THE CP/M USER'S JOURNAL

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Microsystems

Volume 4 / Number 5

May 1983

IEEE-696/ S-100 Standard approved— a list of the changes, plus an S-100 Product Directory

The IEEE-696/S-100 Standard

Three years after the publication of the proposed standard, the IEEE Standards Committee approved a revised version. *Microsystems* brings you the details of all major changes incorporated into the final standard.

More than 150 manufacturers provide more than 1000 products for the S-100 bus. Don and Sol Libes bring you a quick roundup of who makes what.

North Star Still Shines on the Horizon

Steve Leibson reviews a new implementation of CP/M 2.2 for the Horizon. Richard Feldman tells how you can upgrade old N* 32K memories to a full 64K. Randy Reitz reviews SCAN and RENUMBER facilities for N* Basic, and Anthony Skjellum looks at a file comparison program to run under N* DOS.

Upgrading Disk Performance

Bob Weidemann discusses how to speed up your system with extra memory used for disk buffering. Even the old Tarbell single-density workhorse can become a trotter—try Bob Lurie's track-buffering routines.

Software

Kelly Smith offers a useful patch for SID and an improved 64-column display for DDT. Jon Lindsay tells how to recover that MBasic program you forgot to save. David Wolpert shows how to use the VARPTR function in MBasic.

Microsystems Tests:

The MPX-1 from CompuPro: a new and sophisticated I/O co-processor board for the S-100 bus.

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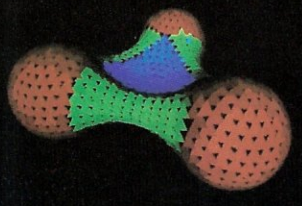
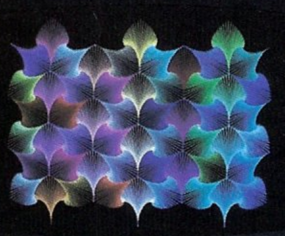
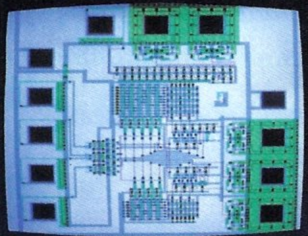


"Three Atoms" Courtesy of Greg Abram, University of North Carolina at Chapel Hill



"Aurora" By Richard Katz, Vectrix Corporation



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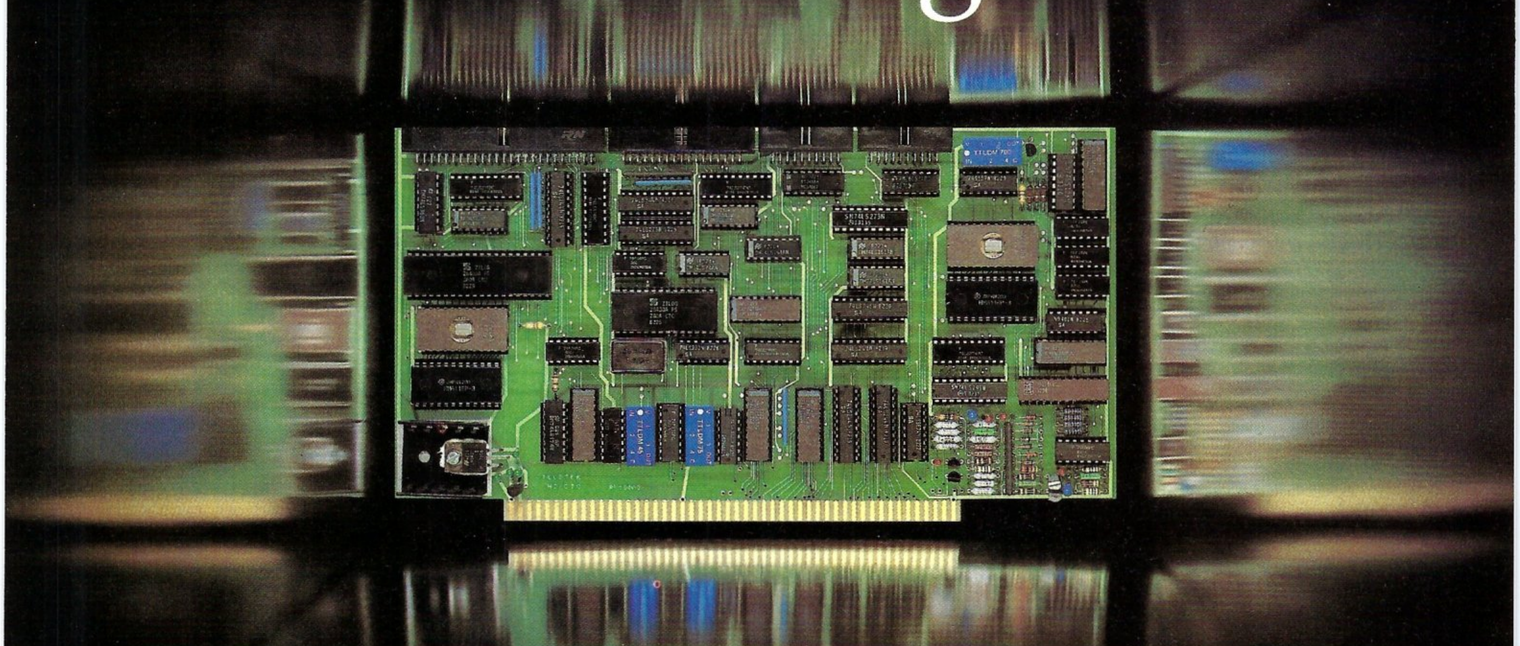

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One Park Avenue
New York, NY 10016
(212) 725-7957

NEW ENGLAND, MIDATLANTIC
Jim Beloff, *Microsystems*
Ziff-Davis Publishing Company
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(212) 725-3452

SOUTHEAST
Mark Browning
Browning Publications
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(404) 455-3430

ADVERTISING COORDINATOR
Rosemarie Caruso, *Microsystems*
Ziff-Davis Publishing Company
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MIDWEST
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(312) 679-1100

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CANADA
Frank Lederer, The Pattis Group
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Toronto, Ontario M4T241
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Lynn Kujawa, Ziff-Davis Publishing
One Park Ave.
New York, NY 10016
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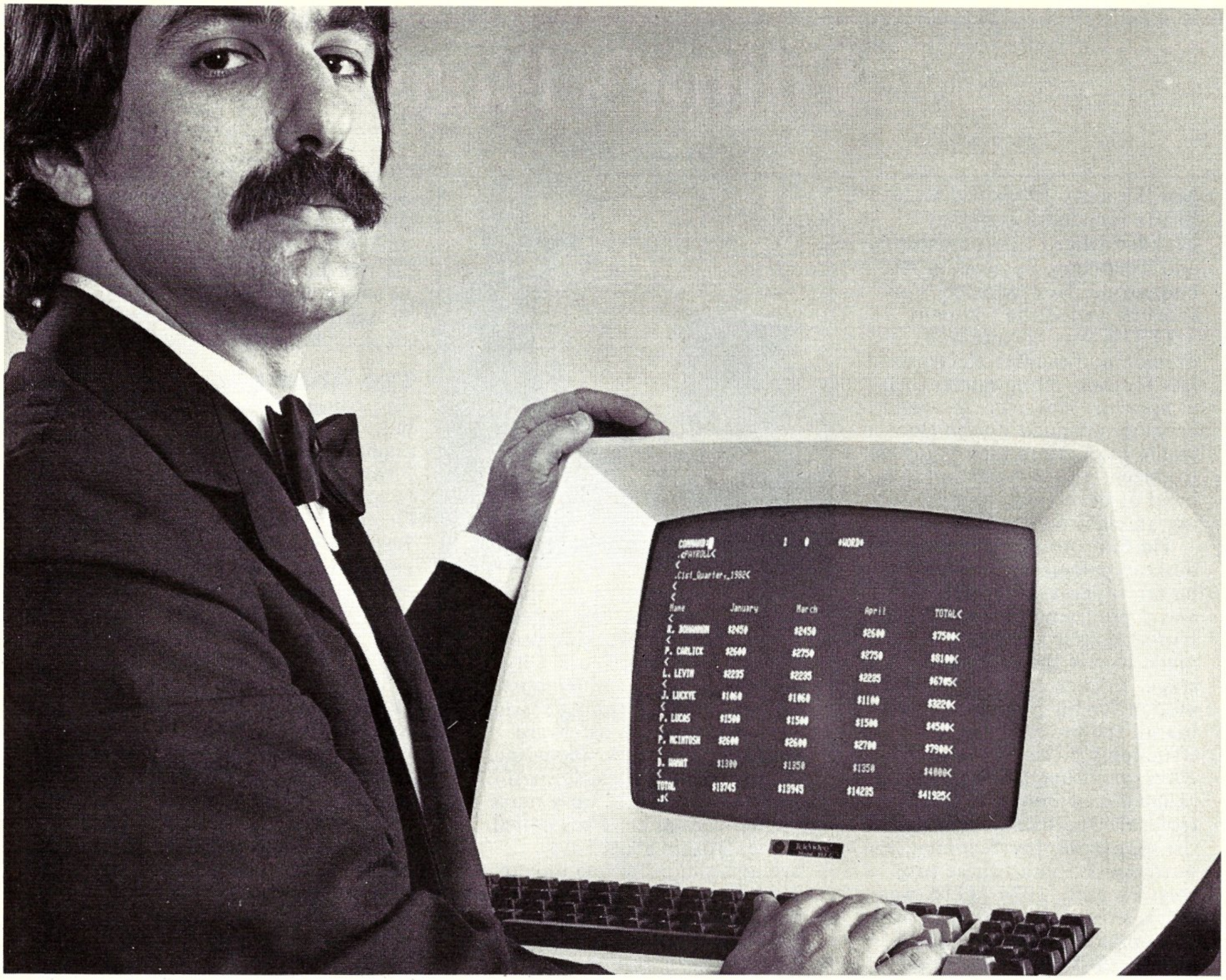

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CIRCLE 193 ON READER SERVICE CARD

Editor's Page

by Sol Libes

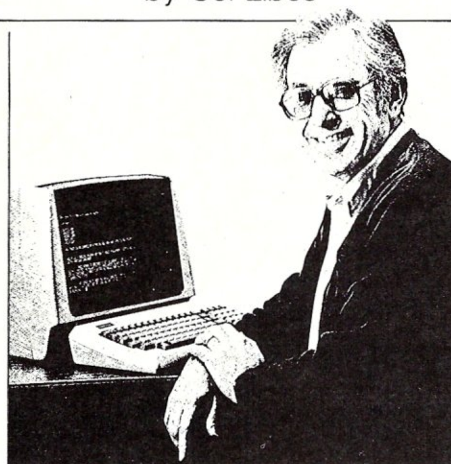
In the early 1970s, Ed Roberts founded a company called Micro Instrumentation and Telemetry Systems in Albuquerque, New Mexico. For short he called the company MITS. It was his intention to develop and market electronic kits for controlling model rocket systems. However, he soon became intrigued by the electronic calculators then being introduced, and decided to try his hand at developing and marketing an electronic calculator kit.

He first brought out a small desktop calculator, and then a battery-operated portable unit and a programmable calculator. Unfortunately the latter never made it past the prototype stage. In each case Ed got promotion for his product by writing up the products as construction articles in *Popular Electronics* magazine (now called *Computers and Electronics*). The technical editor of the magazine, Les Solomon, encouraged Ed in all these projects. By early 1974 MITS was still a small struggling electronics company with a handful of people, their calculator and rocket kit business having failed to get off the ground.

The first personal computer kits

In early 1974 Les suggested to Ed that MITS develop a computer kit based on the new Intel 8080 microprocessor. As Ed himself later admitted, the computer kit was "sort of a last hope." There already was a kit on the market using the Intel 8008, the predecessor of the 8080) and an article on an 8008 system had appeared in another magazine and generated a tremendous response.

A prototype was quickly designed, based on a similar design from Intel but with parts that were more readily and more economically available to MITS . . . the most notable being a 100-pin bus connector. Ed felt that if MITS sold 300 of these computer kits, they would be doing well.



Les Solomon thought the project was great, and asked Ed to bring the working prototype to their New York City editorial office for a demonstration and photographing session. Les agreed to run a feature construction article, including schematic diagrams. Ed, with Les' help, dreamed up a name for the computer: They called it the "Altair 8800." Ed brought the prototype unit to New York City. But something happened in transit, and the unit would not work. However, Les had faith and decided to run the article anyway.

The article appeared in the January 1975 issue of *Popular Electronics*, which was actually published and distributed in December 1974. At the end of the article it was mentioned that MITS was offering a parts kit for the Altair 8800 for $395. At the time Intel was charging $350 just for a single 8080 IC. The Altair price seemed like an absolute steal. Further, MITS offered a complete printed circuit board set for only $77, and a complete set of parts (less the cabinet, power supply, and front panel switches) for only $189. How cheap could you get?

It was like the opening of the floodgates. Within one week after the article appeared, MITS had received 200 orders for the Altair. (Later that year, they received 300 orders in one afternoon.) By the end of February they had 2000 orders, and still all they had was one prototype Altair. Working day and night, with the phones constantly jammed, they managed to ship some board sets by early April. And in May they started shipping complete kits.

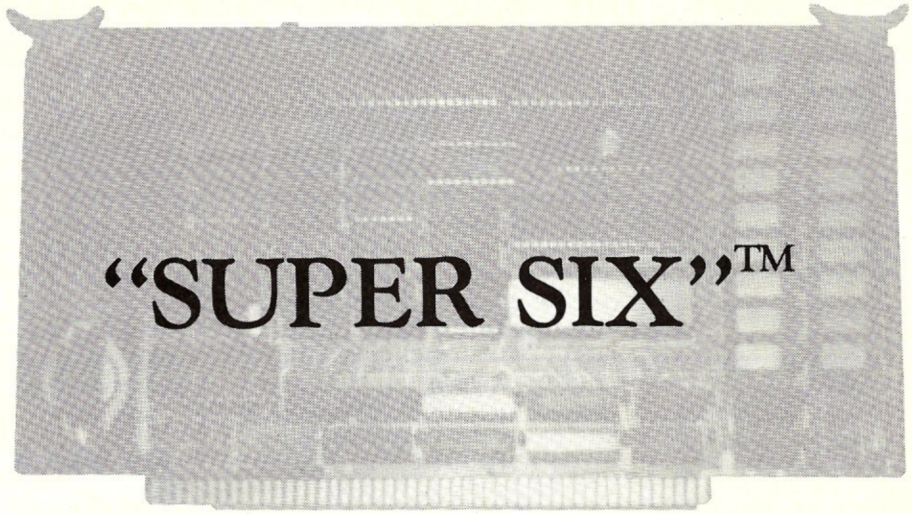
The Altair bus

The Altair-8800 used a 100-pin bus that was laid out by an anonymous draftsman who arbitrarily assigned signal names to groups of connector pins. Originally known as the "Altair Bus," its name was quickly changed by other manufacturers of compatible products to the "Altair/IMSAI bus" and the "Altair/IMSAI/Protech bus." This was too much, and at Atlantic City in 1976 Cromemco's Roger Melon coined the name "S-100 bus," which was universally adopted despite protests from MITS that it was still the "Altair bus."

The Altair came with a 1K RAM card and promises from MITS of additional boards for I/O, memory expansion, and the like. But the owners of Altairs were desperate for these products so that they could get their systems to do something. This led to the start-up of several companies to manufacture peripheral plug-in boards. Most notable, in these early days, were companies such as Processor Technology, Cromemco, and Godbout Electronics. But it was the adoption of the S-100 bus by other manufacturers of mainframes (e.g., IMSAI in January 1976) that established the S-100 bus as the dominant busing system for micros.

Development of the IEEE-696/S-100 Standard

In 1978, Dr. Robert Stewart established a Microprocessor Standards Committee as a subgroup of the IEEE Computer Standards Committee. Bob was also an avid computer hobbyist and owned an IMSAI computer. He was troubled by the incompatibility problems that were plaguing the S-100 mar-



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CIRCLE 148 ON READER SERVICE CARD

Editor's page continued . . .

ket. Thus, he approached George Morrow (president of Morrow Designs) and Kels Elmquist (director of engineering for Ithaca InterSystems) to develop a standard for the S-100 bus. George and Kels, as well as some of the other leading designers of S-100 products, were already beginning to think about putting multiprocessors and 16-bit processors on the bus and recognized that a stadard was needed so that S-100 bus machines could progress efficiently to the next generation of microcomputer technology. George took on the job of committee chairman; a meeting of interested people was called and plans were made. George and Kels undertook to write a draft proposal which was published in the July 1979 issue of *Computer* (official publication of the IEEE Computer Society) and in *Microsystems* (Jan. 1980).

