address
            dw    0             ;scratchpad area
            dw    0
            dw    0
            dw    dirbuf        ;directory buffer address
            dw    ldpb          ;disk parameter block address
            dw    lcsv          ;directory check address
            dw    lalv          ;allocation vector address

ldpb:                           ;Disk Parameter Block
                                ;this block is correct for one board
                                ;where a data block size of 1024 bytes
                                ;is used.  If more than 1 board is used,
                                ;some of the values will be changed
                                ;by the 'lfixfcb' routine, as in that
                                ;instance, a data block size of 2048
                                ;bytes is used
            dw    lspt          ;sectors per track
            if not moreboards
            db    3             ;block shift
            db    7             ;block mask
                                ;for data block size of 1024 byes
            endif
            if moreboards
            db    4             ;block shift
            db    15            ;block mask
                                ;for data block size of 2048 bytes
            endif
lexm:       db    0             ;extent mask
            dw    ldsm          ;disk size-1
            dw    ldir          ;directory entries-1
lal0:       db    11000000b     ;AL0
            db    0             ;AL1
            dw    0             ;number of checked directory entries
            dw    loffset       ;reserved tracks
lxlt:       ds    0             ;L drive does not require translation

;                   L drive routines

lcheck:     lda   disk          ;is L drive the currently selected
            cpi   ldrive        ;disk?  If so return with Z flag
            ret                 ;set to 1

lselect:    mvi   a,ldrive      ;select L drive and store in correct
            sta   disk          ;memory location
            lxi   h,ldph        ;HL = disk parameter header address
            ret

lhome:      lxi   h,0           ;set track to 0
            shld  track
            ret

ltran:      mov   h,b           ;no translation is required; logical
            mov   l,c           ;sector is equivalent to physical
            ret                 ;sector

lread:      call  lsetup        ;set up for normal read or write
            call  lreadsec      ;utility read sector routine
            ret

lwrite:     call  lsetup        ;set up for normal read or write
            call  lwritesec     ;utility write sector routine
            ret

lsetup:     lda   track         ;set up track register
            out   ltrk
            lda   sector        ;set up sector register
            out   lsec
            lhld  dmaadr        ;HL = memory address for read or write
            ret

lreadsec:   mvi   b,128         ;128 byte read
            if checksum
            mvi   e,0           ;E = checksum
            endif
lread1:     in    ldat          ;get byte
            mov   m,a           ;store it
            inx   h             ;increment memory
            if checksum
            add   e             ;calculate checksum
            mov   e,a           ;store it
            endif
            dcr   b             ;B = bytes left to read
            jnz   lread1        ;if not done, get next byte
            if checksum
            call  lcalc         ;set up for checksum
            in    ldat          ;get checksum
            sub   e             ;subtract E;  if not 0 then an
            endif               ;error was detected
            if not checksum
            xra   a             ;force A = 0 and Z flag = 1
            endif
            ret

lwritesec:  mvi   b,128         ;128 byte write
            if checksum
            mvi    e,0          ;E = checksum
            endif
lwrite1:    mov   a,m           ;get byte
            out   ldat          ;write it to L drive
            inx   h             ;increment memory
            if checksum
            add   e             ;calculate checksum
            mov   e,a           ;store it
            endif
            dcr   b             ;B = bytes left to write
            jnz   lwrite1       ;if not done, do next byte
            if checksum
            call  lcalc         ;set up for checksum
            mov   a,e           ;store checksum on L drive
            out   ldat
            endif
            xra   a             ;force A = 0 and Z flag = 1
            ret

            if checksum
lcalc:      lda   track  ;the checksum for a particular sector
            rlc          ;and track are kept on tracks 0 and 1.
            jnc   lcalc1 ;tracks 2 - 127 are on track 0
            mvi   a,1    ;tracks 128 - 255 on track 1
            jmp   lcalc2 ;the checksum resides in the same sector
lcalc1:     xra   a      ;number in a position ecual to the
                         ;track number
lcalc2:     out   ltrk   ;set up track register
            lda   track  ;track corresponds to one byte in
            out   lpos   ;checksum track
            ret
            endif

            if autoformat and checksum
lformat:    mvi   a,80h      ;format byte for checksum tracks
            sta   fbyte
            mvi   h,2        ;format 2 tracks
            mvi   d,0        ;current track
            call  lfmat
            mvi   a,0e5h     ;format byte for data tracks
            sta   fbyte
            mvi   h,254      ;format 254 tracks
            call  lfmat
            mvi   a,'F'      ;set flag
            sta   lfmtok
            ret
            endif
```

```
            if autoformat and not checksum
lformat:    mvi   a,0e5h        ;format byte for all tracks
            sta   fbyte
            mvi   h,0           ;format 256 tracks
            mvi   d,0           ;current track
            call  lfmat
            mvi   a,'F'         ;set flag
            sta   lfmtok
            ret
            endif

            if autoformat
lfmat:      mvi   c,0           ;first sector
            mvi   b,lspt        ;sectors per track
            mov   a,d           ;current track
            out   ltrk
nxtsec:     mov   a,c           ;current sector
            out   lsec
            mvi   l,128/cycle   ;times through format cycle
            call  format
            inr   c             ;increment sector
            dcr   b             ;decrement sector count
            jnz   nxtsec        ;if not done
            inr   d             ;increment track
            dcr   h             ;decrement track count
            jnz   lfmat         ;if not done
            ret
format:     lda   fbyte         ;get format byte
again:      out   ldat          ;format
            out   ldat
            out   ldat
            out   ldat
            out   ldat
            out   ldat
            out   ldat
            out   ldat
cycle       equ   ($-again)/2
            dcr   l             ;decrement cycle counter
            jnz   again         ;if not done
            ret
fbyte:      db    0             ;format byte
            endif
```

```
lfixfcb:
; This routine patches in the correct file control block values for
; more than 1 board.  If BIOS space is at a premium, eliminate the
; routine and the call to it and enter the correct values manually
; when adding boards.
            cpi   2             ;A = number of boards; if 2, the extent
            jnz   fixalloc      ;mask is 1, otherwise it is already 0.
            mvi   a,1
            sta   lexm          ;store it
            ret                 ;other values are ok, so return
fixalloc:
            sui   3             ;subtract 3
            mvi   d,0
            mov   e,a           ;DE = table offset
            lxi   h,altable     ;HL = table address
            dad   d             ;HL = correct table entry
            mov   a,m           ;get ALO value
            sta   lalo          ;store it
            ret
altable:    db    11100000b     ;3 boards
            db    11110000b     ;4 boards
            db    11111000b     ;5 boards
            db    11111100b     ;6 boards
            db    11111110b     ;7 boards
            db    11111111b     ;8 boards

lputcpm:    mvi   a,'W'         ;set flag for write
            sta   writecpm
            call  movecpm
            mvi   a,'T'         ;CP/M is now on L drive
            sta   cpmok
            ret

lboot:      xra   a             ;zero flag for read
            sta   writecpm
            call  movecpm
            ret

movecpm:    lxi   h,ccp         ;CP/M beginning address
            if checksum
            mvi   a,2           ;first track for CP/M
            sta   track         ;store it for lcalc routine
```


CP/M, MS-DOS EPROM PROGRAMMING SYSTEM

2708
2758
2516
2716
2732
2764



2732A
2764A
27128
27128A
27256
27CXX

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- READ DISK FILE INTO RAM
- READ EPROM(S) INTO RAM
- VERIFY EPROM IS ERASED
- SAVE EPROM(S) TO DISK
- PROGRAM EPROM(S) FROM RAM
- COMPARE EPROM WITH RAM
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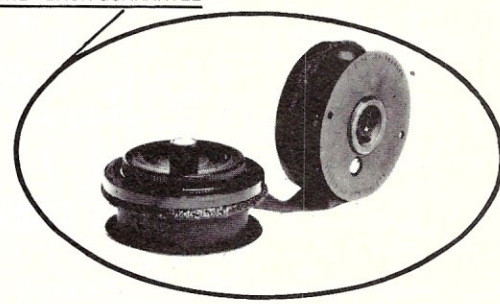

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```
            endif
            if not checksum
            xra   a             ;first track for CP/M
            endif
            sta   thistrack     ;store it
            xra   a             ;force A = 0
            sta   sectorcount   ;CP/M sectors done
nexttrack:
            if not checksum
            lda   thistrack     ;set up track register; position
            out   ltrk          ;register is already 0
            endif
            mvi   d,lspt        ;sectors per track
            xra   a
            sta   thissector    ;current sector
nextsec:
            if checksum
            lda   thistrack     ;set up track register and clear
            out   ltrk          ;position counter to 0
            endif
            lda   thissector    ;set up sector register
            out   lsec
            lda   writecpm      ;check flag
            cpi   'W'
            jz    writeit       ;if write to L drive
            call  lreadsec
            if checksum
            jnz   lreaderror    ;was an error detected?
            endif
            jmp   didit
writeit:    call  lwritesec
didit:      lda   sectorcount
            inr   a             ;increment sector count
            cpi   cpmsectors    ;see if done with CP/M
            rz                  ;return when all sectors done
            sta   sectorcount   ;store it
            lda   thissector
            inr   a             ;increment sector in this track
            sta   thissector    ;store it
            dcr   d             ;all sectors on this track done?
            jnz   nextsec       ;if not done
            lda   thistrack
            inr   a             ;increment track counter
            sta   thistrack     ;store it
            if checksum
            sta   track         ;for lcalc routine
            endif
            jmp   nexttrack

writecpm:   db    0             ;read or write
thistrack:  db    0             ;current track
thissector: db    0             ;sector within current track
sectorcount: db   0             ;total sectors done

            if checksum
lreaderror: xra   a             ;set flag to 0 so that a
            sta   cpmok         ;regular boot will be forced
            ret
            endif

;***************************************************************
; Insert this code in the data storage section of the BIOS.
; Allocation and check vectors for L drive
lalv:       ds    lalvs         ;allocation vector
lcsv:       ds    lcsvs         ;directory check space

;data storage for L drive flags
cpmok       ds    1             ;is CP/M on L drive?
            if checksum
diskboot    ds    1             ;for error on lboot
            endif
```