Responses to the proposal were received during 1980. Another meeting of the committee resulted in the first addendum to the proposal. George Morrow resigned as committee chairman and Howard Fullmer took over. Another committee meeting was held in late 1980 to review the responses received. A third meeting was held in June 1981, at which most of the differences were resolved and another addendum prepared.

The standard receives IEEE approval

In late 1981 Mark Garetz (CompuPro Division, Godbout Electronics) took over as committee chairman, finalized the changes to the standard, and got all the committee members to finally approve the standard. He then piloted it through the review and approval by the IEEE Microprocessor Standards Committee, IEEE Computer Standards Committee, and IEEE Standards board. The standard became an official IEEE standard on December 14, 1982.

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CIRCLE 230 ON READER SERVICE CARD

News & Views

by Sol Libes

Intel news

Intel has begun shipping their 80150 IC, which contains the CP/M-86 operating system. This now makes possible diskless CP/M systems such as an ultracompact portable and also offers the advantage that the operating system cannot be overwritten.

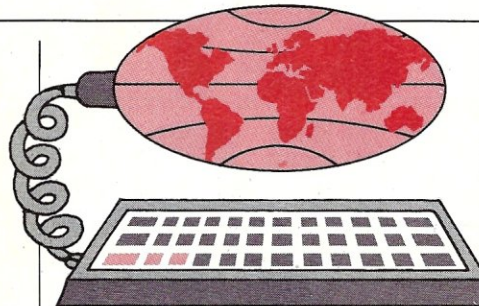
The CP/M chip substitutes a "memory disk" for the disk drive. Thus users can open and close files, store programs and gather statistics on the memory disk, and gain a performance advantage.

Intel is currently shipping samples of its new 16-bit microprocessor chip family and expects to be shipping production quantities this spring. This includes the 80286 microprocessor, 80287 math coprocessor, 82284 clock generator/ready synchronizer, and 82288 bus controller. The 80286 contains memory management and protection features to enhance its multiuser and multitasking operation. The 80287 performs complex floating point math functions with a claimed in crease of 50 to 100 times faster than systems using software or partial hardware support. The 82284 and 82288 replace 15-20 TTL devices, reducing cost and board real estate, and allowing full bus bandwidth operation at 8-10 MHz.

32-bit micros: a progress report

It was just two years ago that Intel shocked the industry by introducing their iAPX32 32-bit microprocessor chip set. However, it was nearly a year before OEMs could get samples and when they did, they found that their systems performed at far less speed than promised by Intel. Further, the iAPX32 was totally different from any of the prior Intel microprocessors, and system development was starting from ground zero. As yet no company is shipping systems using the iAPX32.

Last year Hewlett-Packard and Bell Labs announced their



in-house 32-bit microprocessors, which are already being used in products being shipped by HP and Western Electric. And American Bell is shortly expected to announce systems using the Bellmac 32A microprocessor.

NCR has announced that this month it will start shipping samples of its 32-bit microprocessor. Motorola is expected to start sampling its 68020 32-bitter in the fourth quarter, although some competitors question whether this is a true 32-bit micro. National Semiconductor is promising samples of its 32032, 32-bit device in the first quarter of '84. And Zilog has announced the Z80K, 32-bit micro, which it plans to sell for $30 each, with samples expected in the first quarter of '84. And DEC has disclosed that it has given top priority to the development of a VAX-on-a-chip.

Intel, recognizing the problems with the iAPX32, has launched a two-pronged effort to improve the iAPX32 and also develop a 32-bit device that is upward compatible with the 8086/8088. This new IC, called the 80386, is slated for sampling in the second half of '84.

Texas Instruments, the first company to introduce a 16-bit micro (the 9900) has faltered, just as Intel is faltering with its 32-bit device. There is no doubt that being a pioneer is a very risky undertaking. TI has as yet not disclosed any plans for entering the 32-bit micro marketplace.

It is becoming apparent that we are going to see a bigger battle in the 32-bit arena than is being seen in today's 16-micro battle. And that the first skirmishes will take place in later '84 with the pitched battle lines being drawn in 1985.

News from the UNIX world

The recent Unicom conference, held in San Diego, was the largest Unix conference yet held. Unisoft, who was the first company to transport Unix to the 68000 world, boasted that their UniPlus+ operating system was running on 40% of the systems shown at the show and on 90% of those using the 68000. They further claimed that over 20 companies had already announced systems running UniPlus+, compared to only 12 for Xenix from Microsoft.

The new Apple Lisa was shown at the show running both UniPlus+ and Xenix. And National Semiconductor showed a prototype 16032-based system running Unix. They hope to have the system on the market by the time you read this column.

In the meantime Televideo has discontinued selling its Unix-based micro after only two months because of a "less-than-enthusiastic response." They claim that they are re-engineering the product and will make another attempt at the market.

InfoPro Systems, East Hanover NJ, a publisher of a monthly newsletter for Unix users, has announced that they have filed a suit against McGraw-Hill for copyright infringement. They allege that the UNIX book by Jean Yates and Rebecca Thomas, of Yates Ventures, contained material copied from their newsletters.

Public domain software update

The CP/M Users Group (CPMUG) has released a new volume of software. It is Volume 91 and contains Fast Fourier Transform and printer formatting programs. The disk is

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ZEμS2, our second generation product, has made significant market penetration. Based on the same architecture, it was the first microcomputer to incorporate an integral Uninterruptible Power Supply (UPS) allowing the system to stay up for a period of 20 minutes in case of a power failure or voltage fluctuation. This provides utmost reliability by eliminating CPU crash or damage. ZEμS2 is a flexible system expandable to 32 users and 600MB of storage.

ZEμS3, introduced at NCC '82, is based on the same architecture as ZEμS2 in an 8 user configuration. Applying the latest technologies, the ZEμS3 utilizes a 5¼″ Winchester hard disk and a 5¼″ floppy drive. The cabinet measures a mere 10 x 19 x 27.5 inches, yet it contains all the hardware necessary to handle up to three shared printers as well as data communications.

OSM's MUSE operating system is CP/M* compatible and provides a true multi-user environment for ZEμS' multi-processor architecture. MUSE allows the use of more than 2000 available languages and applications programs written for CP/M* systems.

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CPMUG has also established a new on-line system with a bulletin board and files to be downloaded. Volume 91 can be downloaded from the system. It is up and running from 6 PM to 12 PM weekdays and all day weekends and is operated by Ed Currie (President of Lifeboat Associates). The number is (212) 535-3406, and it operates at 300-450-600 baud.

The SIG/M software group, a subgroup of the Amateur Computer Group of New Jersey, has released 16 more volumes of public domain software, bringing their total up to 107 volumes. These are volumes 92 through 107; they contain the following programs:

Vol 92: 68000 Cross-Assembler, BBS & Little ADA programs
Vol 93: Modem 798 update
Vol 94: Pascal-Z programs
Vol 95: Pascal-Z programs
Vol 96: CP/M-86 Utilities
Vol 97: Pascal-Z programs
Vol 98-107: ZCPR-2 (Z80 CP/M-CCP replacement) & SYSLIB (integrated library of M-80 subroutines)

These disks are available on many RCPM systems and from local CP/M user groups. Or they can be obtained directly from SIG/M, Box 97, Iselin NJ 08830. SIG/M also has a printed catalog available for $2; $2.50 foreign.

How is CP/M doing?

Judging from the CP/M-'83 show held in San Francisco recently, CP/M is doing extremely well. The show people claim that about 55,000 people attended, which makes it one of the largest computer shows ever held.

Digital Research claims that CP/M has now been implemented on over 1,000 different systems and is running on over 700,000 machines. However, all is not well in the CP/M-86 area, where it is estimated that only 2% of the IBM-PC users have purchased CP/M-86, choosing rather to go with IBM-PC DOS selling for one-sixth the price. Therefore DRI has decided to take the bull by the horns and market the IBM-PC version of CP/M-86 themselves. They have cut the price from $240 to $60 (still $20 more than PC DOS) and added more features (e.g., printer spooling). However, this is still expected to be an uphill battle for DRI, since Microsoft is not making available any of its software to run under CP/M-86 on the IBM-PC.

In the meantime, Tandy, the last CP/M holdout, has finally given in and will be furnishing CP/M Plus on their new Model 12 machine along with their TRSDOS operating system. This means that every major personal computer manufacturer now supplies CP/M on at least one of their systems.

DRI has moved aggressively into the CP/M-68K area by furnishing a C-compiler and C-

News & Views
continued . . .

software tools as part of the operating system package, and promoting it as a means for Unix users to easily port Unix software over to CP/M. Several computer manufacturers were already running CP/M-68K at the CP/M-'83 show and were promising early delivery.

There can be no doubt as to the success of the CP/M-'83 show, since the show promoter has already decided to run a CP/M-'83 East in Boston in September.

Future issues

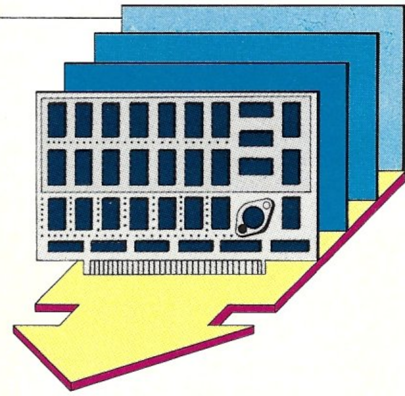
We plan to emphasize the following special topics in coming issues of *Microsystems*:

July:	*Communication*
Aug.:	*Business Applications*
Sept.:	*Unix on Micros (Pt. 2)*
Oct.:	*Local Area Networking*
Nov.:	*16-bit Systems*
Dec.:	*CP/M Software Directory*

If you would like to contribute an article, please contact us to discuss these efforts.

The S-100 Bus

by David Hardy



Now that the IEEE-696 bus standard has been approved and is available to all, it seems only fitting that its features be discussed here. Letters from readers indicate that there is a great deal of interest in the new standard, and that many of the hardware "hackers" are already deep into the mysteries of IEEE-696's new features like bus arbitration, TMA, extended addressing, and 16-bit data transfer operations.

Future S-100 bus columns, in addition to responding to reader inquiries and interests, will deal with each of the new features of the IEEE-696 standard in detail, starting next time with a discussion of the special bus operations of IEEE-696, including the bus transfer protocol and bus arbitration.

In relation to the new IEEE-696 standard, the two questions that I've seen most often in the last two months are "How can I add extended addressing to my S-100 system?" and "Why did they change the term DMA to TMA?"

Extended addressing

With the introduction of CP/M Plus, extended addressing is suddenly a very desirable feature on single-user Z80 or 8080 machines. Although CP/M Plus actually requires multiple banks of memory, the new address lines (A16-A23) can actually be treated as "bank enable" lines to switch between 64K "banks" of memory. I have been doing this in my own systems for some time to provide a multibank environment for both CP/M Plus and MP/M.

Since both operating systems require a certain amount of "common" memory (that is, memory that is *always* enabled), the problem of using the extended addressing lines becomes somewhat more complicated. The most common solution to this problem is to break the available memory into three or more "banks." The first bank, usually the smallest, doesn't use any of the extended addressing lines (A16-A23), so it is *always* enabled. This bank is used as "common" memory. The remaining banks use address lines A16-A23 as their "bank enables" so that the system can choose between banks by simply selecting a certain combination of the extended address lines.

This is virtually the same procedure that is used in most of the old port-mapped bank-select logic schemes that use the output bits of a latched I/O port to enable selected banks of memory. The only difference is that, instead of using an output port to select banks, the eight extended addressing lines are now used.

In fact, the easiest way to add this limited extended addressing to an S-100 machine is to use a simple latched output port of the type shown in Figure 1. Although I suspect that this is hardly what the IEEE-696 designers had in mind when they added extended addressing to the S-100 bus, it is a useful "quick and dirty" method of adding extended addressing to a machine whose master processor doesn't make use of these lines.

DMA vs. TMA

Direct Memory Access (DMA) is a name that implies that a certain device (for example, a disk controller board) can take control of the system's bus and directly drive the control, ad-

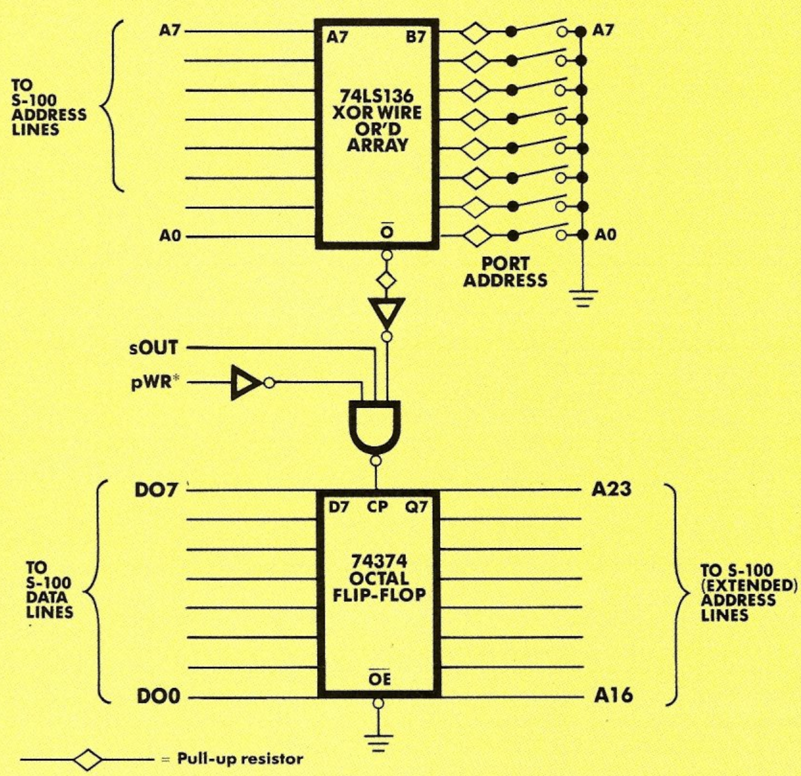


Figure 1. Simple latched output port

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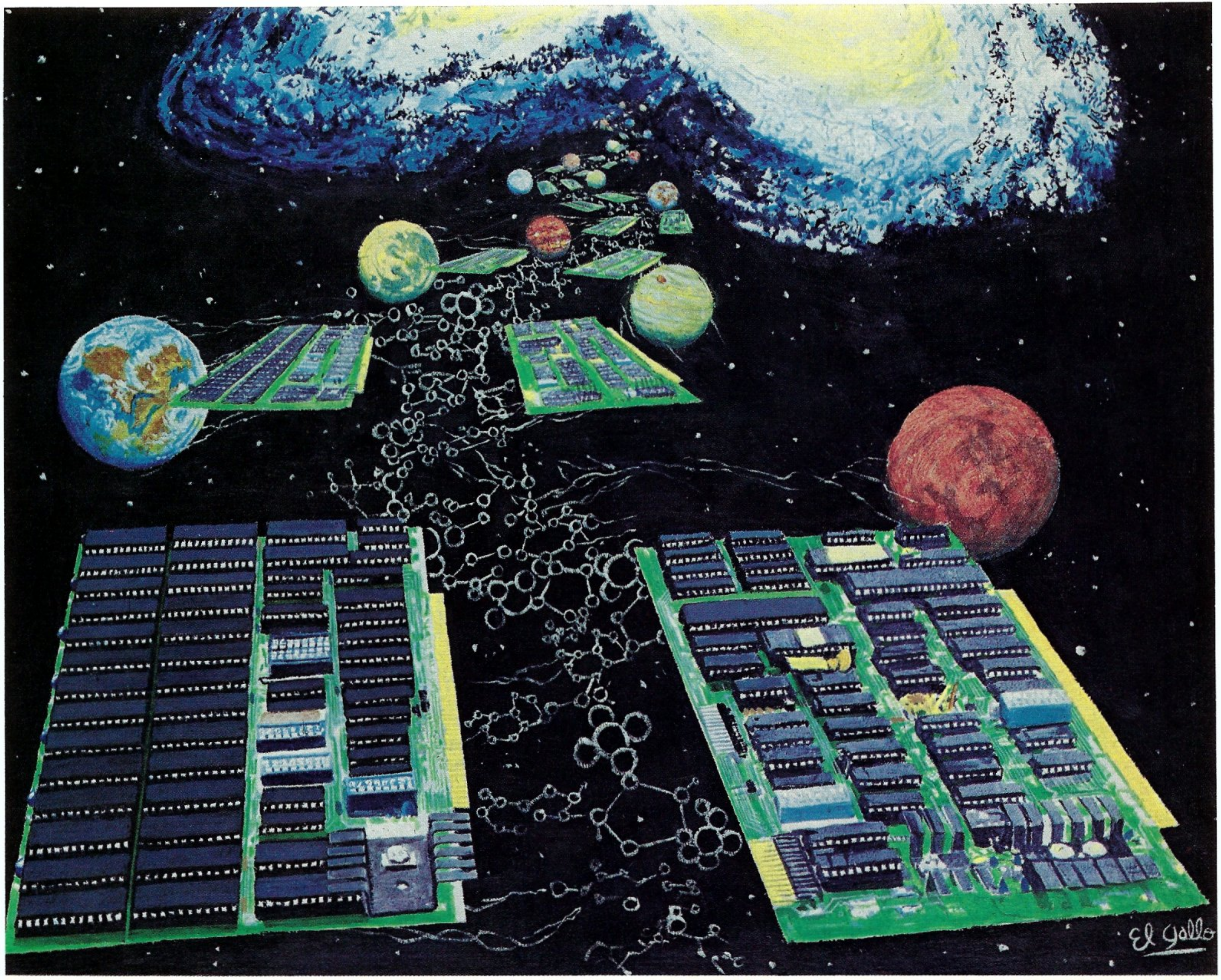
dress, and data lines in order to perform data transfers to/from the system main memory. In other words, it can "turn off" the system's master processor, take control of all (or most) of its lines, and perform temporarily as the system's master processor.