Listing 2. - Program SWAP (sets swap flag for BIOS)

```
boot        equ   0
bdos        equ   5
bioram      equ   40h
swapok      equ   bioram+2      ;flag for BIOS to swap drives
print       equ   9h
cdisk       equ   4             ;location of current disk
cr          equ   13
lf          equ   10
esc         equ   27

            org   100h
            lxi   sp,stack
            xra   a             ;A = 0
            sta   cdisk         ;force selection of drive A
            lda   swapok
            cpi   'S'
            jz    unswap        ;if swapped, unswap
            mvi   a,'S'         ;if not swapped, set flag
            sta   swapok
            lxi   d,swapmsg     ;and print reminder message
            mvi   c,print       ;on message line of console
            call  bdos
            jmp   boot

unswap:     xra   a             ;set flag to zero
            sta   swapok
            lxi   d,unswapmsg   ;blank out reminder message
            mvi   c,print       ;on console
            call  bdos
            jmp   boot

;***************************************************************
;The following messages contain escape sequences which are specific
;to the terminal.  Replace them with the correct values, if
;different.  Sequences given are for a Wyse WY-100 terminal.
;***************************************************************
swapmsg:    db    esc,'A34'     ;reverse video
            db    esc,'F'       ;put in message field
            db    '   '
            db    'D R I V E   S W A P   is in effect...'
            db    '$'
unswapmsg:  db    esc,'A33'     ;blank video
            db    '$'
            ds    50
stack:
```


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The CP/M Bus

by Bob Blum

The CP/M Bus Bulletin Board System, operated by Bob Blum, is available for your use 7 days a week, 24 hours a day at 1200 baud. Reach it by calling (404) 449-6588.

Before putting the CP/M bus RCP/M system online last August I had toyed with the idea for more than two years. It usually doesn't take me this long to make a decision, but in this instance the scales were so evenly balanced between pro and con that without a clear cut reason to move ahead it was just to easy for me to procrastinate continually.

The two most prominent factors that were primarily responsible for my constant wavering dealt with the expense of putting a system online and how much the system would be used. I, at first, doubted the merits of having a bulletin board system because I feared that the system wouldn't be put to maximum use due to the high cost of long distance phone calls. Even when taking into consideration the discounts offered by the alternate phone carriers, the cost of a brief 30 minute phone call placed from the west coast to my home in Atlanta can amount to such a shock when the bill arrives that another call of the same length isn't placed without very good reason.

Secondly, and probably the most influential objection was the expense of setting the system up. I didn't want to try to share my S-100 development system with the phone lines because I tend to make use of it at all hours of the day and night. As a consequence of my irregular work schedule the regular hours of operation for the BBS would be severely limited and probably fall into the wee hours of the night. Certainly this would even further limit the use of the system.

So it seemed that to have a system available 24 hours a day would require the purchase of another computer. I didn't have to concern myself with buying a hard disk or it's controller card because I had a 20Meg Tandon drive sitting around unused from another project, but I would need two floppy disk drives, a CPU board of some type, and the usual cables and a cabinet. And since the system would be in use around the clock the components would need to be the very best or suffer an excessive amount of downtime. No matter how prices have fallen recently this still amounted to a sizable sum of money.

On the other hand I wanted to make the submission of material for the column as easy and uncomplicated as possible. I felt that if I made the submission process as quick and simple as placing a phone call that the number of good contributions would increase. I have been guilty a few times of declining to share software that I wrote because I didn't want to go to the trouble or take the time to copy a few disks or print out a program listing. And if I had used this excuse then I was sure that others were doing so as well.

I also wanted to have a more readily accessible and machine independent solution to software distribution. It has been brought to my attention numerous times that keying a large program listing from the pages of a magazine is a less than desirable way to spend ones free time. The alternate solution to distribution is to copy disks into the more than 300 different CP/M formats, but as you might expect the machines to do this job can be quite expensive unless many hundreds of copies are being made. Certainly, a machine independent distribution system would, I thought, be a hit immediately.

Well, I finally decided to move ahead and go online. In retrospect I wish I had done it sooner. The response to the BBS has far out stripped my greatest expectations. In a little over six months of operation more than 3,100 phone calls were answered at 1200 baud. I don't keep a count of the failed calls so I can't tell exactly how many calls were placed at 300 baud; although I estimate that at least 25% more connections would have been made if my modem were capable of dual speed operation. I think the most exciting figures, however, are the number of hours spent by callers doing uploads and downloads. After the first four months of operation, over 12 hours were spent uploading files into the system and another 194 hours were used downloading files into caller computers.

In response to my request for comments about the system many callers took the opportunity to leave their thoughts about the system. Based on the many favorable comments a high level of satisfaction seems to exist for the bulletin board portion of the system. And after counting the number of programs that were downloaded it seems that the correct mix of programs is available in the CP/M section as well. I was most encouraged one weekend after discovering that a regular pattern of program uploads was beginning to develop; I hope this trend continues.

THE SYSTEM

When you call in you will be talking to a Racal-Vadic VA3452 modem that is capable of communicating only at 1200 baud. If you make the mistake of calling at 300 baud you may be able to get carrier lock but it will only be a matter of a few seconds before the connection is broken. So please don't waste your time; call at 1200 baud.

The other hardware components I chose to use are an Ampro single board Z-80 microcomputer driving two 5¼" Teac floppy disk drives and a Tandon 20 Meg hard disk drive controlled by a Xebec S1410 SCSI hard disk controller. And last on the list, because it's the newest addition to the system, is a Z-Time clock/calender add-on card.

All of this hardware has run 24 hours a day for over 6 months with practically no problems at all. An incredible track record considering the number of power surges and outages and the heat of a Georgia summer.

GETTING STARTED

Once beyond the first two weeks of operation the CP/M Bus RCP/M system has run almost flawlessly. I expected to have a few problems at first, while any software bugs that crept in during integration got shook out, but the jury is still out deciding whether I deserved the difficult problems I encountered.

The last problem I expected to have was with the hardware. For weeks prior to going online the system had run flawlessly; that is until it was all tied together in a shiney new cabinet. I was soon to become a home grown expert in cabinet cooling systems.

Having bits and pieces of an uncompleted projects lying around while waiting for parts to arrive is very annoying to me. This was especially true during this project because I was most anxious to get the system online but didn't want to make the mistake of doing so prematurely and risk unnecessary downtime. So sit around it did, everywhere; it was practically impossible for me to get into my office let alone do any work. After several weeks of waiting, everything finally arrived and I

FILES ON DISK A:

USER 0 LOCAL AREA SYSOP/BBS LISTS
1 CP/M 2.2 AND CP/M PLUS PATCHES AND APPLICATION NOTES
2 CP/M PLUS BIOS AND SYSTEM PROGRAMS
3 ZCPR3
4 CP/M 2.2 BIOS AND SYSTEM PROGRAMS
5 AMPRO AND SB180 SPECIFIC INFORMATION
6 LIBRARY UTILITY PROGRAMS
7 SYSLIB AND OTHER PROGRAMMING TOOLS

FILES ON DISK B:

USER 0 PUBLIC UPLOAD/DOWNLOAD AREA
1 MBYE AND BYE AND THEIR OVERLAYS
2 RBBS37 AND RBBS38
3 MISCELLANEOUS RCP/M PROGRAMS
4 XMODEM AND KMD03 AND THEIR OVERLAYS
5 MODEM740 AND IMP241 AND THEIR OVERLAYS
6 MEX AND ITS OVERLAYS
7 ASSEMBLER LANGUAGE DEVELOPMENT TOOLS
8 WP AND TEXT PROCESSING
9 SHAREWARE AND FREEWARE PROGRAMS
10 KERMIT AND ITS OVERLAYS

FILES ON DISK C:

USER 0 NEVADA COBOL USERS GROUP
1 PICTURES
2 GAMES
3 HIGH LEVEL LAUGUAGES
4 MISCELLANEOUS PUBLIC DOMAIN PROGRAMS
5 PUBLIC DOMAIN AND COMPUSERVE DATA LIBRARY DIRECTORIES
6 CP/M BUS PROGRAMS

Figure 1. RCP/M Disk Contents

was able to finish the assembly. I couldn't have been happier with my new Integrand horizontal cabinet made specifically for the Ampro Little Board. Every bolt and connector fit as planned and soon the cabinet was packed to the hilt. On went the top cover and it was tucked swiftly away into it's own cubby hole, never to again see daylight, or so I thought.

Upon arriving home from work several days later I found the CRT screen filled with disk error messages. During a call that day logical drive B: had developed a few bad sectors. This, at first, didn't alarm me because a few surface flaws are to be expected on any type of magnetic media.

To correct the problem and get back online as soon as possible I ran a track patching program that simply reads and rewrites into the same position each sector on the disk regardless of any errors. This may, at first, seem to have been a drastic first step. But I have found, from experience, that the data content of a sector read in error is usually still intact due to the ECC error correction ability of the Xebec controller boards. And even if this caused a problem by writing bad data onto the disk I could always restore the files from my backup disks.

To verify that all the sectors had been written back properly I started a surface analysis program to determine if any obscure errors were hiding from view. This test ran well for about 15 minutes until once again a group of sector errors cropped up, but this time in a completely different place on the disk. This test proved that the disk itself wasn't at fault and I couldn't suspect the disk controller card because it had been operating properly for weeks. The only unknown factor that I suspected was the new packaging of the system. Maybe I was facing a heat related problem rather than a media defect or controller electronics error.

To test my theory I removed the cabinet's top cover and moved the hard disk drive away from the other components and onto a shelf by itself. To insure proper cooling, I installed a small, yet powerful, fan aimed directly at the bottom circuit board of the disk drive. I repeated the same procedure of rewriting all the sectors on the

CP/M commands on this system are:

RBBS P	Return to the RBBS system
XMODEM	Transmit files up or down
BYE	Signoff
EXIT	Signoff
SYSMAP	List the contents of each user area
USER n	Change user areas
WHATSNEW	List newly downloaded programs
FINDFILE	Global search of the system for a file
WHEREIS	Same as FINDFILE
TYPE	Type a file (handles any type file)
LDIR	List a library directory
LTYPE	List a file from a library
DIR	Produce a directory listing
SDD	Same as DIR
FIND	Search a file for a text string

Figure 2. RCP/M Commands

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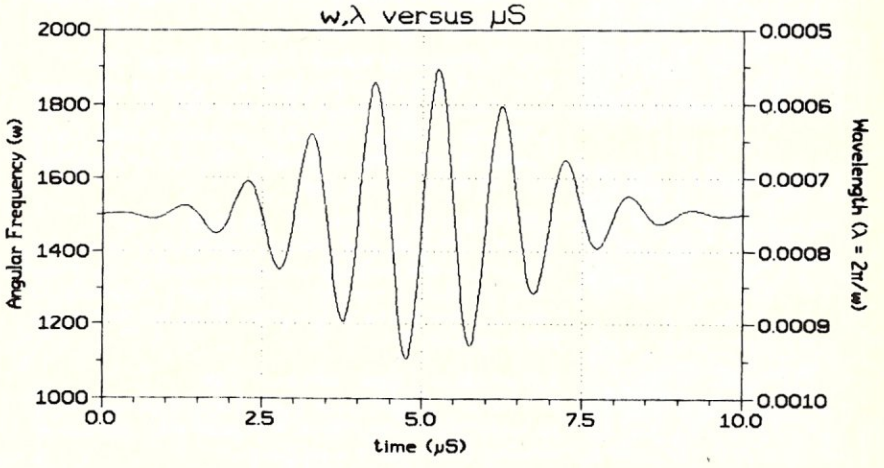

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CP/M-80: Requires 64k (54k TPA) $49.95

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disk and started the surface analysis program again. This time the test ran without error.

I'm not happy with the system being spread around and am pursuing a better solution to my heat problem, but for now if this is what it takes to insure maintenance free operation then I suppose I can overlook the mess for awhile.

ESTABLISHING CONTACT

When calling in to the system hit your return key several times to allow the software to set it's internal baud rate to your speed. Even though my hardware is only capable of 1200 baud operation, the software being used will support multiple baud rates.

Next you will be asked whether your terminal needs nulls for proper operation. If you are not using a CRT you may have to enter a number between 1 to 9 at this prompt to allow for carriage return time on your printer. Once beyond these two preparatory steps you will enter into the message system. From this point I think the system is self-prompting enough to get you started and doesn't require a lengthy tutorial.

Although, before calling in for the first time it may be helpful to first study the two listings accompying this column. The first one gives a very brief description of the contents of each user area and listing two documents the commands that you can use. Good luck and enjoy.

News, Views & Gossip

continued from page 7

RANDOM BITS

I am sure it will not surprise readers of M/SJ to hear that Taiwan's exports of personal computers and related products rose 26% in '85 to $1.27 billion with the U.S. taking 65% of their exports.... Consumer Reports, the most respected consumer products reviewing organization in the country, recently issued a preliminary review of the **Atari 520ST** and **Commodore Amiga** systems and referred to them as *high tech doorstops*. They also reviewed the new **Commodore 128** system, which also runs CP/M and stated that it can run a *dated library of CP/M business programs.... more slowly than they do on a CP/M machine.* ....**Qume Corp.**, following in Shugart's footsteps, has withdrawn from the floppy disk drive business.... **KayPro** has ceased production of the KayPro I and 10. The KayPro 2x remains the only CP/M-based machine they make. Most of their production is now devoted to PC/XT/AT compatibles.... **CompuCorp**, Santa Monica CA has announced a desktop machine based on the National Semicondutor 32032 microprocessor, selling for $4,995, and running both Xenix and MS-DOS.... With 1-Mbit DRAM chips now in mass production in Japan, the focus of attention at the recent ISSC conference was on 4-Mbit chips. **TI, NEC** and **Toshiba** described their devices at the meeting promising samples the middle of next year and production in early '88.... **Osborne Computer Corp.** has been forced into liquidation by its creditors. The company had been operating under chapter 11 bankruptcy since September 1983.

COMPUTER FLEA MARKET CALENDAR

Clubs, or companies, running computer flea markets or swap meets should notify us, as early as possible, to be listed in this calendar.

May 3-4th: Cincinnati OH: Ramada Inn of Sharonville. First Midwest T/S Computerfest. Run by Jack Roberts, 3832 Watterson, Cincinnati OH; (513)271-5575.

May 10th: Boston MA area: Northeast Trade Center & Exhibition hall, Woburn MA. Run by Ken Gordon Productions (201)297-2526 or (800)631-0062 outside NJ.

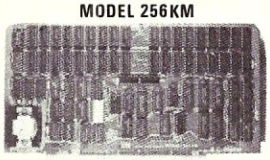
May 24th: Durham NC. Lower level of South Square Mall and covered parking deck. Annual Hamfest/Computerfest. Run by D.F.M.A., Box 8651, Durham NC 27707; (919)544-3556.

June 7th: Secaucus NJ. Meadowlands Hilton Hotel. Run by Ken Gordon Productions.

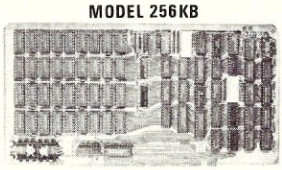
June 14th: Philadelphia PA area. George Washington Conference Center, Willow Grove PA. Run by Ken Gordon Productions.

For S100 bus by S. C. Digital, Inc.

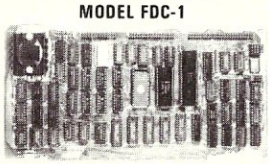
MODEL 256KM



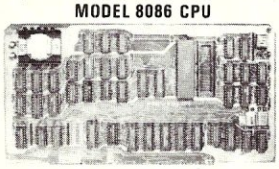
MODEL 256KB



MODEL FDC-1



MODEL 8086 CPU



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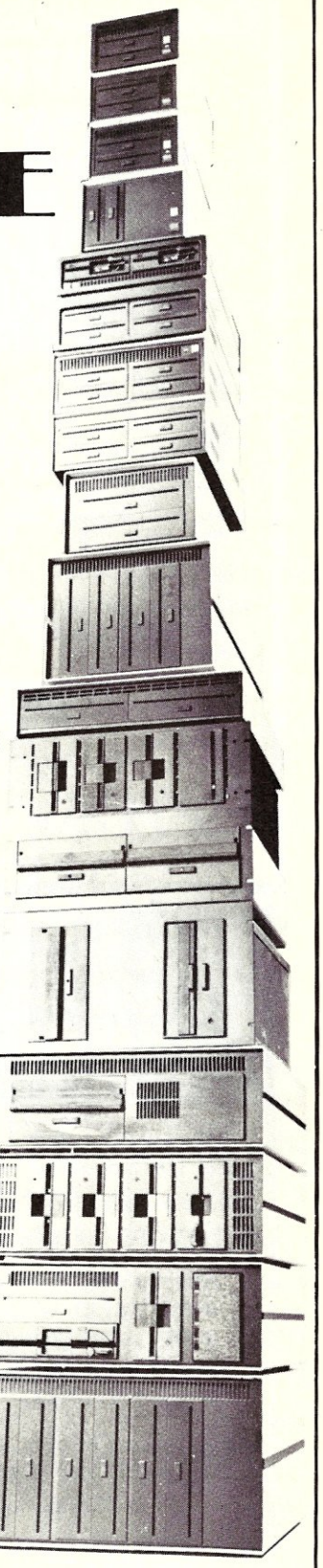