As microcomputer technology evolved, it became apparent to the standard's designers that the S-100 bus was capable of "lending" control for more than just memory access operations. In fact, any "temporary" master processor could take over the bus for any kind of bus access at all (within limitations, of course) and freely drive any passive system components (called bus slaves) that it desired. To indicate that this broader form of temporary master access was available with the S-100 bus, the name TMA (Temporary Master Access) was coined, to replace the less descriptive name DMA.

The designers of the 696 standard further enhanced the TMA process by adding four new lines to the S-100 bus that allowed up to 16 temporary masters to vie for control of the system bus at the same time. These four lines, called TMA0*-TMA3*, allow prioritized arbitration among any temporary masters that simultaneously request bus access. This method of arbitration requires that each temporary master have its own arbitration controller[1] in order to establish (and assert) its priority. In addition, each temporary master must have a unique priority.

Basically, what happens is this: Any temporary master wishing to perform TMA will place its priority code on the TMA bus by placing the complement of its priority code on the four TMA lines TMO*-TMA3*. These TMA bus lines (being negative-logic) are normally pulled up to a logic one, so that each line can be made ACTIVE by pulling it down to a logic zero. In this manner, each of the four lines is WIRE OR'ed to each temporary master, so that more than one temporary master may assert its priority on the TMA bus at the same time. Once a "requesting" temporary master has asserted its code on the TMA bus, it READS the TMA bus, then compares what it sees with its own priority code. If there is no difference, then it assumes that it has "won" the arbitration. If there is a difference, then it must compare the bits of the TMA bus with its own priority code to determine if there is a higher-priority temporary master asserted on the TMA bus. If the temporary master determines that it has "lost" the arbitration, then it will continue comparing the TMA bus. If the temporary master determines that it has "lost" the arbitration, then it will continue comparing the TMA bus with its priority code, and wait until it has the highest asserted priority before it will attempt TMA. The ac-



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S-100 Bus continued. . .

tual procedure involved in performing TMA is a great deal more complicated than the simple description offered here, and will be discussed in greater detail in the next S-100 bus.

The main disadvantage of TMA (with respect to simple DMA, at least) is the inherent complexity of its arbitration scheme. Ironically, its arbitration ability is also TMA's biggest advantage, since it greatly increases the flexibility of the S-100 bus. It is the complex TMA arbitration process that makes it possible for the S-100 bus to support multiprocessing as well as many other complicated functions.

It is really the ability of the S-100 bus to allow TMA that gives rise to the terms "temporary bus master (TBM)," "Temporary Master Access controller (TMAC)," "Slave Processor," "Bus Arbitration," and "Bus Slaves" that are used so confusingly in so many of the S-100 board advertisements.

S-100 Bus continued. . .

Next, in the July issue, more reader questions and feedback, and we start the in-depth look at the IEEE-696 bus.

Notes

1. Refer to the article "IEEE-696/S-100 Standard Update" in this issue, page 00, for the controller circuit used and the timing diagrams. Also, a detailed discussion of TMA will be found in the book, *Interfacing to S-100/IEEE-696 Microcomputers*, by Sol Libes and Mark Garetz, published by Osborne/McGraw-Hill.

This column is intended as a forum on S-100 topics. I encourage readers to send in questions about the S-100 bus, which I will attempt to answer in this column. The questions should, in general, be directly related to the hardware structure and timing of the bus; general questions or problems encountered in trying to interface a specific product.

Letters to the Editor

Dear Sir,

I am an avid reader of *Microsystems* and a recent owner of a Morrow Designs Decision I (with dual 5¼" drives). Is there a user's group for the Morrow?

Vincent B. Robinson
333 East 90th Street, #1J
New York, NY 10028

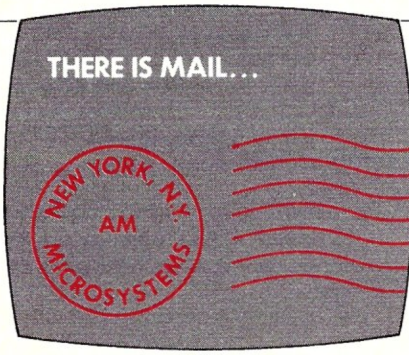
Sorry, we do not know of any user group specifically for this system. If there is one, we would like to publicize its existence.—Editors.

Dear Mr. Libes,

I read with interest "A Look At Pascal/MT+" by Jeff Duntemann. I wonder if we are using the same Pascal/MT+. Contrary to Mr. Duntemann's statement, Pascal/MT+ has been marketed by Digital Research for nearly a year. Moreover, Digital dropped any royalty requirements for its compilers in July 1982, so this claim is wrong.

My company uses Pascal/MT+ to produce commercially available CP/M programs. Unlike Mr. Duntemann, I do not find Digital Research's demand "to insert copyright notices into your code and examine your books whenever they please" to be "nonsense". Digital owns the code, and if they want to protect their ownership it is not too much to put a notice alongside ours. Moreover, when Digital was charging royalties, they had to have the right to inspect the books to enforce proper payment. I have seen (and signed) a number of software royalty contracts, all of which allowed inspection at the discretion and timing of whoever is owed the royalties.

For scientific computing and general number crunching, the 6.5 digits is not very accurate, since round-off errors can rapidly accumulate. Unfortunately Pascal lacks the double-precision and complex types available in Fortran. Even some versions of Basic offer double precision.



Overall, Pascal/MT+ is the best available compiler for developing programs that will be used many times. It allows stand-alone programs, chaining and overlaying. The no-royalty policy makes it very nice. On the other hand, it does compile very slowly.

The Speed Programming Package seems less than a total solution to this. It only catches narrowly defined "syntax" errors. It will not catch attempts to equate incompatible variables, for example. Nor will it use "include" files. Finally, the SPP insists that the entire file must fit in memory at the same time. All of this limits SPP to small programs—precisely where it is least needed.

Our solution has been to develop programs using Pascal/M, which is interpreted, and then translate it into Pascal/MT+.

Finally, the linker for Pascal/MT+ is also weak. One major weakness occurred when overlaying the addresses in hex. A survey around the office found that no one could add in hex, so we bought a TI Programmer calculator.

Incidentally, Mr. Duntemann is wrong that "we could all be buying our compilers from IBM in 10 years." I just bought their Pascal compiler (written by Microsoft) and it is not suitable for serious program development. First, they offer no telephone consulting/hotline, except what your local IBM store can offer (which is very little). Second, it does not allow you to chain or link one program to another. Third, it has no overlay/segment structure to allow large programs to fit into small spaces. Fourth, it has no option to flag deviations from ISO standards—and it offers many, so it is easy and tempting to write nontransportable code.

No, there are no excellent Pascal compilers out for micros, only some with problems you can work around. My ideal one would allow segmenting to be specified in the source code like Pascal/M, would chain like Pascal/MT+, offer more accuracy than 6.5 digits, have an interpreted and compiled option, and indicate when the ISO standard is violated.

Eric Weiss, President
The Winchendon Group
3907 Lakota Rd.
P.O. Box 10114
Alexandria, VA 22310

Chris Terry replies:

Jeff Duntemann's review of Pascal MT+ was written some time before we printed it and he did not see the article until it was about to go to press, when he called our attention to the matter. DR has since acquired MT Microsystems, and the statement concerning royalties on items linked from the MT+ library is no longer true. DRI has drastically revised its licensing agreements, and there are now no royalty charges for inclusion of the runtime libraries of Pascal MT+, CB-80, or PL/I-80. We apologize for any inconvenience the error may have caused.

Gentlemen:

In browsing through your Jan '83 issue, I noticed that Cromemco was not mentioned in connection with UNIX-like systems. CROMIX is certainly a derivative of UNIX. In reading past issues of your magazine, I have noticed a definite lack of Cromemco advertising, and references to Cromemco, despite the fact that they are the largest manufacturer of S-100 equipment. When will we hear more about Cromemco?

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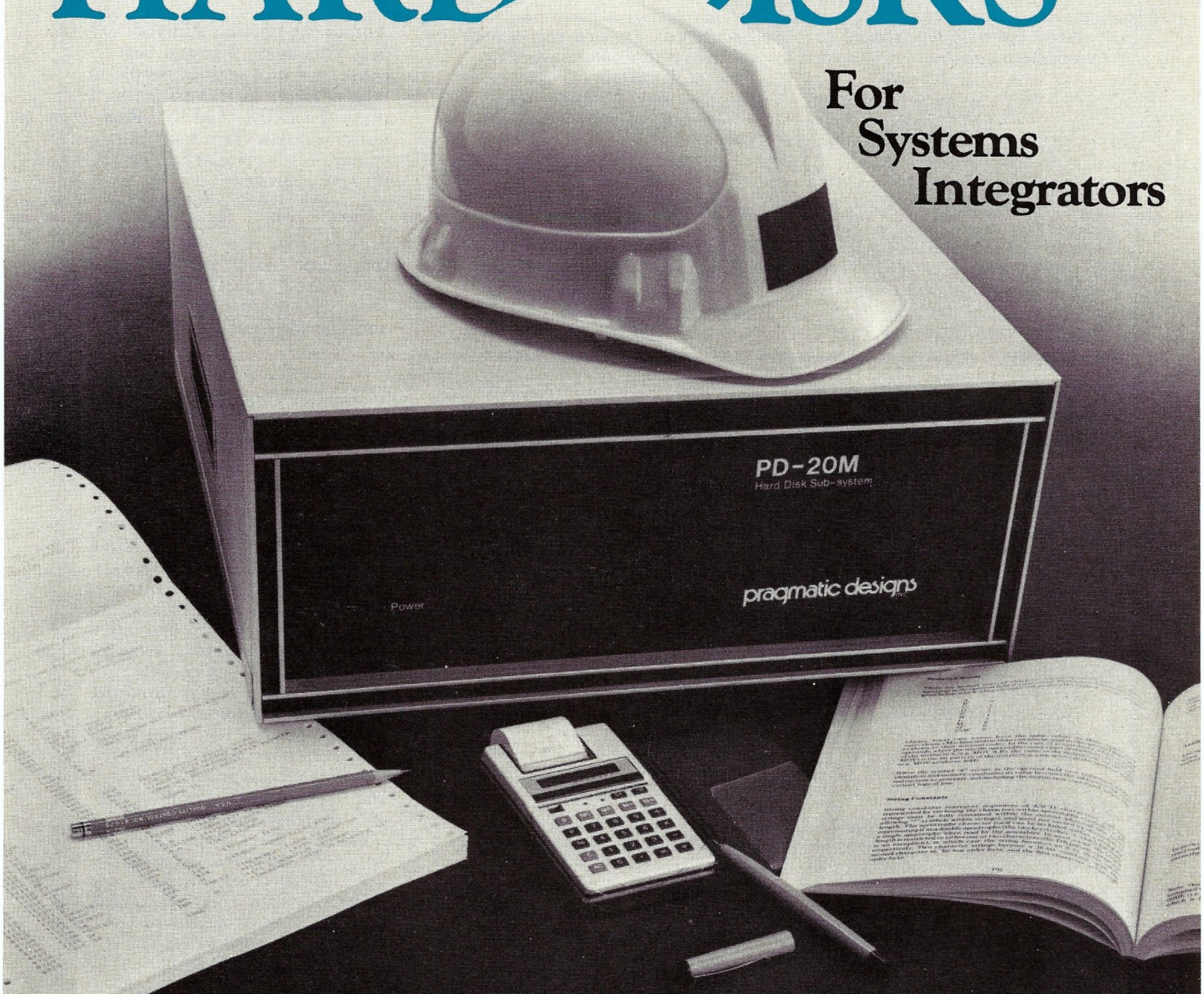

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Keep up the good work. I enjoy the magazine.

Wayne T. Watson
1857 Appletree Lane
Mountain View, CA 94040

Dear Wayne:
Cromemco did not return our UNIX questionnaire, hence we did not list them. Also, despite repeated requests to furnish information and loaner products for reviews, we have never received anything from Cromemco. In fact, our repeated letters and phone calls are never acknowledged. We continue to meet with a stone wall every time we try to deal with Cromemco.

—Sol Libes

Gentlemen:
Particularly appreciated your recent article on the Jade Bus Probe (Nov/Dec '82). Bought it. And presently use it. You really hit me with that article.
The S-100 bus was the first. And in my opinion still the best. But being first and best caused a lot of jealous people to take potshots at it. Personally, I think the IEEE tried to filibuster it to death. Two months is enough for a standard to be set up and approved.
On the size of your magazine: I feel it is about right at present. *Byte* is too large. My suggestion—stick strictly to 696-related advertisements, features, and discussions. Do that, and you may not get too large.

R.O. Whitaker
Computer Compatible Inst. Co.
4719 Squire Drive
Indianapolis, IN 46241

Sol Libes replies:
It typically takes about 3 years for a standard to be written and pass through the IEEE machinery to final adoption. There is no doubt that this long delay causes problems in an industry where technology is changing so rapidly. However, we must recognize that the members of an IEEE standard committee are unpaid volunteers and hence tend to give the task less than top priority. Further, many people within the industry have vested interests that must be resolved. This also takes time. Thus it took almost 3 years for the S-100 standard just to come out of the working committee, and about 7 months to move through the various IEEE committees to adoption.

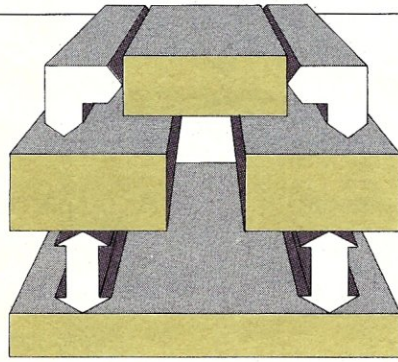
Gentlemen:
I believe you printed erroneous information in your News & Views column of the February issue. Content-addressable memory for the S-100 system bus was available in 1978 from Semionics Corp. See the articles serialized in *Computer Design*, especially Part 3 in the October 1978 issue.
Please don't give credit to the English for what we had five years ago!

Ralph E. Kenyon Jr.
RFD Lower Prospect Hill
Chester, MA 01011

The UNIX File

by Ian F. Darwin

The UNIX File is scheduled to appear every other month. It will focus a spotlight on important aspects of UNIX. If you have questions about UNIX, send them in and I will attempt to answer them.



Part 2
Easy applications and sophisticated text processing

One of the reasons people find UNIX so useful is its ability to produce simple 'applications' without writing any programs. So I'll start by looking at a simple application of the 'shell' command language. Then we'll look at some text processing applications, and see what the two areas have in common.

How many times do you need to look up telephone numbers? If you're like me, you forget them often enough that you need to keep them in a list. I keep mine on the UNIX system, and when a number is needed, I let my system do the walking. To find the telephone number of the *Microsystems* editor, for example, I need only type

```
phone libes
```

and I'll see something like

```
libes, sol - microsystems - 201-522-9347
```

Note that if I said

```
phone microsystems
```

I would get all the phone numbers of *Microsystems* staff:

```
libes, sol - microsystems - 201-522-9347
terry, chris - microsystems - 212-725-6856
```

How is the **phone** command written? It uses one of the more powerful UNIX tools, **grep.** The curious name **grep** is a mnemonic for Global Regular Expression Print; inside the UNIX editor the command

```
g/RE/p
```

will print all occurences of the RE. A RE or regular expression is a powerful extension to the 'character string' which most other editors allow you to find. RE's can have wildcards analagous to those in filenames, can look for classes of characters, special characters, and numerous other kinds of text. REs are widely used in UNIX; the editor uses them while editing a file, and **grep** uses them to search through a file or multiple files. Thus the command

```
grep libes phonebook
```

will likely produce the first printout shown above if I have a file called 'phonebook' which includes all my telephone numbers. And similarly

```
grep microsystems phonebook
```

will produce the second. But typing the **phone** command is easier, and I can create the **phone** command just by making a file called **phone** which contains the line

```
grep "$1" phonebook
```

I must mark the file as 'executable' to UNIX, which I do with the command **chmod** (change mode). Once I've created the **phone** command and a text file ('phonebook') with the names and telephone numbers I use often, I am set to use the newly created phone command:

```
phone dec
dec - toronto - 675-2580
```

to remind me of the phone number of our local DEC office. I use the standard UNIX editor (or any other editor I choose) to maintain both the **phone** command and the file 'phonebook.'