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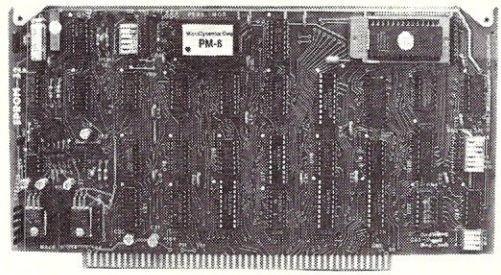

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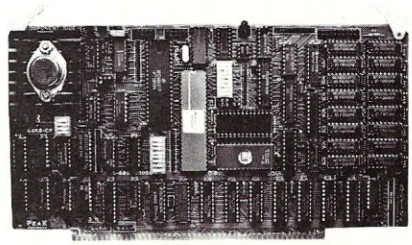

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Sample Abstract #43

id	keyword
43	T_Asst. Director
43	F_Sales
43	G_73
43	P_Fabrics
43	P_Yarns
43	P_Clothing
43	$_37000
43	D_MBA
43	M_Marketing
43	S_Columbia U.

Sample Queries

(a) experience in Sales and Marketing; not a V.P. or Director; 10-15 years work experience; current salary not higher than $50K.

ALL
MATCH
F_Sales
MATCH
F_Marketing
NONMATCH
T_Director
T_V.P.
GRTR/=
G_71
LESS/=
G_76
LESS/=
$_50000

(b) not a steel industry executive (Director, V.P. or C.E.O.)

ANY
NONMATCH
T_Director
T_V.P.
T_C.E.O.
NONMATCH
P_Steel

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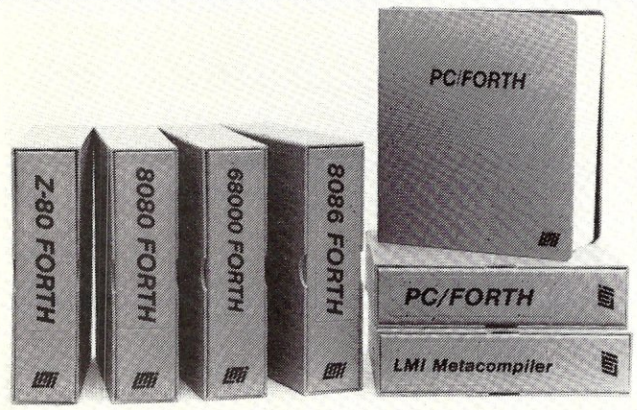

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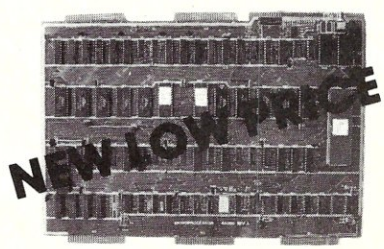

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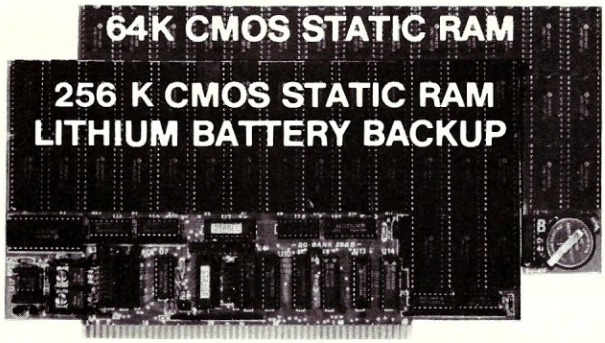

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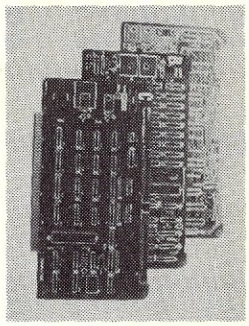

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The Data Base Forum

by Nelson T. Dinerstein

This column will be a regular feature in M/SJ. It will discuss problems associated with the application of database managers such as dBase-II/III, Framework, and Rbase 5000. Suggestions, comments and questions are welcomed.

MORE COMMENTS ON dBASE II SPEED TECHNIQUES

Following up on my Data Base Forum columns in the November/December 1985 and January/February 1986 issues of this journal, the following comments are in order.

1. A COMMENT ON RULE 3

Rule 3: If an index will be used infrequently, add records to the file without using the index. Then, when the index is required, create the index just before it is used.

This rule refers to the situation where data is entered into a file on a regular and frequent basis. If you enter several records into a large file with a number of indexes, then you may have to wait several minutes between entry of the records, waiting for the index files to be updated. If you infrequently run a program, say to produce a report once a month, and only this program uses the index named I, then you may wish to enter the records (a frequent operation) without the index I being active. This will speed up entry of the data. Then, when you are ready to print the report, index the desired database to create the index I. The key idea here is that it is often very inconvenient to wait between entry of records, but may be convenient to schedule the reindex during a work break. When you return from the break, the reindexing will be completed and you can continue with the printing of the report.

2. A CORRECTION FOR EXAMPLES 3 AND 4

In these two examples, it was intended that the database be reindexed after exit from the loop. Unfortunately, the code appeared in a form that actually skipped the reindexing, since the RETURN statement was used to exit from the loop. Two alternatives are to place the INDEX statements in the calling routine (rather than immediately after the end of the loop) or to exit from the loop with a technique that does not use the RETURN. The original example is shown in Listing 1.

The RETURN in the IF statement causes the problem. You can rewrite this in two parts (the calling and the called routines) as shown in Listing 2.

Alternatively, you can rewrite the code in one module without the use of the RETURN statement (Listing 3).

3. ACTIVATING ONLY THE REQUIRED INDICES FOR UPDATES

Rules 7 and 8 and example 5 indicate that you should avoid code that will update indices that do not need to be updated. An elegant technique to accomplish this is to

Listing 1.

```
USE X
DO WHILE T
        STORE " " TO ANSWER
        ERASE
        @ 5,1 SAY "ENTER ANOTHER RECORD (Y/N)" GET ANSWER
        IF ANSWER ⟨⟩ "Y"
                RETURN
        ENDIF
        ⟨enter a record here⟩
ENDDO
INDEX ON ⟨field name⟩ TO A
INDEX ON ⟨field name⟩ TO B
INDEX ON ⟨field name⟩ TO C
```

Listing 2.

```
* CALLING ROUTINE
DO SUBROUTINE
INDEX ON ⟨field name⟩ TO A
INDEX ON ⟨field name⟩ TO B
INDEX ON ⟨field name⟩ TO C

* SUBROUTINE
USE X
DO WHILE T
        STORE " " TO ANSWER
        ERASE
        @ 5,1 SAY "ENTER ANOTHER RECORD (Y/N)" GET ANSWER
        IF ANSWER ⟨⟩ "Y"
                RETURN
        ENDIF
        ⟨enter a record here⟩
ENDDO
```

Listing 3.

```
USE X
STORE T TO AGAIN
DO WHILE AGAIN
        STORE " " TO ANSWER
        ERASE
        @ 5,1 SAY "ENTER ANOTHER RECORD (Y/N)" GET ANSWER
        IF ANSWER ⟨⟩ "Y"
                STORE F TO AGAIN
                LOOP
        ENDIF
        ⟨enter a record here⟩
ENDDO
INDEX ON ⟨field name⟩ TO A
INDEX ON ⟨field name⟩ TO B
INDEX ON ⟨field name⟩ TO C
```

Listing 4.

```
USE INVENTORY INDEX INVPARTNO
DO WHILE .NOT. EOF
        STORE # TO MEMRECNO
        SET INDEX TO
        GOTO MEMRECNO
        ERASE
        @ 5,1 SAY "ITEM NUMBER:" + INVPARTNO
        @ 6,1 SAY "QTY ON HAND" GET MEMQTY
        READ
        SET INDEX TO INVPARTNO
        GOTO MEMRECNO
        SKIP 1
ENDDO
```

Listing 5.

```
USE INVENTORY INDEX INVPARTNO
DO WHILE .NOT. EOF
        ERASE
        @ 5,1 SAY "ITEM NUMBER:" + INVPARTNO
        @ 6,1 SAY "QTY ON HAND" GET QTY
        READ
        REPLACE MEMQTY WITH QTY NOUPDATE
ENDDO
```

Listing 6.

```
* REFORM.PRG
* FORMAT FILE FOR REGULAR LUNCH LETTER
@ 2,1 SAY ;
   "ENTER CONTROL-PG DN TO COMMENCE EDITING = = PRESS RETURN
         TO TERMINATE"
@ 4,1 SAY "TEXT OF THE LETTER:" GET MISCLET
RETURN
```

use the NOUPDATE option in the REPLACE statement. The original example is shown in Listing 4.

This example can be improved considerably as shown in Listing 5.