Maintain a one-line command? Well, commands like **phone** tend to start small and grow. After a while we realised that on a multiuser system, some numbers should be available to everybody while others are of a personal nature. So we made a file in a public area '/usr/adm' (the directory for administrative files), and put the **phone** command itself in a public directory so that everybody could use it (without having to know what's in it). **Phone** now looks like this:

```
if test -r $HOME/phonebook
then grep "$1" $HOME/phonebook
fi
grep "$1" /usr/adm/phonebook
```

which first checks to see if a file called 'phonebook' exists and is readable (**if test −r**) in the user's home directory (the place where their files are stored). If so, that file is searched first. If it is not readable, the user is *not* given a 'FILE NOT FOUND' error such as many other systems would provide. The **phone** command simply goes on to look in the public file.

Of course the first day this version of **phone** is in use, somebody will complain how ugly it is to have it type everything in lower case. Readers of English are used to mixed case; they expect to see names printed as Libes, DEC, Microsystems. We can easily edit the phonebook file to be in 'human readable' case, but will people have to know exactly how the lines are capitalized? No, because I just change the phone command to say

```
grep -y
```

which allows operand text entered in lower case to match text in either case in the file. Thus

```
phone libes
```

results in

```
Libes, Sol - Microsystems - 212-522-9347
```

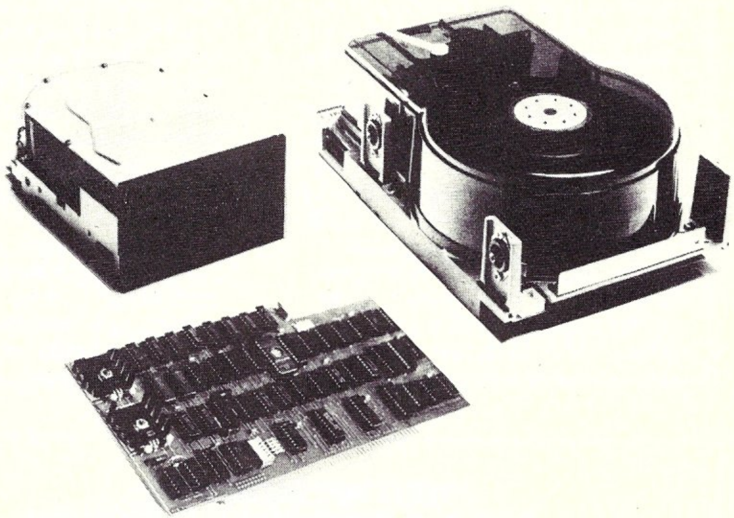
The phone command also illustrates the ways in which programs can and do grow in a UNIX environment. The first prototype of a tool is often a simple shell script. This is then

Super Subsystems For Super Micros

Fixed Disk Subsystems

47 MEGABYTE 8″ subsystem includes PCE's FDC 4000 hard disk controller, the Fujitsu M2303BE 47 MB, 1.2 MBYTE/SEC, 8″ Winchester type fixed disk drive, and an 8″ single density diskette (P/M) containing Z-80 source code for the FDC 4000 drivers, format and diagnostic programs. PF47 SUBSYSTEM $3,995.00

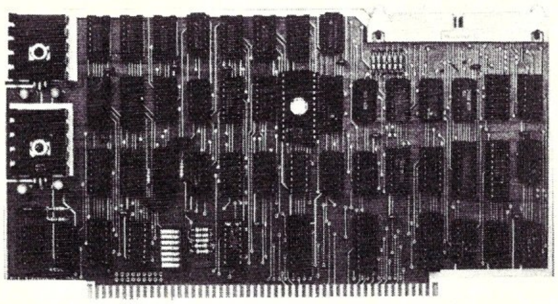
20 MEGABYTE 5.25″ subsystem same as above, but includes the Fujitsu M2234B 20 MBYTE 5.25″ Winchester type fixed disk drive instead of the M2303BE. PF20 SUBSYSTEM $2,275.00



Winchester Fixed Disk Controller

Completely I/O Mapped—No Wait States—No CPU Cycle Stealing

The FDC 4000, an IEEE 696 (S-100) compatible fixed disk controller provides an interface between the host system and any disk drive having a Shugart SA4000 type interface. Manufacturers producing this type drive include Shugart, Fujitsu, 3M, and others. FDC 4000 $895.00



8″ Floppy Disk Controller With 16K Track Buffer

Completely I/O Mapped—No Wait States—No CPU Cycle Stealing

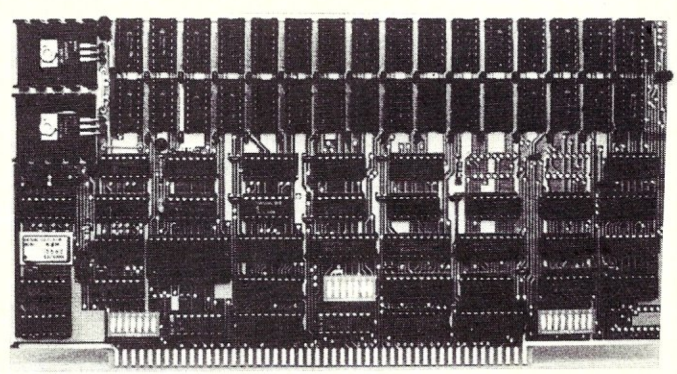
The FDC 800, an IEEE 696 (S-100) compatible floppy disk controller, controls up to 4 (16 with encoded drive select) 8″ floppy disk drives. Any combination of single or double density, single or double sided drives is accomodated. Any portion of the 16K of on-board static RAM may be used as a sector or trac buffer, to hold portions of the operating system, or may be configured as a virtual disk. Features hardware only head load delay and a circuit that watches for disoriented or missing diskette with the drive ready and the door closed. Comes with Z-80 source code for CP/M BIOS. FDC 800 $480.00

256K RAM In 4K Blocks

The BSR 64/256 is an 8 bit bank selectable dynamic random access memory card designed to operate in Z-80, 8080 and 8085 based S-100 computer systems with a CPU clock frequency of up to 5MHz (A model) or 6MHz (B model).

Individual 64K banks are selected via the IEEE 696 8 bit address bus extension. If the host system is not capable of driving the extended address bus, one of the BSR 64/256 cards in the system may be configured to drive it through an onboard latched output port.

System area is allocated in 4k blocks by writing a system mask out to two latched output ports. Another port allows any one of up to eight cards to be assigned as the current system master. Logically, up to 64 cards may be addressed in a single computer system. BSR 64/256 A @ 5MHz $895.00



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expanded and improved based upon actual use. Finally, if the command is used often or if efficiency becomes a concern, the program can be written in an efficient programming language such as C. Experienced UNIX programmers almost never code in assembler language: They've seen that software can be made almost as efficient, easier to maintain, and much more portable if it is written in a high-level language in the first place. Of course this model of the development cycle is inadequate for a 5000-terminal airline reservation system, or an online banking teller system with thousands of branches online. Or is it? Clearly the conventional data-processing establishment could profit by looking at the UNIX approach to development.

Another aspect of this program deserves comment: its generality. Unlike a program written specifically to search for names (parsing the name and demanding that it be in a certain format) and print the corresponding numbers, this program searches whatever text you enter. As an example, I recently got a telephone bill which included some long-distance calls I didn't remember having made. I just typed

```
phone 201-555-1234
```

and when the system printed the name of a supplier in New Jersey I recognized the name and remembered the conversation I'd had with him. A more specialized search program might have prevented me from finding out the supplier, unless the programmer had anticipated my inquiry. In general, the more specific you make a program, the more work you must do to anticipate all possible inputs, and the less likely you are to get it right.

To see some more shell files, all on a particular topic, let's turn to the realm of text processing on UNIX.

Scratch 10 computer users and you'll likely find 11 different meanings for the term 'text processing'. I'm using the term in a general sense—the manipulation of words—which goes beyond document preparation. But to do document preparation, you must have editing power and formatting capability. Editing and formatting can be merged in a 'word processor' such as Wordstar on CP/M and dedicated word-processing boxes, or they can be separate functions, as seen by those who use CP/M with an editor and DRI's TEX, for example. Both approaches have their advantages and their adherents.

Integrated systems—if they're done properly—offer a superlative ease of use for preparing text that people will read. But they impose their own limits on the kinds of formatting that you can do. The greatest advantage that separate systems offer is that they can allow use of a single set of tools for text processing and for program development. The standard UNIX text processors—**nroff** and **troff**—are powerful but low-level document formatters which don't incorporate editing facilities. **Nroff** prepares documents for viewing on CRTs, printers and hardcopy terminals; **troff** formats them for typesetting. Both accept almost exactly the same input language. Because of the complexity of **n/troff,** one normally uses a package of 'formatter macros' which defines standard sequences—much as Scribe and Scribble do, except that **n/troff** have been in use for a much longer period of time. Commonly used macro packages called 'mm', 'ms' and 'me' provide formatting of most types of documents. Mm is probably the largest, and is the one I use most. Mm provides features such as automatic numbering of sections and subsections, generation of tables of contents, etc., which **n/troff** by itself doesn't, and which many other text processors do not. Documenting new UNIX programs is made easy by the 'man' macro package, which ensures that all the Volume I Manual pages are in the same format. The Bell UNIX documentation is done entirely in **n/troff,** as are thousands of other documents and a number of books.

Example: **nroff** without macros, and with mm macro package without:

```
.sp 2
2.4.2 Subsequent Analysis
.sp 1
.ti +5
```

with:

```
.H 3 "Subsequent Analysis"
```

A second major advantage of the separation of editor and formatter is the ease with which—on UNIX at least—one can add pre- and post processors to the formatting system. The UNIX world has for years used two text preprocessors, one for tabular work (**tbl**) and one for setting mathematical equations from textual descriptions (**eqn**). More recent additions include a package (**refer**) for automatic extraction of bibliographic citations from one or more lists of references, packages for simple pictures and diagrams (**pic** and **ideal**) and others. All these work with the standard UNIX text formatter **n/troff.** The user invokes as few or as many of these preprocessors as needed—they are generally transparent to each others' commands. The sequence of commands is usually imbedded in a shell file, for example:

```
tbl afile bfile cfile | eqn | nroff
```

and, as with CP/M's SUBMIT, the files can accept parameters from the command line; the form

```
tbl $* | eqn | nroff
```

will process as many files as are specified on the invocation through the table, equation and **nroff** processors. There are also ancillary tools included in real UNIX, such as spelling checkers, word frequency counts, and so on. We'll see these in more detail later. Because all the text files are in a standard format, people are encouraged to develop new applications for text manipulation. In fact, UNIX

UNIX File continued. . .

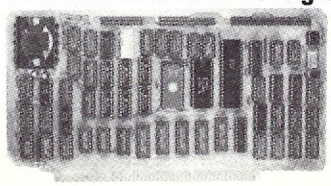
does not have any 'record' structure built into the operating system.

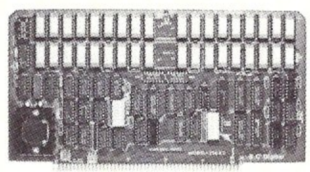
Some people regard this as one of UNIX's main contributions to computer science. Programmers who have to use BDOS will know how deeply the record size of 128 bytes is imbedded into CP/M, even though almost all new systems allow you to use larger sectors on disk. UNIX allows you to request any reasonable number of bytes (from one up to . . .) in a read or write request, and will map the request onto whatever real device is in use, without making you worry whether it is a disk or a console. Each program is therefore free to structure its files as the programmer sees fit.

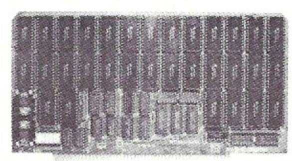
The convention normally used for text files is that the file consists of a series of characters, separated into lines for readability by the 'newline' character (stored as a linefeed character). Almost all programs that handle text—and computer programs can be thought of as text, as can data, words of a document, name and address lists, and anything else that is intended for people to read—can read data in this format. Thus a whole range of utilities works uniformly on all these kinds of data, without knowing what sort of data is involved. And speaking of sorts, the UNIX **sort** utility proves useful in numerous applications—but that's a topic for another column.

Summary

I've talked about two nominally unrelated aspects of UNIX—command files such as **phone** and text manipulation utilities such as **n/troff** and the associated preprocessors. What all these do have in common, to my mind, is their generality—they can be (and are being) used in ways above and beyond their authors' intentions, because the people who wrote them intentionally made them general. This generality pervades much of UNIX and makes it a flexible working environment.







UNIX File continued. . .

Micros at the UNIX Convention (Jan. '83)

I didn't get to San Diego, unfortunately, but I've spoken with several people who were there. And Dave Emberson and Yin Shih ran one simple benchmark on all the machines in the display area. They sent their informal results to the loose nexus of UNIX sites called 'Usenet' through its news facility. It's noteworthy that the 68000 UNIX software market is about evenly split between UniSoft and Microsoft. Exhibitors of the 68000 running UniSoft's UniPlus+ included DUAL, Wicat, Pacific Micro and Corvus, while 68000-based XENIX systems included the Altos, Parallel, TRS Model 16, and the IBM-PC with the Sritek 68000 card. The Apple LISA was shown with both versions of 68000 UNIX! And several other 68000 vendors had their own ports of UNIX.

I predict that independent software vendors will concentrate on UniPlus+ and Xenix to get the widest marketing base; there's already considerable software for the two systems. The 8086 and Z8000 markets are divided, with Xenix having the major share, and fighting off Coherent and several vendors' own ports.

The much-touted National Semiconductor NS16032 was present in one system; presumably it was a prototype, since it did rather poorly in this particular benchmark. Their numbers seem to rate the other machines in about the same order as the *Byte* article "Eratosthenes Revisited: Once More Through the Sieve" by Jim and Gary Gilbreath, January, 1983. Another possibility is that the 16032 is nicely designed, but just plain slow. But it's premature to judge a CPU on one benchmark in one configuration. We'll see how the NS16032 stacks up in the future. The next UNIX Convention is set for the week of July 11th in Toronto. That's my home town, so maybe I'll see you there. If not, watch this space for a report on the conference!