COMMENTS: The corrections and modifications listed above were suggested by Anthony Winters of Task-Force, Haifa, Israel. I am most grateful to Mr. Winters for calling my attention to the items that needed clarification or correction. But I was bothered by item 3 above. How could I not know the more elegant technique for the control of updates in the REPLACE statement? After all, the use of the NOUPDATE option is elegant and obviously much better than the original example (example 5 in the January/February issue). After serious reflection, I realized that I had fallen into a common trap. I learned dBASE II before the NOUPDATE option became available and continued to program using the *old* technique. When new versions of dBASE II became available, I did not even notice the minor change in the syntax of the REPLACE statement. It is my intention to help you understand the nature of common problems encountered in the popular database languages (like dBASE II and III), and to propose some useful solutions. Since this column is a forum for the interchange of ideas and since I have no right to expect that my solutions to common problems will always be the *best*, I expect that I will be caught with *egg on my face* from time to time. Nevertheless, your comments, suggestions, corrections, and additions are both welcome and encouraged.

II. WORKING WITH TEXT IN dBASE III

1. THE dBASE III MEMO FIELDS

Memo fields increase the flexibility of working with textual material. The purpose of this article is to introduce you to dBASE III memo fields: their creation, manipulation, and use.

When you create or modify the structure of a database, enter the letter M to indicate that the field in the database record will be used as a memo field. dBASE III places a pointer in this database record so that it can find the actual memo in a separate memo file that has the .DBT extension. All of the memo fields associated with a database are stored in the same .DBT file. A database record can contain up to 128 memo fields and each memo field can contain up to 4096 characters in standard versions of dBASE III. If you are using the Developer's Release, you have the choice of a word processor (editor). If you use the dBASE III editor, then the limit is 5,000 bytes of text. If you use another editor (specified in the CONFIG.DB file), then the maximum size of the memo text is determined by the limitation of your chosen editor. If the memo field is empty, then it uses no storage space in the .DBT file. If the memo field is not empty, then the minimum storage for the memo field in the

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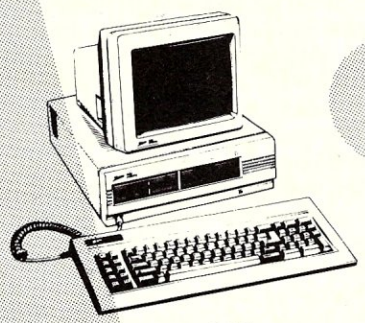

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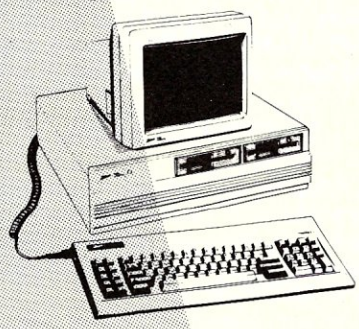

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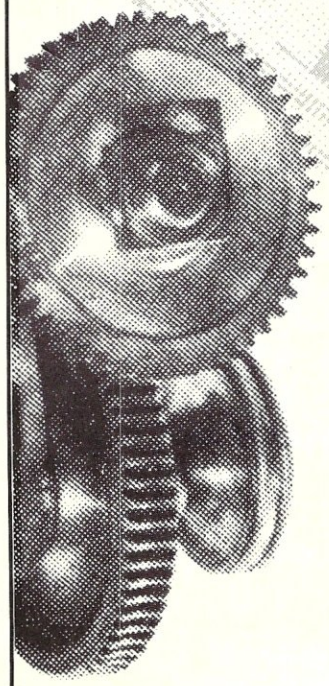

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.DBT file is 512 bytes, since storage is allocated in blocks of 512 bytes. Note that the pointer in the .DBF file requires only 10 bytes, no matter what the size of the actual memo.

To enter data into or to modify the contents of a memo field, edit the .DBF record, place the cursor on the memo field to be edited, and press CTRL-PGDN (while depressing the CTRL key, press the PG DN key). In standard versions of dBASE III, the editing menu can not be placed at the top of the screen for assistance in editing. In the Developer's Release of dBASE III, the default mode is to place the editing menu at the top of the screen. The function key F1 can be used to toggle the display of this editing menu. I personally believe that you will find this feature of the Developer's Release to be desirable, if your clients are to enter and modify their own text. When the text is entered or modified, dBASE III will automatically right justify the text in the expected manner. In the Developer's Release you can control the width of the printed (or displayed) text, when the memo is printed by a program. This is accomplished through the use of the SET MEMOWIDTH command. This command is not available in the standard version of dBASE III. The line length of the text stored in the memo field is therefore independent of the manner in which you choose to display it. Other useful commands (keystrokes) noted in the editing menu are: CTRL-END to save the text and return to the editing of the .DBF records, and PG DN to save the text but remain in memo editing mode. Once you have returned to the .DBF record, you may continue editing in the normal manner or press CTRL-W to terminate the editing of the record and save your changes. Use CTRL-Q to abort your changes.

The above procedure is a bit complex, so you may wish to simplify it for your client. Create a format file to control the display of the memo field before you attempt to edit the field. For example, use a format similar to the one given in Listing 6.

Some directions to the user are provided at the top of the screen, a description of the field to be edited is provided, and the editing itself is limited to the memo field itself (MISCLET). This screen display may be invoked by the following program:

```
CLEAR
SET FORMAT TO REGFORM.PRG
EDIT 1
```

When the user terminates the editing of the memo field, the format screen is displayed once again, and indicates to the user that the editing can be terminated by pressing the RETURN key.

To print contents of a memo field, use code similar to the the following:

```
LIST OFF MISCLET TO PRINT
```

When you use this form of the LIST command, you will notice that the name of the field (MISCLET) is displayed immediately above the text. This is because dBASE III prints column headers for each field in a database record, whenever the LIST or the DISPLAY commands are used. To suppress the name of the field in the display, use the command SET HEADING OFF in an appropriate place, such as in the main driver of your application system.

2. TEXT AND ENDTEXT

I have encountered a number of situations where I would have liked to include some graphics characters in my screen displays. For example, it would be nice, in some situations, to draw a border around a menu and to separate the functions in the menu. In the past, I have elected to leave out the border and the separating lines, because neither my usual editor, SED (an editor supplied with the Developer's Release to facilitate the creation of code for screen displays and reports), nor the dBASE III editor (invoked through the use of MODIFY COMMAND), can handle the characters with ASCII decimal values greater than 128.

I recently tried Volkswriter Deluxe, version 2.2, from Lifetree Software, that changed my reluctance to include these graphics characters (characters with ASCII decimal code > 128). I found it quite simple to define special keystrokes using the ALT key in combination with the numeric key pad. After the definition was completed (actually a special keyboard interpretation file was constructed), entering the ALT/number keystrokes produced the graphics characters on the screen exactly as I desired to see them when the dBASE III program was run. Volkswriter saves each of the keystroke characters of the edited text in a plain ASCII file. When you display this (text) file on the screen through the use of the MS/DOS TYPE command, you will see each of the text and graphics characters in their normal form. To include this special text (a mixture of letters, numbers, and graphics characters) in your dBASE III program, use the TEXT and the ENDTEXT statements and place the text between them. Most editors allow you to copy text from another file without changing it, so you can use Volkswriter for the entire program or you can use your personal editor for the creation of the program (minus the special text), use Volkswriter to create the special text, and then copy the special text into your program. Don't be surprised if the special text looks different when you view it on your screen through another editor, since most editors do not handle these characters gracefully. To verify that the special text has been copied correctly, exit from your

continued on page 22

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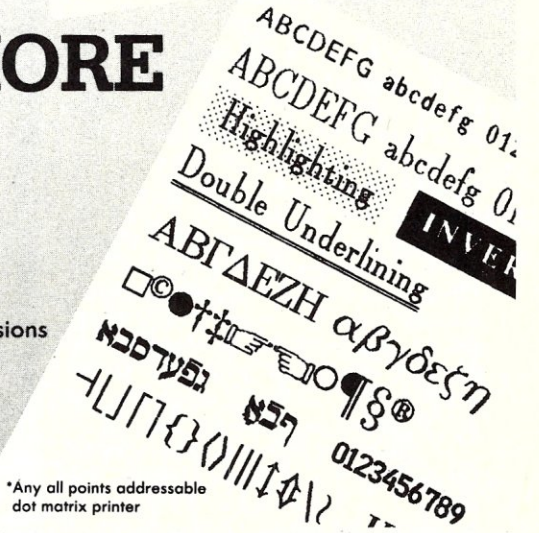

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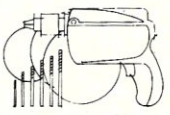

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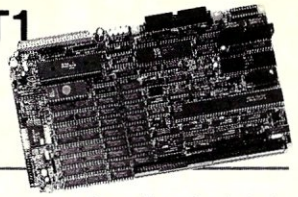

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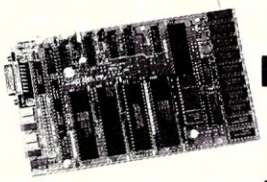

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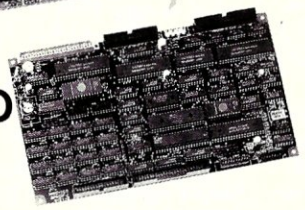

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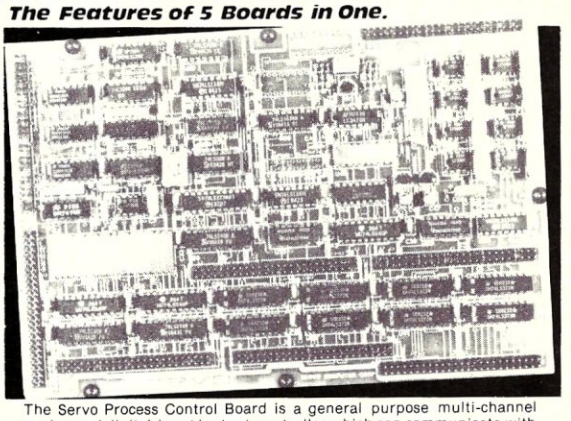

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The UNIX File

by Ian F. Darwin

This column discusses the UNIX operating system. If you have comments or questions about UNIX or this column, please write to Ian Darwin at Box 603, Station F, Toronto, Ontario, Canada M4Y 2L8. If you have access to the uucp network, mail "ihnp4!darwin!ian". I can't always answer immediately, but I will get back to you; electronic mail gets answered first!.