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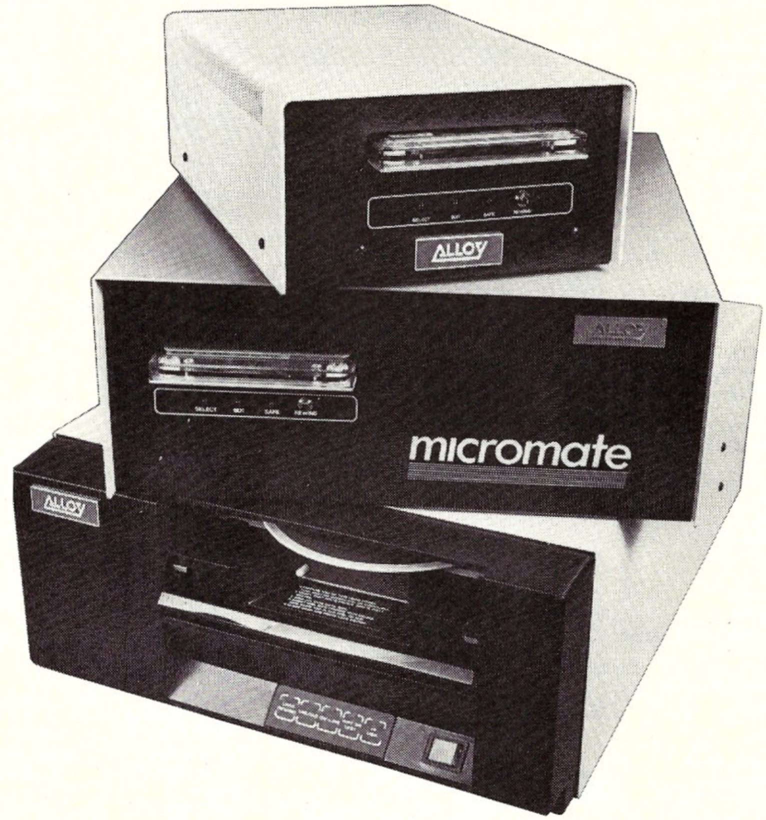

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Mathemagic (Advanced programmable calculator package)	90	65
Graphmagic	90	65
ISA (See Sorcim)		
Kensington Microware Ltd.		
Format II	250	169
Lightning Software		
Mastertype	40	30
Link Systems		
Datafax	199	149
Datalink	100	75
Link Index	195	149
Link Video	55	41
Link Sampler I	60	45
Link Disk	70	51
LJK Enterprises		
Letter Perfect with Mail Merge	150	112
Data Perfect	100	78
Edit 6502	100	78
Lower Case Character Generator (accessory)	25	19
Lotus		
Executive Briefing System	199	149
Micro Lab		
The Invoice Factory	200	144
The Merger	50	37
The Learning System	150	108
Painter Power	40	30
US Constitution Tutor	30	22
English SAT #1	30	22
VisiBlend	50	37
VisiFactory	75	54
The Asset Manager	200	144
The Tax Manager	180	129
Data Factory 5.0	300	216
Wall Streeter	300	216
Payroll Manager	300	216
Microsoft		
Typing Tutor II	25	19
Time Manager	150	116
A.L.D.S. †	125	97
Adios μMath-80	125	97
Adios μMath/μSimp	250	194
M-Sort	195	151
μLisp/μStar	200	156
Multiplan	275	179
MUSE		
Supertext 40/56/70	125	79
Supertext 40/80	175	126
Form Letter Module 48K	100	72
Address Book Mailing List 48K**	50	36
Data Plot 48K**	60	43
Elementary Math Apple Soft 48K**	40	29
The Voice 48K	40	29
**Requires Applesoft, ROM or Apple II Plus		
Omega		
Locksmith	100	75
On-Line Systems		
The General Manager	230	168
Screenwriter II	130	85
The Dictionary	100	70
Expeditor II+ (Applesoft compiler)	135	94
LISA 2.5	80	56
EPFIV (Extended Programming Facility IV)	80	56
Peachtree		
Series 40 GL, AR, AP, Inventory, Payroll (ea)	400	239
Penguin Software		
Complete Graphics System	70	50
Special Effects	40	30
Graphics Magician	60	45
Additional Fonts and Character Sets	20	15
Complete Graphics System II (Apple Tab Ver.)	120	86
Special Effects (Apple Tab Ver.)	70	50
Program Design, Inc.		
The New Step-by-Step	80	58
Sensible Software		
Super Disk Copy III	30	23
Multi Disk Catalog III	25	19
Disk Recovery ("The Scanner")	30	23
Applesoft Plus Structured BASIC	25	19
Disk Organizer II	30	23
DOS Plus	25	19
Quickloader	25	19
Image Printer-Letter Quality	40	30
Image Printer-Epson	40	30
Image Printer-NEC Dot Matrix	40	30
The Bug	50	37
Build Using	30	23
Edit Soft	30	23
Quadrant 6112	35	26
Sensible Speller	125	94
• for Supertext	125	94
• for Apple CP/M	125	94
• Pascal	125	94
BEST (Applesoft Program Optimizer)	40	30
Software Dimensions		
Accounting Plus™		
GL, AR, AP, Inv ea	395	239
All four	1250	669
Software Publishing		
PFS:File	140	99
PFS:Report	125	79
PFS:Graph	140	99
Silicon Valley		
Word Handler	199	145
List Handler	90	68
Dictionary	125	94
Sirius		
Pascal Graphics Editor (48K II/II+)	100	69
Southeastern Software		
Data Capture 4.0	65	45
Data Capture 4.0/Videx, Smarterm, Superterm	90	65
Southwestern Data		
Z-Term Professional †	150	99
ASCII Express	80	59
ASCII Express Professional	130	89
STC		
Professional Time and Billing	395	284
Language Reading Development Program	175	126
Apartment Manager	325	234
Stock Market Software, Inc.		
On Balance Volume Charting (Stock Market analysis) [Includes $300.00 first year maintenance and update fee]	1500	1299
Stoneware		
DBMaster	229	148
Utility Pak #1	99	65
Utility Pak #2	99	65
DBMaster/Hard Disk	499	359
Stat Pac	99	71
Micro Memo	40	30
Electronic Price Sheet	100	72
Compucube	30	22
Graphics Processing System (Standard)	60	45
Graphics Processing System (Professional)	179	129
VisiCorp (Personal Software)		
VisiCalc II 3.3	250	169
VisiFile	250	169
VisiLink	250	169
Desktop Plan II	250	194
VisiPlot	200	156
VisiTrend/Plot	300	234
VisiDex	250	194
VisiTerm	100	65
VisiSchedule	300	234
Business Forecasting Model (req. Visi-Calc)	100	78

† = CPM Softcard needed

APPLE ///

Applied Software Technology		
Versa Form VS-3	495	371
DataMost		
Write On	130	99
Denver Software		
EASy (Executive Accounting System)	725	562
Insoft		
TransForth ///	125	94
ALD System ///	75	56
Link Systems		
Link Index	195	146
Link Video	55	42
Link Sampler I	60	45
Datafax	249	187
Datalink	149	112
Micro Lab		
Data Manager ///	750	562
Software Publishing Corp.		
PFS: File	175	120
PFS: Report	125	86
PFS Graph	175	120
VisiCorp		
Desktop Plan ///	300	234
Visischedule ///	300	234
Visicalc Advanced III	400	312
Business Forecasting Model	100	78

APPLE IIe

Software Publishing	
PFS File	99
PFS Report	79
PFS Graph	99
VisiCorp	
Visicalc Enhanced	202

APPLE HARDWARE

Hayes		
Micromodem II [4]	379	259
• with terminal pgm	409	289
Kensington		
System Saver (Fan)	90	65
Micro-Sci		
A2 35T Disk Drive [5]	479	329
Microsoft		
RAMcard (memory board)	100	69
Softcard (CP/M board)	345	219
Premium System: Softcard, 16K RAMcard, Videx Videoterm 80 col. Card, Softswitch, Osborne CP/M User Guide [5]	695	489
Personal Computer		
Appli-Card (6MHz)	595	429
Videx		
Keyboard Enhancer II	149	99
Videoterm w/Soft-Switch	375	239

* =Manufacturer's trademark.

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WHY PAY MORE?

CIRCLE 185 ON READER SERVICE CARD

The IEEE-696/S-100 Standard Update

by Don and Sol Libes

The IEEE-696/S-100 bus is without doubt the most popular microcomputer busing system in use today. There are over 200 companies manufacturing approximately one thousand S-100 products. The reasons for its popularity can be attributed to the following:

First: the S-100 bus is not processor-dependent. Virtually all the general-purpose microprocessors have been implemented for S-100 based machines. This includes 8-bit micros such as the 8080, Z80, 8085, 6502, 6800 and 6809. And 16-bit micros such as the 8088, 8086, 80286, 9900, Z8000, Pascal Microengine, LSI-11, 68000 and 16032. Over 15 different microprocessors have already been interfaced to S-100.

Second: the availability of about 1000 different products for S-100 based machines. Virtually every peripheral product one can conceive of is currently available as a plug-in for S-100 machines. The list ranges from modems and front panels to sophisticated music synthesizers, 9-track mag tape formatters, and bubble memory. No other bus offers this high a degree of product support.

Third: the power of the S-100 system. S-100 systems can directly address up to 16 megabytes of memory and 64K I/O ports. One can have up to 11 vectored interrupt lines, up to 16 masters (with priority), and up to 22 slaves on the bus. And systems are already operating at system clock speeds of over 10 MHz.

The S-100 bus has been the leader in state-of-the-art technology for microcomputers. Invariably, new state-of-the-art products first appear on S-100 systems before they appear on other computer systems.

Sol Libes, P.O. Box 1192, Mountainside, NJ 07092

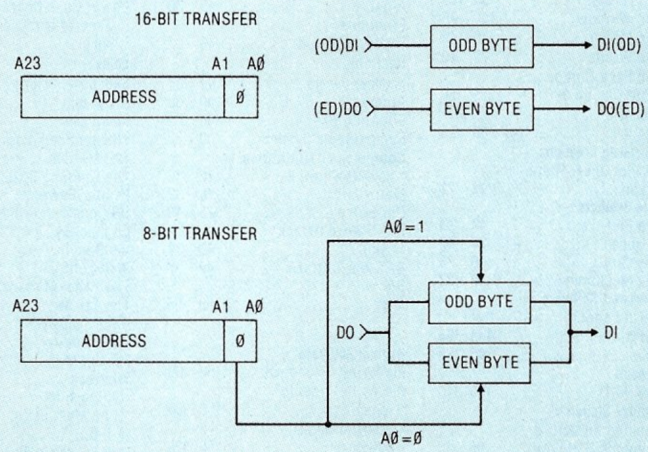


Figure 1. *8/16-bit address and data usage.* © 1982 IEEE

This includes both hardware and software—e.g., the CP/M operating system, Microsoft Basic, floppy disks, hard disks, memory disks, high-resolution graphics, multiuser facilities, multiprocessing, 16-bit micros, and on and on.

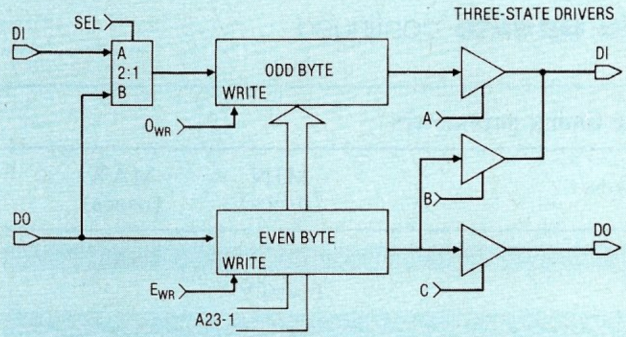
The IEEE-696/S-100 Standard is very important because it lays the foundation for the use of the S-100 busing system by the next generation of high-speed, very powerful microcomputer systems with sophisticated architectures.

The IEEE-696/S-100 Bus Standard was adopted by the IEEE Standards Board at its December 1982 meeting and now is an official IEEE standard. It is, in large measure, the same as the proposed standard, which was published in the January 1980 issue of *Microsystems.*[1]

It was our intent to publish the approved standard

Table 1. Bus transfer timing parameters

		MIN	MAX
tSET	DELAY pHLDA TO ADSB*, SDSB*, DODSB* LOW	0	
tOV	TIME BOTH TEMPORARY AND PERMANENT MASTERS DRIVE THE CONTROL OUTPUT LINES	0.4tCY	
tDH	HOLD TIME ADDRESS, STATUS, AND DATA OUT FROM END OF STROBE TO CDSB* RISING	0.2tCY	
tREL	DELAY FROM HOLD* RISING TO ADSB*, SDSB* AND DODSB* HIGH		1.0tCY
$tHD\overline{HA}$	DELAY FROM HOLD* FALSE TO pHLDA FALSE	1.0tCY	
$t\phi CDSB$	DELAY FROM ϕ RISING TO CDSB* LOW DELAY FROM ϕ RISING TO CDSB* HIGH	0	0.3tCY
$t\overline{HD}HA$	DELAY FROM HOLD* FALLING TO pHLDA RISING	1.0tCY	



SEL selects A for word references, B for byte references.

Output enables: A = $16_{rd} + (8_{rd} \cdot A\emptyset)$
B = $8_{rd} \cdot -A\emptyset$
C = 16_{rd}

Write enables: $E_{wr} = 16_{wr} + (8_{wr} \cdot -A\emptyset)$
$O_{wr} = 16_{wr} + (8_{wr} \cdot A\emptyset)$

Where: 16_{rd} = Device select • sXTRQ* • pDBIN
8_{rd} = Device select • –sXTRQ* • pDBIN
16_{wr} = Device select • sXTRQ* • pWR*
8_{wr} = Device select • –sXTRQ* • pWR*

Figure 2. *8/16-bit memory organization.* © 1982 IEEE

in this issue of *Microsystems*; however, we have not received permission from the IEEE to do so.[2] Therefore we have undertaken to report the changes to the standard and hope that the reader has a copy of the original standard. Also, as of this writing, the IEEE has still not published the standard. It should, however, become available from the IEEE in the near future.[3] In the meantime, to find out about the status of its printing and how to obtain a copy, contact Mark Garetz, CompuPro Division, Godbout Electronics, Oakland Airport, CA 94614; (415) 562-0636. If writing to Mark, enclose a business-size, stamped, self-addressed envelope.

There were many changes to the proposed standard. Most, however, were changes in wording to clarify points which were vague or poorly defined and which do not represent technical changes. We will not discuss these here. Rather, we will confine our discussion to the changes in the standard we feel are substantive.

16-bit data words

For 8-bit microprocessors, the S-100 standard specifies two 8-bit-wide unidirectional data buses (DI=Data In and DO=Data Out). For 16-bit microprocessors, the standard calls for the DI and DO lines to be used as a bidirectional 16-bit-wide data bus. A problem exists in defining this protocol, since some 16-bit microprocessors store their 16-bit words with the low-order byte first and the high-order byte second (e.g., the 8086/8088), while other microprocessors do it the opposite way (e.g., the 68000).

The original version of the proposed standard referred to the high- and low-order bytes of the 16-bit data word. This was not consistent with all 16-bit microprocessors. The problem was resolved by renaming the "low byte" to the "even byte" (ED0-ED7, Even Data) on the DO bus and the "high byte" to the "odd byte" (ED0-ED7, Odd Data) on the DI bus.

When 16-bit data is being transferred, address bit A0 will always be low and data will be transferred as shown in Figure 1 (top). However, during 8-bit transfers, A0=0 indicates that the byte is in an even byte and A0=1 indicates an odd byte, as shown in Figure 1 (bottom). Therefore, there must be circuitry on the CPU card to implement this protocol. A block diagram for this circuit is shown in Figure 2.

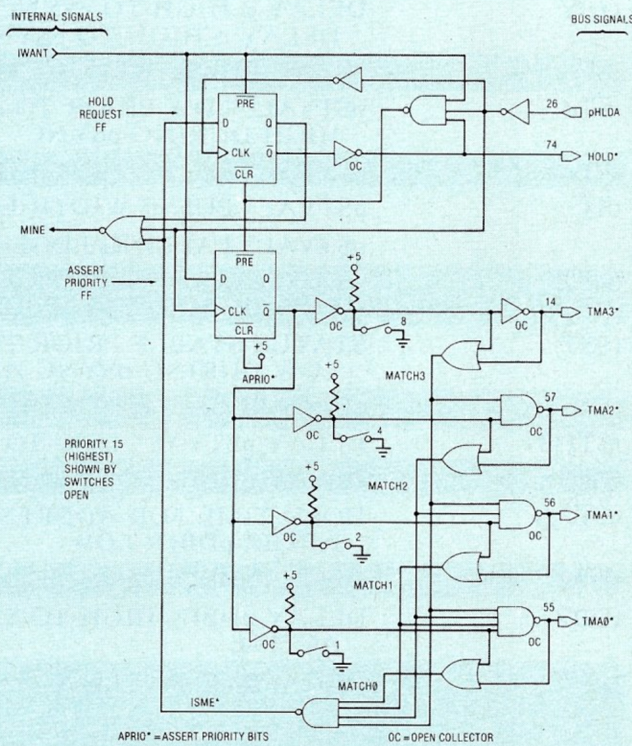


Figure 3. *Bus arbitration example.* © 1982 IEEE

TMA

All references to "DMA" in the proposed standard were changed to "TMA" to avoid confusion. TMA stands for "Temporary Master Access." This term is more appropriate, since a TMA cycle is used when control of the bus is transferred from a Permanent

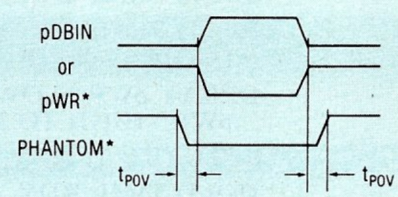


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Figure 4. *Overlap of PHANTOM* and read/write strobes.*

The IEEE-696/S-100 Standard is very important because it lays the foundation for the use of the S-100 bus by the next generation of high-speed, very powerful microcomputer systems.

Table 2. Read/write cycle timing parameters

		MIN (nsecs)	MAX (nsecs)
tCY	ϕ PERIOD	166	2000
tCYH	ϕ PULSE WIDTH HIGH	0.4tCY	
tCYL	ϕ PULSE WIDTH LOW	0.4tCY	
$t\phi SY$	DELAY ϕ HIGH TO pSYNC HIGH; DELAY ϕ HIGH TO pSYNC LOW	10	0.4tCY
tSY	pSYNC PULSE WIDTH HIGH	0.7tCY	
$t\overline{ST}\phi$	pSTVAL* LOW PRIOR TO ϕ HIGH DURING pSYNC	0	
tST	pSTVAL* PULSE WIDTH HIGH	50	
$t\overline{ST}$	pSTVAL* PULSE WIDTH LOW	50	
	pSTVAL* FALLING EDGE PRIOR TO pSYNC HIGH		
$tA\overline{ST}$	ADDRESSES STABLE PRIOR TO pSTVAL* LOW DURING pSYNC HIGH	70	
$tS\overline{ST}$	STATUS STABLE PRIOR TO pSTVAL* LOW DURING pSYNC HIGH	40	
tDB	pDBIN PULSE WIDTH HIGH	0.9tCY	
$t\overline{ST}DB$	DELAY pSTVAL* LOW TO pDBIN HIGH	20	
$t\overline{DB}SY$	DELAY pDBIN LOW TO pSYNC HIGH	0	
$t\overline{DB}AS$	HOLD TIME FOR ADDRESSES AND STATUS AFTER pDBIN LOW	50	
$t\overline{DB}Z$	DELAY pDBIN LOW TO SLAVE DI DRIVERS Hi-Z		70
$tDB\overline{Z}$	DELAY pDBIN HIGH TO SLAVE DI DRIVERS ACTIVE	10	70
tACC	DELAY pSTVAL* LOW TO DATA VALID	SPECIFIED BY MANUFACTURER: WORST CASE MAXIMUM FOR ALL SLAVES AND WORST CASE MINIMUM FOR ALL MASTERS	
$tS\overline{DB}$	DATA VALID SETUP TIME TO pDBIN LOW		
$t\overline{WR}$	pWR* PULSE WIDTH LOW	0.9tCY	
$t\overline{ST}\overline{WR}$	DELAY pSTVAL* LOW TO pWR* LOW	30	
tWRSY	DELAY pWR* HIGH TO pSYNC HIGH	0	
$tD\overline{WR}$	SETUP TIME DO VALID TO pWR* LOW	0.1tCY	
tWRASD	HOLD TIME ADDRESSES, STATUS, AND DO FROM pWR* HIGH	0.2tCY	
tWRMR	DELAY pWR* LOW TO MWRT HIGH; DELAY pWR* HIGH TO MWRT LOW		30
$t\overline{RDY}\phi$	SETUP TIME RDY, XRDY, SIXTN* TO ϕ RISING	70	
$t\phi RDY$	HOLD TIME RDY, XRDY, SIXTN* AFTER ϕ RISING	20	
tPOV	OVERLAP OF PHANTOM* AND pDBIN OR pWR*	30	
$tSY\overline{ST}$	DELAY FROM pSYNC HIGH TO pSTVAL* LOW	30	
$tA\phi$	ADDRESSES STABLE PRIOR TO ϕ HIGH DURING pSYNC HIGH	80	
$tST\phi$	STATUS STABLE PRIOR TO ϕ HIGH DURING pSYNC HIGH	50	

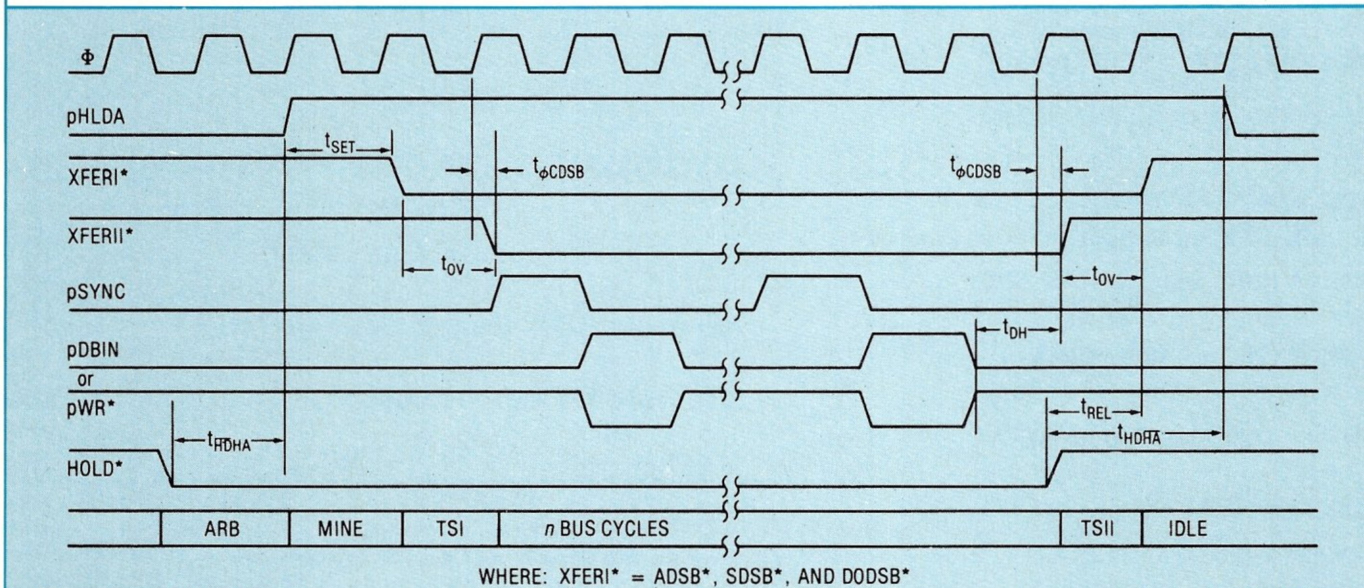

Figure 5. *TMA timing.* © 1982 IEEE

Master to a Temporary Master. The recommended TMA bus arbitration circuit was revised and is shown in Figure 3. For a discussion of TMA operation, see Dave Hardy's "S-100 Bus" column, also in this issue.

PHANTOM

The PHANTOM* line is now required to disable memory slaves for both read and write cycles. The timing for PHANTOM* was redefined as occurring no later than 30 nanoseconds before a read or write strobe and lasting until at least 30 nanoseconds after the read or write strobe to ensure reliable operation, as shown in Figure 4.

Control bus timing

The standard now recommends that new memory slaves be configured so as to respond to the MWRT signal.

The PWRFAIL* signal is now required to go low at least 16 milliseconds before the local voltage regulators drift out of spec, and stay low for at least 16 milliseconds to ensure reliable operation.

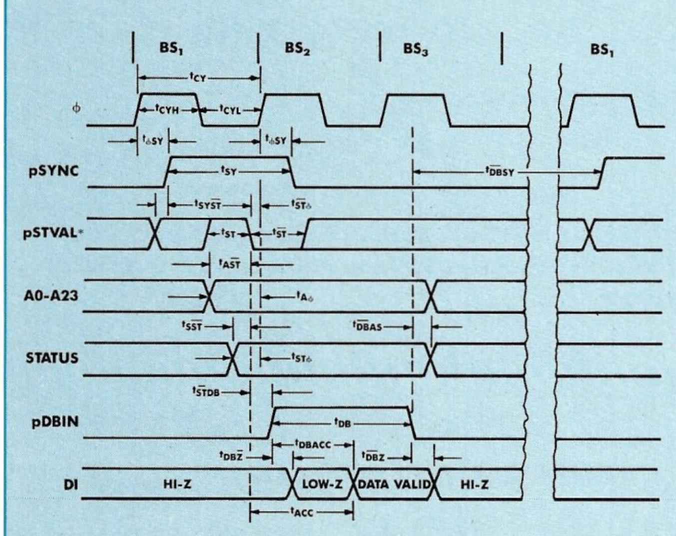

Figure 6a. *Read cycle timing diagram* © 1982 IEEE

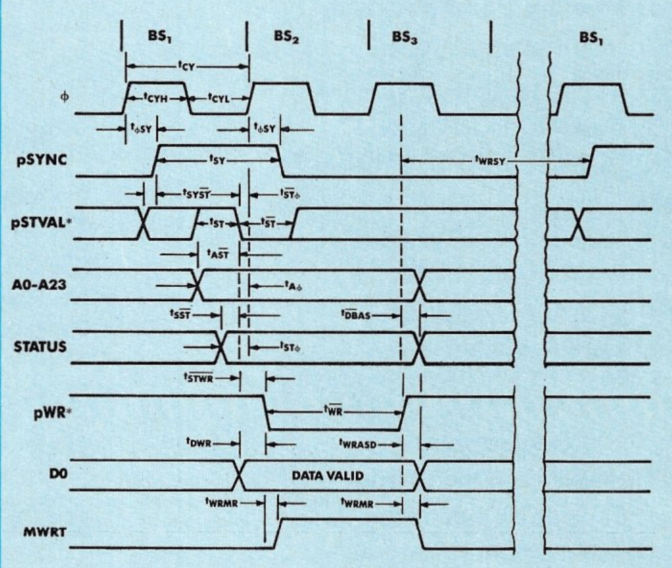

Figure 6b. *Write cycle timing diagram.* © 1982 IEEE

The S-100 bus has been the leader in state-of-the-art technology for microcomputers. Invariably, new products appear first on the S-100 system.

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The bus timing was also revised to ensure more reliable operation, as shown in Figures 5 and 6 and Tables 1 and 2.

Physical changes

The following changes were made in defining the physical design of plug-in boards. The "Clear Area" originally specified at the top center of the board and intended for a hold-down bar space was removed, as

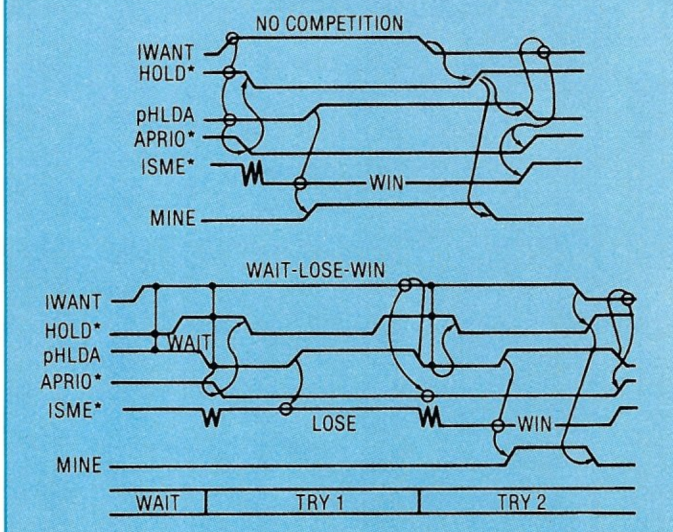


Figure 6c. *Bus arbitration timing diagrams.* © 1982 IEEE

this space is too often needed for connectors to external devices. Further, a "double height" (10″ high) board is now permitted as an option.

Notes

1. The January 1980 issue of *Microsystems* is no longer available from *Microsystems*. However, Electronic Control Technology, 763 Ransey Ave., Hillside NJ 07205; tel: (201) 686-8080, has a limited number of copies of that issue (which is now a collector's item), and is selling them for $4 plus a $1 shipping/handling charge. The proposed IEEE-696/S-100 Standard also appears in a book written by Sol Libes and Mark Garetz, entitled *Interfacing to the S-100/IEEE-696 Bus* (Osborne/McGraw-Hill).

2. The IEEE has refused to give us permission to reprint the standard in its entirety. This represents a change in policy from 1979, when we did receive permission and published the complete proposed standard in our January 1980 issue. Permission to print was refused despite the fact that one of the authors of this article wrote portions of the standard (without compensation) and could obtain permission from the other co-authors of the standard. It is the IEEE's position that the standard is the work of an IEEE committee and not of individuals, and hence the individuals have no rights in this matter; further, that such publication represents competition to the sale of the standard by the IEEE.

3. The IEEE has indicated that the printed standard may be available from them as early as next month (June 1983). No information was available on how and where to order it when we went to press.

S-100 Product Directory

by Don & Sol Libes

The following chart is a concise listing of approximately 500 S-100 products available from almost 150 companies. We have compiled this chart from a questionnaire mailed to over 200 companies, which according to our records manufacture one or more S-100 products. Regretfully, about one quarter of the companies choose not to respond and hence are not listed in this directory. In other words, we believe that there are really 50 more companies and another 100-200 products that really should appear in this directory.

This directory comprises approximately 500 products, and hence it was necessary to omit specifications for the products. We hope, this fall, to publish this directory in book form and include specifications on all the products. In the meantime, we suggest that you use the *Microsystems* reader service card to obtain the detailed specifications from the supplier.

In some cases we were able to list some of the specifications. For example, we were able to indicate the microprocessors used in the complete systems, single board computers and CPU cards. In these cases the following abbreviations were used:

85 = 8085
86 = 8086
88 = 8088
032 = 16032
286 = 80286
68K = 68000
Z8K = Z8000

In the case of the RAM and ROM cards we indicated the maximum memory that the card could contain. In the RAM cards an "S" or "D" following the memory size indicates either static or dynamic type memory.

For the I/O interface cards we indicated the maximum number of serial and parallel ports. Thus the designation "3S+2P" indicates that the board can contain up to three serial and two parallel interfaces. Note that many of the I/O cards also contained interrupt controllers and/or ROM circuits. Regretfully we could not fit this information in.

For the video and graphic controller cards we indicated either the number of lines and columns (e.g., 24x80) or the pixel resolution, and whether the board has color capabiltiy.

We recognize that this directory is not complete, since many companies did not respond to our questionnaire. Therefore, companies that produce S-100 products and who wish to be listed in future directories should send us information on their products.

Sol Libes, P.O. Box 1192, Mountainside, NJ 07092

	Complete Systems	Single Board Computers	CPU 8-bit	CPU 16-bit	Memory RAM (K)	Memory ROM (K)	I/O	Video (lines x cols.)	Graphics (Pixels)	Local Area Net	IEEE-488	Modem	Disk Controller Floppy	Disk Controller Hard	Tape Controller	Analog I/O	EPROM Programmer	Clock/ Calendar	Speech Synthesizer	Prototyping Extender	Card Cage/ Motherboard	Mainframes	Power Supplies	Other	Reader Service Card Numbers
Ackerman Digital Systems		6809			32S 128S	2-512							●						●	●		●			1
Action Computer Enterprises		Z80		8086			8S																	Interrupt Controller	183
ADES														●	●										2
Advanced Computer Products					64S															●					3
Advanced Digital Corp.	Z80	Z80												●											148
Alloy Computer Products															●										4
Alpha Micro	68K			68K	128D		4S,6S, 1P						●	●	●										5
Applied Innovations				8088 8086																					6
Applied Systems Corp.		8085																							7
Artec Electronics		8085			8/16/ 32S	32							●												8
ASC Associates														●											9
Automated Control Systems																●									10
California Computer Systems		Z80			64D 16/32S		4,6S 4P 2S+2P						●	●						●	●	●			11
California Data Corp.																●									12
California Digital																						●			13
Cambridge Development Lab.								28x80																	14
Casheab																								Music Synthesizer	15
Cer-Tek																	●								76
Chrislin Industries					64D																				17
Components Express					64S																				226
Compupower Corp.																							●		18

	Complete Systems	Single Board Computers	CPU 8-bit	CPU 16-bit	Memory RAM (K)	Memory ROM (K)	I/O	Video (lines x cols.)	Graphics (Pixels)	Local Area Net	IEEE-488	Modem	Disk Controller Floppy	Disk Controller Hard	Tape Controller	Analog I/O	EPROM Programmer	Clock/Calendar	Speech Synthesizer	Prototyping Extender	Card Cage/Motherboard	Mainframes	Power Supplies	Other	Reader Service Card Numbers
CompuPro/Godbout Electronics	8085 8088		Z80 8085	88/86 286/68K 16032	16/32/ 64/128S	32	2S,8S 3P+1S 1P+3S		128x128 Color				●	●			●				●	●		I/O processor, multi-function, RAM, disk & interrupt controller cards	
Computer Design Labs							1P+2S +ROM																		84
Computer Dynamics														●											19
Computer Systems	8088 68K	8088		68K																					20
Compu/Time					256D								●					●							21
Corvus Systems														●											22
Cotton Associates	Z80				32S																				23
Cromemco	Z80 68K	Z80	Z80	68K	4S;16/ 64/256/ 512D	32	3S+2P 4P,8P 2S+2P		754x482 Color	C-NET	●		●	●		●				●	●		●	Joysticks, AC controller, I/O processor cards	24
Cybertext Corp.																								S-100-to ≈ Compu-writer typesetter interface card	25
Cygnus Systems																			●						26
D&W Digital											●														66
Destek Group										Desnet															27
Digiac Corp.	Z80		Z80		64D		2P+4S						●												29
Digicomp Research Corp.	Z80 64K		Z80	68K	64/128 256D		3P+4S																	Pascal card	30
Digital Graphic Systems	Z80/85 86/68K								484x512 512x512 Color																249
Digital Media																								PAL/FPLA programmer	31
Digital Multi-Media Control																●									32
Digital Research Computers					16/32/ 64S	32																			33
Digitex Div./InterCare	Z80	Z80																						System runs Datapoint software	34
Douglas Electronics																				●	●				35
Dual Systems Control Corp.	68K			68K	256D	64	4S							●		●		●			●				36

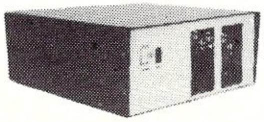
S-100 Product Directory continued . . .

Retail Showroom
1780 West 2300 South
Salt Lake City, Utah 84119

The Great Salt Lake Computer Company, Inc.