UNIFORUM '86 - SOME ANNOUNCEMENTS

UniForum is a large UNIX trade show held each January. This year's UniForum in Anaheim, California featured announcements by several of the big league players as well as attendance by practically every major vendor in the UNIX market. IBM announced a RISC*-based computing workstation, the PC RT, running System V on top of a virtual-memory manager. Don't let the term PC mislead you; this has little in common with the 8/16-bit IBM PC executive toy. The RT has a fast 32-bit custom processor with 40-bit addressing in the underlying hardware. There is a backwards-compatibility option for those with MS-DOS software. The CPU is claimed to be fast, and several well-known software products are already ported to it. One bit of speculation that I overheard is that IBM could announce a product similar to its mainframe VM/CMS system for this architecture. By this line of argument the machine is a clever marketing ploy; the corporate DP/MIS manager faced with people who want UNIX can now say *If you want UNIX, buy the IBM RT PC* and then later pressure them into running an IBM operating system *for better performance* or *for IBM support*. Just speculation, of course; IBM would never do anything so Machiavellian. More believeable is that they are trying to compete head-on with workstation makers like Sun, Apollo, Masscomp, etc. Ignoring the speculation, IBM has announced a fully-committed UNIX entry, implying more solid support of UNIX than previous "-IX" products for the PC and mainframe systems. Speaking of the PC and UNIX, Santa Cruz Operation unveiled SCO Xenix, a full-blown System V, for the IBM PC and compatibles. And other vendors had a range of products, from add-in boards to UNIX database front-ends for the ubiquitous PC.

*RISC is Reduced Instruction Set Computer; RISC architectures feature simplified instruction sets for which modern compilers can generate efficient code, large sets of general-purpose registers, and other features optimised for executing high-level language code.

AT&T was out in full force, with some *old-timers* and many new faces in attendance. New announcements from AT&T centred around System V Release 3, planned for later in 1986. I've discussed plans for SVR3 in a recent column, and there's little change from what I said. Also announced was the first release of the System V Validation Suite (SVVS, pronounced ess-vee-vee-ess). SVVS is a series of tests that test a UNIX kernel's conformance to standards.

AT&T's standard for System V is the System V Interface Definition (SVID, pronounced as one syllable); the second edition of the SVID was exhibited at the show. Edition 2 of the SVID is two volumes; volume 1 is the kernel and library interface, and Volume 2 is the commands. Since the added Volume 2 is the commands, we can probably infer that the second release of SVVS will include code to validate the commands. The SVID committee seems to have sensibly taken a least-common-denominator approach to specifying the commands rather than requiring all the commands to have all possible options (purists will be pleased to note that SVID's version of cat has only one option, the -s switch for silence if files are missing). The importance of having the commands documented in the SVID is that in a few years, as systems are brought into conformance, software vendors will be able to assume a common subset of commands and their options on all systems, for use in writing shell scripts that can be incorporated into distributed software. It is probably even possible for companies distributing 4.2BSD-derived UNIXes to make their systems conform to the SVID by adding some commands, which would make everyone's life easier. If developers catch on, we will for a second time have *the possibility of portability* across UNIX systems.** For now, I have a list of some portability constraints for commands (see below).

Another multivendor standard that appears to have reached critical mass is the Network File System, NFS, from SUN. NFS is one of several competing protocols for making files on one UNIbox appear as local files to users on another system over a network. *Competing* is too strong a word; this competition is over. Only AT&T could get away with introducing a competitor for it at this stage, and that's exactly what they did. I think they're too late; a dozen or so vendors were showing NFS. If AT&T's SVR3 commercial UNIX offering includes the full *file system types* facility from Bell Labs Research UNIX, they could arrange to have both SUN NFS and their own remote file system running concurrently. If not, they will lose sales to vendors supporting NFS. Vendor independence is the name of the game in UNIXdom. Attempts to lock users into a particular vendor's software are why many people moved to UNIX in the first place, and should not be perpetrated by AT&T of all companies.

The PC RT, the SVID and NFS were arguably the most important revelations at this UniForum's trade show. This is not to disparage the many fine contributions made by other vendors; space precludes a full listing. I also heard several people say that the technical program this year was an improvement over past years'! Previously, if you wanted a good technical program, you went to USENIX instead of UniForum; now it seems you have some choice. Next year's UniForum will be held in Washington, D.C. on January 20-23, and should be even bigger and better.

** The first time was when Seventh Edition UNIX was the only widely distributed version outside AT&T; AT&T eliminated the possibility of portability then by releasing System III as the *official* UNIX rather than an adaptation of Version 7, and Berkeley contributed by making many changes to the kernel interface and commands.

AND SPEAKING OF DATES...

While you've got your calendar out, mark in the Summer 1986 USENIX, June 10-13, in Atlanta, Georgia. And if you're into long-range planning, write down the Summer 1987 USENIX. It's scheduled for June 10-13, 1987 in Phoenix, Arizona. These USENIXes will have trade shows as well as a first-rate technical program.

For those overseas, or wishing to be there, there's the COMUNIX 86 Conference in conjunction with the European UNIX User Show at the Olympia 2, London, England, June 3-5, 1986. Sponsor is /usr/group/UK, and the conference is organized by EMAP International Exhibitions Limited. The theme of the conference is *Unix Solutions*. The call for papers stated that presentations should *aim to demonstrate the profitable application and effective use of UNIX*.

COMMAND PORTABILITY

What if you write a shell file on System V and it fails in a customer's or friend's shop because they run 4BSD and some command that you used doesn't even exist? There is much that could be said about

command portability. So much so that AT&T has written a book (volume II of the SVID) specifying what commands shall be on the system. It will be years before 90% of the UNIX systems conform to the SVID. In the meantime, here are a few commands to beware of when writing shell scripts. Most of this material also applies to *makefiles*, descriptions of commands and dependencies used to build up systems out of components.

There is a core of commands that you can count on. Old favorites like cat, ls, rm, ed, mail and their friends are likely to exist on any system that claims to be UNIX.

Cut and paste are useful but don't exist on V7 or 4BSD systems. Public domain versions exist, but you'd have to ship these if you wanted to be sure of their being there. Use awk instead.

The install command is used to install shell files or binaries in system libraries. It's a problem, since at present there are two incompatible versions, one from Berkeley and one from System V.

The output from commands like who, ls -l and others is likely to vary. Some versions of ls -l, for example, print both the owner and the group, thus will appear to have one *extra* column. Don't depend on the fine details of the output format.

Some versions of chown let an ordinary user give files away to others, some do not. Don't expect to see this behavior in every UNIX.

Crypt cannot be shipped outside of the U.S.A. because the U.S. government apparently regards it as a munition! Don't rely on cpio, since, apart from the existence of numerous versions of the cpio format, the program isn't even found on all UNIXes. Use tar, or if you are sending files by uucp or electronic mail, use one of several *shell archive* programs.

One of the biggest problems for shell script writers is the ubiquitous echo command. Just,

```
echo hello world
```

works on every UNIX. But to use echo as a prompt, you don't want it to put a newline at the end. On Bell UNIXes and 4BSD, you say,

```
echo -n "What is your name?"
```

but on USG (development) UNIXes you say,

```
echo "What is your name?\c"
```

The only portable ways around this are to have prompts that end with a newline, or to provide your own version of echo in a private bin directory and include this in the PATH variable at the beginning of your shell scripts.

Don't take the approach of saying

```
/usr/mysoftware/bin/echo -n "What is your name?"
```

or,

```
/usr/mysoftware/bin/echo "What is your name?\c"
```

That is, do not specify a *full path* for commands. Instead, use PATH at the start of the shell file. Why? Several reasons. It's easier to get changes right if they only occur in one place. And if the path is wrong, the user will still get some sort of echo rather than a mysterious *command not found* message.