Mail Orders
P.O. Box 26816
Salt Lake City, Utah 84126

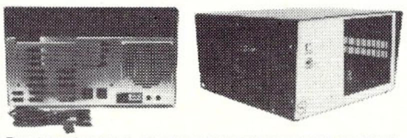
QT 5¼" MAINFRAME



- Provisions for any 2 - 5¼" drives • 15 ea DB 25 cutout
- 2 ea 50 pin • 2 ea 34 pin • 1 ea Centronic • EMI filter (fused)
- 2 AC outlets • Avbl. with 6 - 8 or 12 slot motherbd • Power supply (+8V16A/±16V3A/+12V5A)

QTC-MF+MD8 (8 slot MB) $720.00
QTC-MF+MD12 (12 slot MB) $765.00

QT 8" MAINFRAME

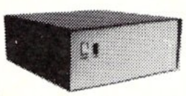


- Provision for any 2 - 8" drives (hard or floppy) • 15 ea DB 25 cutout • 2 ea 50 pin • 2 ea 34 pin • 1 ea Centronic • EMI filter (fused) • 2 AC outlets • Avbl with 6 - 8 or 12 slot motherbd
- Power supply (+8V16A/±16V3A/+5V6A/−5V1A/+24V6A)

Desk Top Version
QTC-MF+DD8 .... $800.00
QTC-MF+DD12 .... $850.00

Rack Mount Version
QTC-RMF-DD8 .... $900.00
QTC-RMF-DD12 .... $950.00

QT STANDARD MAINFRAME

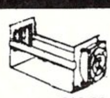


- Provisions for any 2 - 5¼" drives
- 15 ea DB 25 cutout • 2 ea 50 pin
- 2 ea 34 pin • 1 ea Centronic
- EMI filter (fused) • 2 AC outlets
- Avbl with 6-8-12-18 or 22 slot MB
- Power supply (+8V16A±16V3A)

Desk Top Version
QTC-MF+12 .... $675.00
QTC-MF+18 .... $720.00
QTC-MF+22 .... $800.00

Rack Mount Version
QTC-RMF+12 .... $775.00
QTC-RMF+18 .... $820.00
QTC-RMF+22 .... $900.00

QT S-100 CARD CAGES



- Made of anodized steel • Card guides for ea. MB • 1 - Indicates w/MB
- 2 - Indicates w/MB + 1 ea fan
- 3 - Indicates w/MB + 2 ea fans

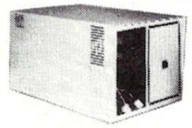
QTC-CC4	$20.00	CC12	$60.00
CC4-1	$75.00	CC12-1	$165.00
CC6	$25.00	CC12-2	$200.00
CC6-1	$90.00	CC12-3	$225.00
CC6-2	$115.00	CC18	$75.00
CC8	$35.00	CC18-1	$220.00
CC8-1	$100.00	CC18-2	$250.00
CC8-1	$135.00	CC18-3	$280.00

QT S-100 MOTHERBOARDS

- Silence Plus • Built in Termination • IEE696 • Terminal strip for easy power connection

4 Slot Motherboards		6 Slot Motherboards	
QTC-MB4BB	$20.00	QTC-MB6BB	$30.00
QTC-MB4K	$35.00	QTC-MB6K	$50.00
QTC-MB4A	$45.00	QTC-MB6A	$65.00
8 Slot Motherboards		**12 Slot Motherboards**	
QTC-MB8BB	$35.00	QTC-MB12BB	$40.00
QTC-MB8K	$65.00	QTC-MB12K	$95.00
QTC-MB8A	$95.00	QTC-MB12A	$135.00
18 Slot Motherboards		**22 Slot Motherboards**	
QTC-MB18BB	$65.00	QTC-MB22BB	$75.00
QTC-MB18K	$135.00	QTC-MB22K	$150.00
QTC-MB18A	$185.00	QTC-MB22A	$200.00

QT 8" THINLINE MAINFRAME

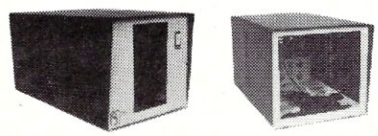


- Provisions for 2 ea 8" thinline drives • 15 ea DB 25 cutout
- 2 ea 50 pin • 2 ea 34 pin • 1 ea Centronic
- EMI filter (fused) • 2 AC outlets
- Power supply (+8V16A/−5V1A/+24V6A)

Cadillac Version
QTC-IMF+DD6C (6 slot MB) $500.00

Ford Version
QTC-IMF+DD6F $389.00

QT DISK DRIVE CABINETS



"All in One" Vertical Disk Drive Cabinet

For 1) 2 ea or 4 ea 8" thinline drive
2) 2 ea standard 8" drives
3) 1 ea hard disk + 1 ea standard 8"

- Power supply (+5V6A/−5V1A/+24V6A)
- Positive pressure fan w/filter • EMI filter
- Power interface cable for any 8" drive

QTC-DDC88V *For 2 standard size 8" drives* $325.00
QTC-DDC88T *For 2 thinline 8" drives* $325.00
QTC-DDC8V *For 1 ea 8" drive* $275.00

Horizontal Disk Drive Cabinet

For 2 ea 8" standard size drives
- Power supply (+5V6A/−5V1A/+24V6A)
- Interface cable for any 8" drive

QTC-DDC88H $300.00

DISK DRIVES

8" Disk Drives

801R Shugart SS/DD $355.00
851R Shugart DS/DD $455.00
DT8 (842) Oume DS/DD $465.00
BEST BUY M-2894-63 MIT DS/DD *(call for qty price)* $409.00
M-2896-63 MIT 8" thinline DS/DD $475.00

5¼" Disk Drives

TM100-1 or B-51 for IBM $200.00
TM100-2 or B-52 for IBM $270.00

QT DISK DRIVE SUB ASSEMBLY

- Vertical or horizontal disk cabinet - 11"h × 11"w × 20"d 5"h × 17"w × 20"d

QTC-DDS+0 *w/2 ea SS/DD Siemens drives* $595.00
QTC-DDS+1 *w/1 ea DS/DD MIT 2894-63* $695.00
QTC-DDS+2 *w/2 ea DS/DD MIT 2894-63* $1150.00
QTC-DDS+3 *w/2 ea SS/DD 801R Shugart* $975.00
QTC-DDS+4 *w/2 ea DS/DD 8" thinline drives* $1150.00

TERMINALS

Televideo 925C $725.00
Televideo 970 .... $1095.00

MONITORS

BMC12A (15 MHZ) $75.00
BMC12EV (20 MHZ) $129.00
BMC Color #9191 .... $279.00
Sanyo 12" Green (15 MHZ) $80.00

PRINTERS

Star-Gemini $355.00
OK1-82A (120 cps) Serial + pad $389.00
OK1-83A (120 cps) Serial + pad $649.00
OK1-84A (200 cps) Serial $1079.00
OK1-92A (160 cps) $519.00
OK1-93A (160 cps) $899.00
NEC-8023A $475.00
BEST BUY
Toshiba P-1350 (LTR quality) $1575.00
Tractor $295.00
Sheet feeder $1095.00

BOARD SETS

Best Bare Board Set Available
QTC-SBC 2/4 CPU
QTC-EXP+III 256K Memory bd.
QTC-FDC 5/8 Floppy disk controller
Bare Board Set $150.00
1) Includes manuals & assembly instructions
2) Parts available
3) Monitor & B10S available

QT CLOCK/CALENDAR

S-100 or Apple • Time in hrs, min, sec. • AM/PM or Military Format • Date in Mo., Day, Yr, Day of Week & Leap Year recognition • 4 hard interrupts (1024 Hz, 1Hz, 1 min, 1 hr)
- On board battery (will last 14 mos. w/no power on)

QTC-CCS-BB (S-100) $60.00
QTC-CCS-K (kit) for S-100 .... $100.00
QTC-CCS-A (A+T) for S-100 .... $125.00
QTC-CCA-BB (for Apple) $40.00
QTC-CCA-A (for Apple) $125.00

CPU BOARDS

QTC-SBC 2/4 BB $50.00
QTC-SBC 2/4 A A+T $265.00
QTC-Z+80 BB $28.00
Teletek FDC-I A+T $595.00
Teletek Systemaster A+T $695.00

MEMORY BOARDS

DYNAMIC (64K/256K or 1 MEG)
QTC-EXP+III Bare Bd. $65.00
QTC-EXP+III 64K A+T $450.00

STATIC
S-RAM 64K BB $60.00
S-RAM 64 A+T $349.00
S-RAM 128K A+T *(Fully IEEE696)* $895.00

I/O

QTC-I/O+BB *2 SER 3 PAR* $60.00
QTC-I/O + A+T $340.00
QTC-ADA *ADA Converter* A+T $375.00
QTC-Dual GPIB-488 *IEEE 488 Interface bd.* A+T $475.00

DISKETTES

5¼" soft sector (for Apple) .... $17.00 for 10
1 yr warranty - with hub ring
5¼" soft sector DS/DD .... $24.00 for 10
5¼" plastic library case .... $2.50 ea, $20.00 for 10
Flip file storage case *(stores 70 diskettes)* .... $19.00 ea

APPLE CORNER

Micro-SCI Drive $269.00
w/controller .... add $79.00
Rana Elite I $299.00
Rana Elite II $439.00
Rana Elite III $569.00
Rana Controller $99.00
QT Apple Compatible Drive $235.00

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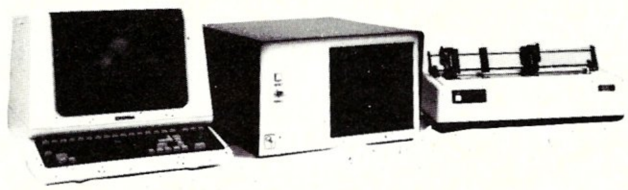
S-100 MICRO-SYSTEMS



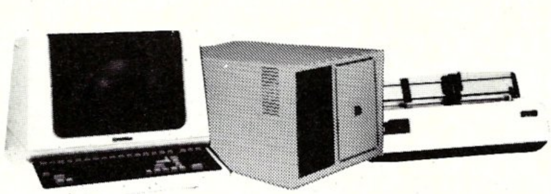
QT Maxi-System Package

$5395.00

List $7995.00 Save $2600.00

Includes:

- **MAINFRAME -** QTC-MF+DD8 Desk Top or Rack Mount Mainframe (11"h × 17"w × 20"d)
- **TERMINAL -** Televideo 925C w/detachable keybd.
- **PRINTER -** Your choice of **Toshiba P-1350** (Letter quality 100 cps) or **OKI-DATA 84A** (200 cps)
- **MOTHERBOARD -** 8 slot standard & 12 slot optional
- **CPU -** Systemaster single bd. computer (4Mhz)
- **MEMORY -** 64K RAM standard Expandable to 256K
- **FLOPPY DISK CONTROLLER -** Supports 5¼ or 8" drives
- **DISK DRIVES -** 2 megabytes on line • Double side double density 8" drives
- **I/O PORTS -** 2 Serial + 1 parallel port
- **MISCELLANEOUS FEATURES -** Key lock switch • 2 AC outlets for printer + terminal • Filtered fan • 15 ea DB25 cutouts
- Cables • Documentation
- **SOFTWARE -** CPM® Standard • 8 slot motherbd. (12 slots optional)



QT Maxi-Mini System Package

$3495.00

- Maxi in capacity (2, 4 MG)
- Mini in price and size (11"h×11"w×20"d)

Includes:

- **MAINFRAME -** QTC-IMF+DD6 Desk Top Mainframe (11"h×11"w×20"d)
- **TERMINAL -** Televideo 925C w/detachable keybd.
- **PRINTER - OKI-DATA 82A** (200 cps)
- **MOTHERBOARD -** 8 slot standard & 12 slot optional
- **CPU -** Systemaster single bd. computer (4Mhz)
- **MEMORY -** 64K RAM standard Expandable to 256K
- **FLOPPY DISK CONTROLLER -** Supports 5¼ or 8" drives
- **DISK DRIVES -** 2 megabytes on line • Thinline double side double density 8" drives
- **I/O PORTS -** 2 Serial + 1 parallel port
- **MISCELLANEOUS FEATURES -** Key lock switch • 2 AC outlets for printer + terminal • Filtered fan • 15 ea DB25 cutouts
- Cables • Documentation
- **SOFTWARE -** CPM® Standard • 8 slot motherbd. (12 slots optional)

CONNECTOR CORNER

RS232 Connectors

SOLDER TYPE		FLAT RIBBON TYPE	
DB25P	**2.50**	IDC25P	**6.25**
DB25S	**3.00**	IDC25S	**6.60**
DB25 Hood	**1.00**	IDC25 Hood	**1.60**

HARD DISK SUB ASSEMBLY

QTC-DDC8V cabinet with SA1004 - 10 MG Hard Disk
Only **$1550.00**

Retail Showroom
1780 West 2300 South
Salt Lake City, Utah 84119

The Great Salt Lake Computer Company, Inc.

Mail Orders
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Salt Lake City, Utah 84126

CIRCLE 206 ON READER SERVICE CARD

S-100 Product Directory continued . . .

	Complete Systems	Single Board Computers	CPU 8-bit	CPU 16-bit	Memory RAM (K)	Memory ROM (K)	I/O	Video (lines x cols.)	Graphics (Pixels)	Local Area Net	IEEE-488	Modem	Disk Controller Floppy	Disk Controller Hard	Tape Controller	Analog I/O	EPROM Programmer	Clock/ Calendar	Speech Synthesizer	Prototyping Extender	Card Cage/ Motherboard	Mainframes	Power Supplies	Other	Reader Service Card Numbers
Dylon Corp.											●														37
Dynabyte Business Computers	Z80 8086																								38
Echo Communications Corp.			Z80																						39
Eclipse Data Products													●	●						●	●	●			40
Educational Microcomputer Systems		68K	Z80					24x80																	41
Electralogics					64S		8S+1P											●							42
Electronic Control Technology	8080 Z80		8080		16/48/ 64S	64	3S+1P +ROM			●										●	●	●	●		56
Empirical Research Group	68K			68K	64S 256D		4S						●												43
Exidy Systems Inc.																								S-100 interface for Sorcerer computer	44
Extek																	●								45
Fischer Computer Systems																								Shaft encoder-counter card	46
Fulcrum Computer Products					64S		2S	25x80			●											●			47
Genesis Computer Corp.	Z80																								173
Graphics Development Labs									●																48
GSR Computers					256D								●					●							50
Hayes Microcomputer Products												●													51
Heath/Zenith Data Systems	8085 8088		8080 8085		256D		4S						●	●											52
IMS International	Z80		Z80		64D		1P+2S	24x80		●			●	●							●				53
IMSAI Div. Fischer-Freitas	8080 8085				16/32/ 64S		2S 4P	24x80					●							●	●		●	Interrupt & stereo sound controller cards	54
Independent Business Systems	Z80	Z80													●										55
Inner Access Corp.	Z80			68K			8S+ ROM										●			●				PROM/EPROM simulator card	57

	Complete Systems	Single Board Computers	CPU 8-bit	CPU 16-bit	Memory RAM (K)	Memory ROM (K)	I/O	Video (lines x cols.)	Graphics (Pixels)	Local Area Net	IEEE-488	Modem	Disk Controller Floppy	Disk Controller Hard	Tape Controller	Analog I/O	EPROM Programmer	Clock/ Calendar	Speech Synthesizer	Prototyping Extender	Card Cage/ Motherboard	Mainframes	Power Supplies	Other	Reader Service Card Numbers
Integrand																						●	●		49
Intercontinental Micro Systems		Z80	Z80		256D																				58
I/O Technology					128S		3P+2S				●					●		●		●					59
ISA Co., Ltd.		Z80									●		●	●											60
Ithaca Intersystems	Z80 Z8K		Z80 Z8K		64S 256D		4S						●	●	●									Memory management card	63
Jade Computer Products	Z80		Z80		64S		2P+2S 6S						●							●	●			Plug-in front panel type card	16
JC Systems	Z80	●											●												64
J.E.S. Graphics									144x192 288x192 Color							●									65
Jones Futurex, Inc.																								Encryption/ Decryption	68
Konan Corp.							1P+8S							●	●										69
Kramer Systems International																								S-100 interface for Superbrain, Compu-Star, Televideo, etc.	70
Laboratory Computer Systems																				●					71
Lehigh Valley Logic, Inc.																								Encryption/ Decryption	72
Lomas Data Products				8086 8088	64/128/ 256D		2P+2S						●												248
Macrotech International					1MD 256D																				73
Marcey, Inc.																						●			28
Measurement Systems & Controls					64S																				74
Memory Merchant			Z80	8088	64S																				98
Methode Electronics																				●					75
Micro Designs																								Floating point processor card	77
Micro Dynamics Corp.									256x192								●								62

S-100 Product Directory continued . . .