I've seen people use absolute paths like /bin/echo or /usr/bin/echo (or the corresponding *test* commands) in shell files, too, and I still think it's bad. Some people do it for the purported efficiency gain, others to prevent collisions with user commands. The efficiency gains are more than wiped out when the UNIX developers build echo or test into the shell, as they have done on some systems, and your shell file still has to go off to /bin to read in the program. The preferred way to prevent collisions with user commands is to set PATH in the shell file; you optimize efficiency gains and still prevent collisions.

The getopt command should be used to parse options in a standard way. It's on all System III and System V systems now, will be in 4.3BSD, and there are several public domain versions of it that you can ship with your system if need be. One such public domain version of getopt appeared in the C Forum in the March/April '86 isssue of M/SJ! The source is only a few kilobytes.

How do you print files onto a terminal? Cat will always work. Some systems have paginators called p, pg, or more. While more may be more common than the others, at this point it's unwise to assume it will be there on every UNIX. It's easy enough to write a short paginator that you can include, and that will be generally useful if it arrives on a system that doesn't already have one.

There are several sets of commands that are so wildly different that they cannot be relied on. These include accounting commands (last, lastlog, du, quot, and disku) and spooler commands (lpr, lp,

As far as typesetting, forget it. With the number of versions of troff in circulation, you can't depend on it. Best bet: write a shell file called typeset and use it as a primitive in your other shell files or the makefile. Send me mail if you want my version of typeset.

I've listed some commands and issues to keep in mind when writing shell scripts and makefiles. There's more; a future issue of this column will continue the discussion.

That's all for this month. I welcome letters and electronic mail on these and other topics, especially suggestions for future columns.

Ian Darwin is Director of Research and Development for SoftQuad, Inc., developers of supported and enhanced troff publishing software.

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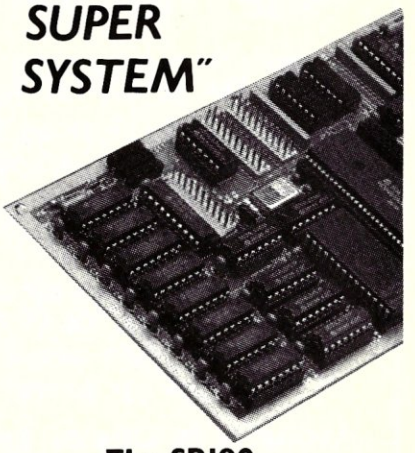

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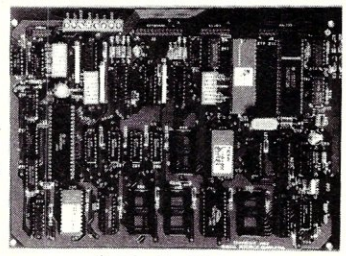

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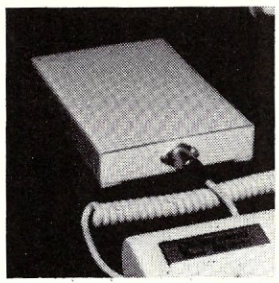

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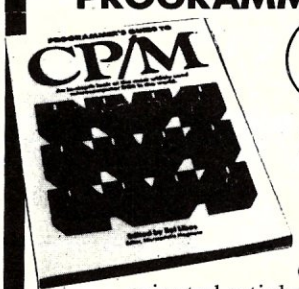

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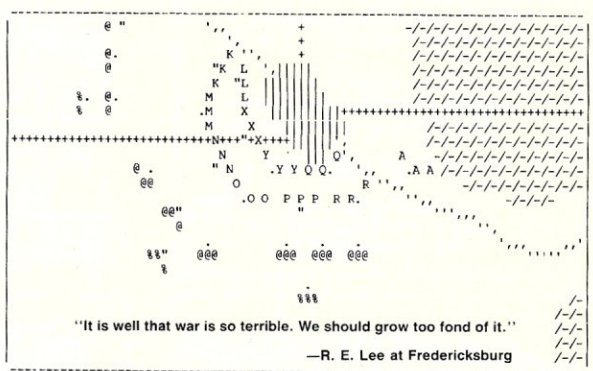

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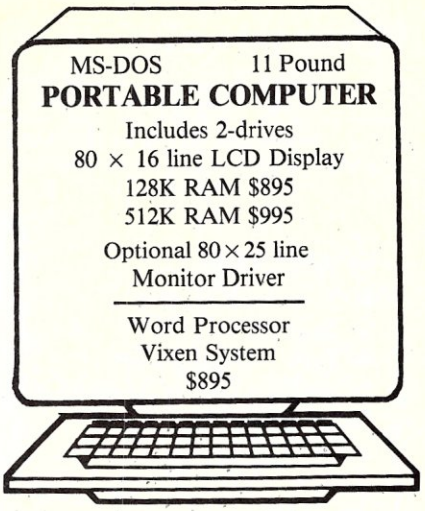

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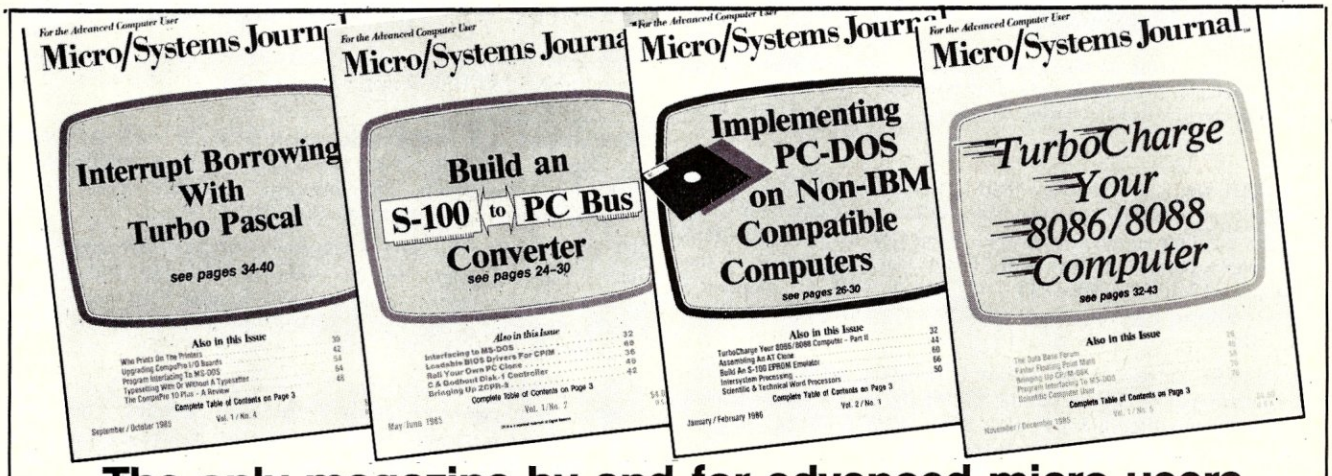

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JANUARY: Enhancing MP/M-Part 1; Installing MP/M; Add Concurrency to MP/M; Two Users on CP/M; Relocating Assemblers & Linkage Editors-Part 3; S-100 Wait States; REVIEWS: MP/M-8/16, ProComp-8, Paragraphics Game Board, ProLog.

1983

NOVEMBER: Intro to 80286, 68000, and 16032 Microprocessors; Intro to Local Area Networks-Part 2; Extended Memory Management for older S-100 Systems; Notes on Microsoft Fortran-80; Building S-100 Parallel Ports; REVIEWS: Compupro CPU-68K, System 8/16, Xenith Z-100, Nevada & Ellis Computing Fortran.

OCTOBER: Intro to Local Area Networks, Part-1; Build Low-Cost LAN; Build S-100 Bubble Memory Card; Use Radio Shack Model 100 portable with a CP/M system; Write Menu Driven Utility for Setting Printer Options; North Star Improvement; True Z-80 Random Number Function; Hide Code in Basic REM statement; Machine Code loader for MBasic; Increase Single-Density Disk Formatting; Relocating Assembler & Linkage Editors, Part-2; Run MX-80 with North Star; User Group Directory; CP/M-86 Versus CP/M-80; REVIEWS: CP/NET, QBAX, S-Basic.

AUGUST: XERA Program; Logging-On CP/M; WordStar Date/Time Patch; Find Location of Variable in North Star Basic; Prevent System Crashes During Warm Boot; Enhance Spreadsheet Print Files; Plotting Package-Part 3; Run WordStar under TP/M; 50-line Text Formatter; Using the LU Utility; User Areas under CP/M; REVIEWS: Stiff Upper Lisp, MuLisp-80, Supersoft Lisp, Cromenco C-10, Access Manager, Fancy Font, Computime SBC-880 S-100 card.

JULY: Using RCPMs; RCPM Directory; PIP Data Between Computers; Toward Smarter Modem Programs; Interface MX-80 via Parallel Interface; Digital Audio On CP/M System; Customize CP/M CBIOS; Plotting Package Part-2; REVIEWS: DRI PL/I-86 and PL/I-80, S-100 PMMI MM-VTI.

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APRIL: IEEE-488 Tutorial; Interfacing to Lab Instruments; CP/M-86 System in Lab; Implementing CP/M+ PART II; Build Simple S-100 Card Extractor; Macros & MacroAssemblers; REVIEWS: Pickles & Trout S-100 488 Controller; CP/M Utilities; Morrow Decision I.

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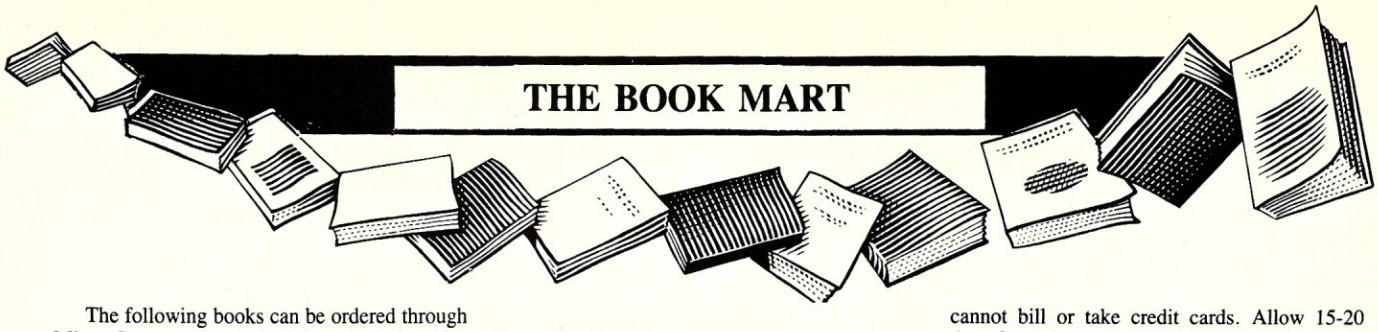
1981

NOVEMBER/DECEMBER: Introduction to the C Language, Virtual Segment Procedures, Little-Ada Part-II, A Disk Alignment Routine, Northstar DOS/BIOS Directory & File Conversion using UCSD Pascal; REVIEWS BDS-C, Small-C, Tiny-C and Whitesmiths-C; Tarbell Double-Density Disk Controller.



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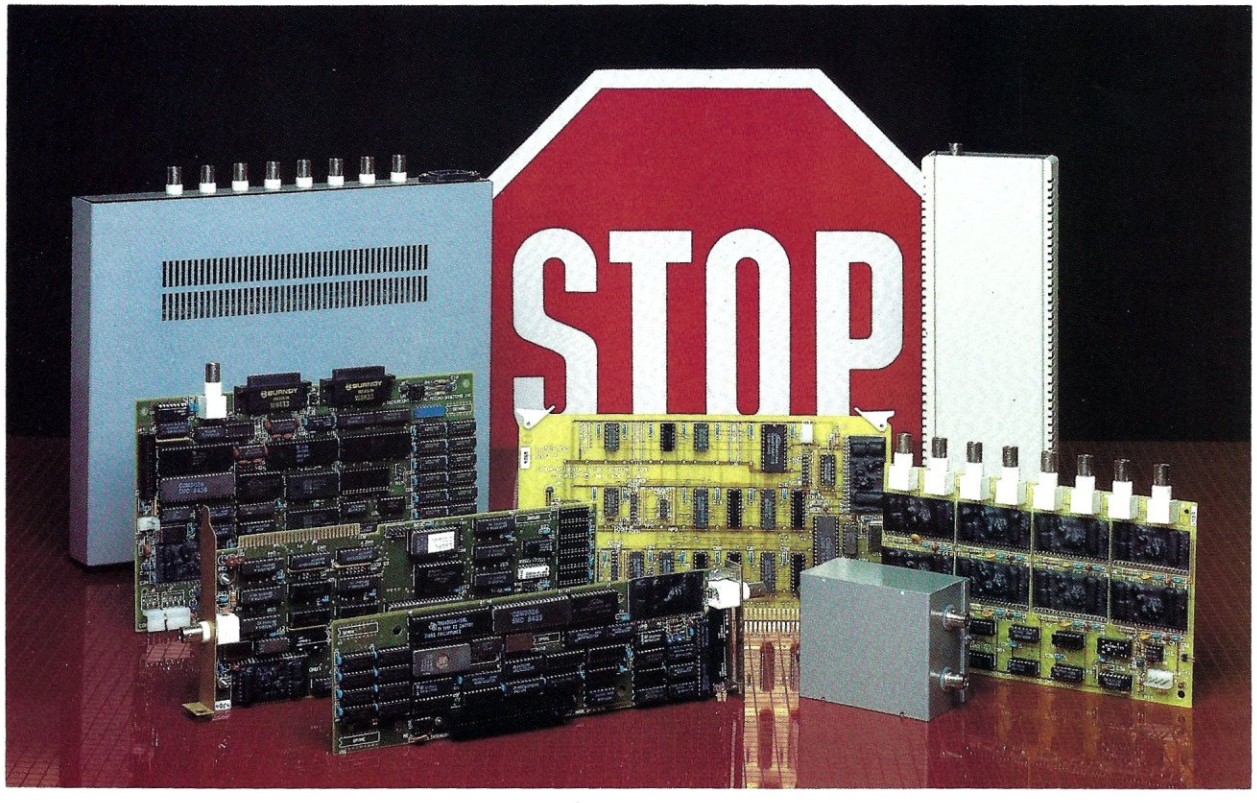

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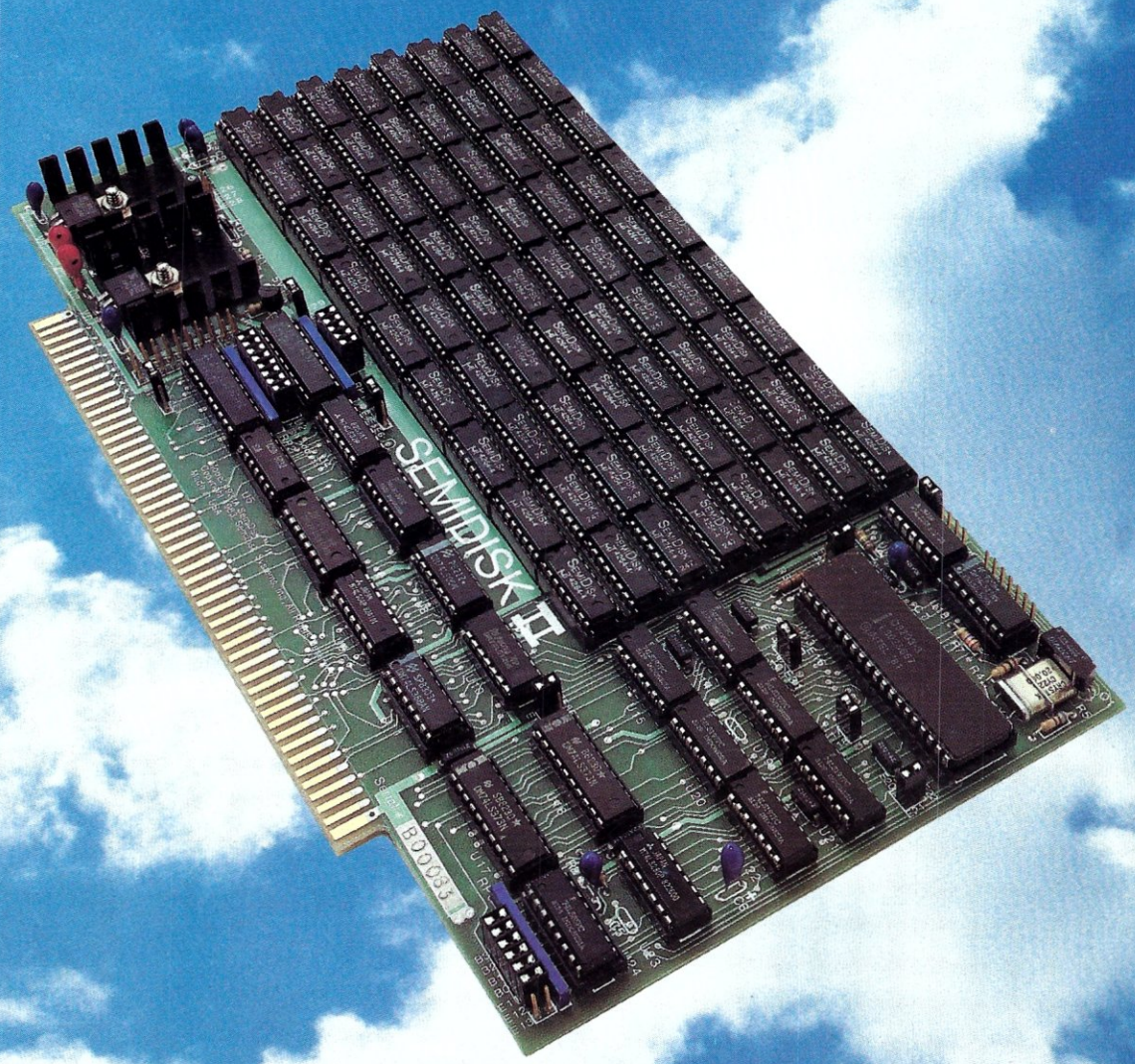

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