			CPU		Memory								Disk Controller												
	Complete Systems	Single Board Computers	8-bit	16-bit	RAM (K)	ROM (K)	I/O	Video (lines x cols.)	Graphics (Pixels)	Local Area Net	IEEE-488	Modem	Floppy	Hard	Tape Controller	Analog I/O	EPROM Programmer	Clock/Calendar	Speech Synthesizer	Prototyping Extender	Card Cage/Motherboard	Mainframes	Power Supplies	Other	Reader Service Card Numbers
Micro-Expander	Z80																								78
Micromation													●												79
Micro Mike's, Inc.	Z80																								80
Mimic, Inc.							1P												●						82
Monitor Dynamics														●											83
Morrow Designs	Z80		Z80		64S		1P+3S 4P+2S						●	●						●					85
Mullen Computer Products																				●					86
MuSys Corp.	Z80	Z80																							87
National Instruments											●														88
Netronics R & D, Ltd.	8085	8085			16/32/48/64D	8							●						●						89
New World Computer Co.														●											90
North Star Computers	Z80		Z80		32/64D		4S						●	●	●				●					Floating point processor card	91
Optronics Technology																	●	●							188
Owens Associates	Z80																								92
P & E Microcomputer Systems																								PROM/EPROM simulator card	93
Para Dynamics Corp.																						●	●		94
ParaGraphics									512x576																95
PCE Systems					64/128/256D									●											61
Perex, Inc.										Ether-net															96
Pickles & Trout											●														97
Piiceon				8086 8088	64/256D								●	●											99

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	Complete Systems	Single Board Computers	CPU 8-bit	CPU 16-bit	Memory RAM (K)	Memory ROM (K)	I/O	Video (lines x cols.)	Graphics (Pixels)	Local Area Net	IEEE-488	Modem	Disk Controller Floppy	Disk Controller Hard	Tape Controller	Analog I/O	EPROM Programmer	Clock/Calendar	Speech Synthesizer	Prototyping Extender	Card Cage/Motherboard	Mainframes	Power Supplies	Other	Reader Service Card Numbers
Polymorphic Systems	8080 80186		8080					16x64						●								●			100
Potomac Micro-Magic												●							●					Touch-tone transmitter-receiver card	101
Processor Interfaces, Inc.														●	●										102
QDP Computer Systems	Z80																								103
QT Computer Systems	Z80	Z80																●			●	●			104
Quality Computer Services														●											105
Quantex															●										106
Quasar Data Products	Z80													●											107
Random Factors, Ltd.																●									108
S-100, Inc.						16														●				Cassette I/O card	184
S.C. Digital			Z80		64/128 256D 16/32S	32	1P+3S						●												109
Scion Corp.								40x85	512x480 Color															Graphics terminal, Frame Grabber, color decoder & color mix cards	110
Scitronics																		●						Power monitor & power controller cards	111
SDSystems	Z80		Z80		64/ 256D		4S	24x80					●				●								112
Seattle Computer Products	8086			8086	64S		2S+4P						●	●											113
SemiDisk Systems																								Disk emulator board	114
Sierra Computer Products						16/32											●			●					115
Sierra Data Sciences	Z80	Z80	Z80				4S						●	●							●	●		MUX/Display board	116
Sigen Corp.														●											117
Signum Systems																								In-circuit 8048 emulator card	118
Simpliway Products								24x80																	67

S-100 Product Directory continued . . .

	Complete Systems	Single Board Computers	CPU 8-bit	CPU 16-bit	Memory RAM (K)	Memory ROM (K)	I/O	Video (lines x cols.)	Graphics (Pixels)	Local Area Net	IEEE-488	Modem	Disk Controller Floppy	Disk Controller Hard	Tape Controller	Analog I/O	EPROM Programmer	Clock/Calendar	Speech Synthesizer	Prototyping Extender	Card Cage/Motherboard	Mainframes	Power Supplies	Other	Reader Service Card Numbers
Ski Electronics				8080																					119
Snow Micro Systems, Inc.												●				●		●						Ham station, RTTY, stepper motor controller & front panel cards	120
SPC Technologies, Inc.															●									Math processor card	121
SSM Microcomputer Products			8080 Z80		16/64S	16/128	8S 2P+2S	16x64 24x80 50x80												●					122
Static Memory Systems, Inc.					16/64S	32																			123
Sunny International																						●	●		179
Suntronics Co.	Z80	Z80	Z80										●					●		●	●	●			124
Systems Group			Z80		64/ 128D		8S						●												125
Tarbell Electronics	Z80		Z80		64S		1P+2S						●												223
Tecmar, Inc.	8086 Z80		Z80	8086	64D 16S	4	1P+2S						●	●		●		●						Video digitizer & monitor interface cards	126
Teleram Communications Corp.																								Bubble memory card	127
Teletek		Z80	Z80		64/ 256D	8	2P 2P+4S						●	●	●									Intelligent I/O card	220
Theta Labs, Inc.							4S 2P+2S																		128
U.S. Micro Sales	Z80		Z80		64S								●	●	●						●	●	●		129
Vector Electronics Co.																				●	●	●			130
Via Video, Inc.																								Color graphic NTSC video encoder	131
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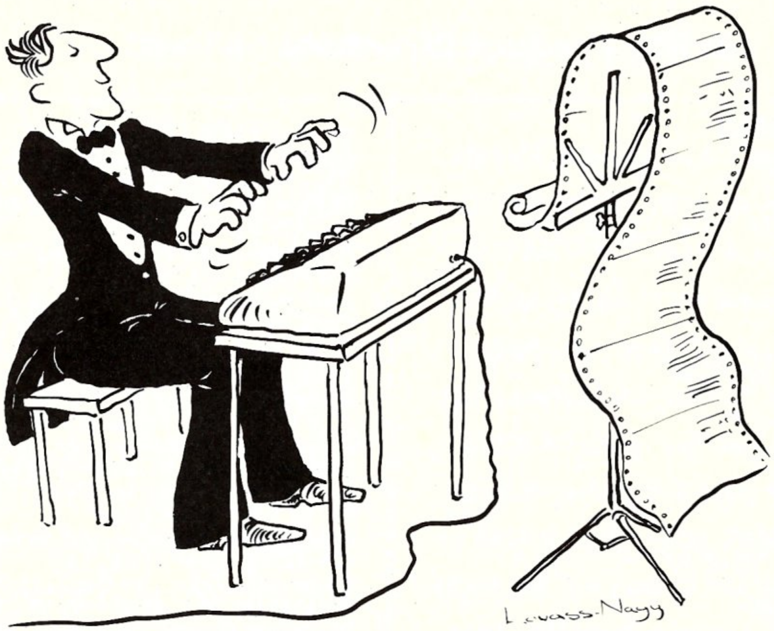


The Well-Tempered Cross-Assembler

Before Johann Sebastian Bach developed a new method of tuning, you had to change instruments practically every time you wanted to change keys. Very difficult.

Before Avocet introduced its family of cross-assemblers, developing micro-processor software was much the same. You needed a separate development system for practically every type of processor. Very difficult and very expensive.

But with Avocet's cross-assemblers, a single computer can develop software for virtually any microprocessor! Does that put us in a league with Bach? You decide

Development Tools That Work

Avocet cross-assemblers are fast, reliable and user-proven in over 3 years of actual use. Ask NASA, IBM, XEROX or the hundreds of other organizations that use them. Every time you see a new microprocessor-based product, there's a good chance it was developed with Avocet cross-assemblers.

Avocet cross-assemblers are easy to use. They run on any computer with CP/M* and process assembly language for the most popular microprocessor families.

XASM05	6805	$200 each
XASM09	6809	
XASM18	1802	
XASM48	8048/8041	
XASM51	8051	
XASM65	6502	
XASM68	6800/01	
XASMF8	F8/3870	
XASMZ8	Z8	
XASM400....	COP400	
XASM75	NEC 7500	$500

(Coming soon: XASM68K .... 68000)

Turn Your Computer Into A Complete Development System

Of course, there's more. Avocet has the tools you need from start to finish to enter, assemble and test your software and finally cast it in EPROM:

Text Editor VEDIT -- full-screen text editor by CompuView. Makes source code entry a snap. Full-screen text editing, plus TECO-like macro facility for repetitive tasks. Pre-configured for over 40 terminals and personal computers as well as in user-configurable form.

CP/M-80 version $150
CP/M-86 or MDOS version $195
(when ordered with any Avocet product)

ROM Simulator -- ROMSIM by Inner Access eliminates need to erase and reprogram EPROM. Installed in an S-100 host, ROMSIM substitutes RAM for EPROM in external target system. 16K memory can be configured to simulate the 2708, 2758, 2716, 2516, 2732, 2532, 2764, 2564 in either byte or word organization. Avocet's configurable driver makes loading of HEX or COM files fast and easy.

From $495 depending on cabling and RAM installed.

EPROM Programmer -- Model 7128 EPROM Programmer by GTek programs most EPROMS without the need for personality modules. Self-contained power supply ... accepts ASCII commands and data from any computer through RS 232 serial interface. Cross-assembler hex object files can be down-loaded directly. Commands include verify and read, as well as partial programming.

PROM types supported: 2508, 2758, 2516, 2716, 2532, 2732, 2732A, 27C32, MCM8766, 2564, 2764, 27C64, 27128, 8748, 8741, 8749, 8742, 8751, 8755, plus Seeq and Xicor EEPROMS.

(Upgrade kits will be available for new PROM types as they are introduced.)

Programmer $389
Options include:
- Software Driver Package .... $ 30
- RS 232 Cable .... $ 30
- 8748 family socket adaptor ..... $ 98
- 8751 family socket adaptor $174

Call Us

If you're thinking about development systems, call us for some straight talk. If we don't have what you need, we'll help you find out who does. If you like, we'll even talk about Bach.

VISA and Mastercard accepted. All popular disc formats now available -- please specify. Prices do not include shipping and handling -- call for exact quotes. OEM INQUIRIES INVITED.

*Trademark of Digital Research.

AVOCET SYSTEMS INC.
DEPT. 483M
804 SOUTH STATE STREET
DOVER, DELAWARE 19901
302-734-0151 TLX 467210

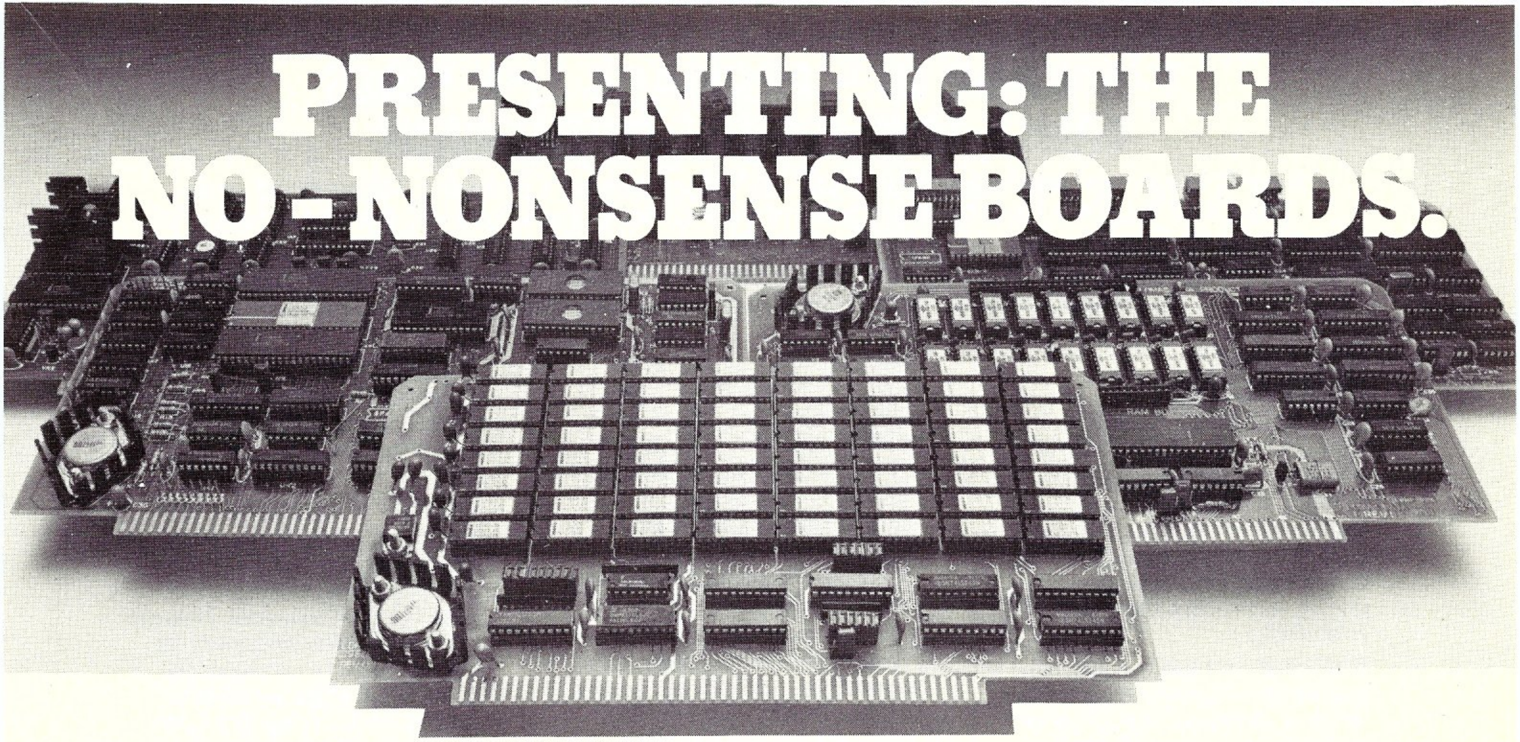
CIRCLE 201 ON READER SERVICE CARD

S-100 Product Directory continued . . .

S-100 VENDOR LIST

Ackerman Digital Systems, 110 N. York Rd., Elmhurst, IL 60126 (312) 530-8992
Action Computer Enterprises (ACE), 55 West Del Mar Blvd., Pasadena, CA 91105 (213) 351-5451
ADES, 2627 Pomona Blvd., Pomona, CA 91768 (714) 594-5858
Advanced Computer Products, Box 17329, Irvine, CA 92713
Advanced Digital Corp., 12700-B Knott Ave., Garden Grove, CA 92641 (714) 891-4004
Alloy Computer Products, 12 Mercer Road, Natick MA 01760 (617) 655-3900
Alpha Micro, 17881 Sky Park No., Irvine, CA 92714 (714) 957-8500
Applied Innovations, 3000 Scott Blvd., Suite 106, Santa Clara, CA 95050
Applied Systems Corp., 26401 Harper Ave., St. Clair Shores, MI 48081 (313) 779-8700
Artec Electronics Inc., 605 Old Country Rd., San Carlos, CA 94070 (415) 592-2740
ASC Associates, Box 615, Lexington Park, MD, 20653 (301) 863-6784
Automated Control Systems, 1105 Broadway, Somerville, MA, 02144 (617) 628-5373
California Computer Systems, 250 Caribbean, Sunnyvale, CA, 94086
California Data Corp., 3475 Old Conejo Rd., Newbury Park, CA 91320 (805) 498-3651
California Digital, PO Box 3087, Torrance, CA 90503
Cambridge Dev. Lab., 50 Milk St., 15th Steadman Cole, Boston, MA 02109
Casheab, 5737 Avenida Sanchez, San Diego, CA 92124 (619) 277-2547
Cer-Tek, 6020 Dniphan Dr., El Paso, TX 79732 (915) 581-6697
Chrislin Industries, Inc., 31352 Via Colinas, Westlake Village, CA 91361 (213) 991-2254
Components Express Inc., 1380 E. Edinger, Santa Ana, CA 92705 (714) 558-3972
Compower Corp., 2220 Landy Ave., San Jose, CA 95131 (408) 942-1600
CompuPro Div., Godbout Electronics, Box 2355, Bldg. 725, Oakland Airport, CA 94614 (415) 562-0636
Computer Design Labs, 342 Columbus Ave., Trenton, NJ 08629 (609) 599-2146
Computer Dynamics, 105 S. Main St., Greer, SC 29651 (803) 877-7471
Computer Systems, 26401 Harper, St. Clair Shores, MI 48081 (313) 779-8701
Compu/Time, PO Box 5343, Huntington, CA 92646
Cotton Associates, 1278 Glenheyre, Suite 505, Laguna Beach, CA 92651 (800) 854-6413
Corvus Systems, Inc., 2029 O'Toole Ave., San Jose, CA 95131 (408) 946-7700
Cromemco Inc., 280 Bernardo Ave., Mt. View, CA 94040
Cybertext Corp., Box 860, Arcata, CA 95521 (707) 822-7079
Cygnus Systems, 1245 Columbine #402, Denver, CO 80206 (303) 393-6526
D&W Digital, 1524 Redwood Drive, Los Altos, CA 94022 (415) 887-5711
Destek Group, 830 C East Evelyn Ave., Sunnyvale, CA 94086 (408) 737-7211
Digiac Corp., 175 Engineers Rd., Hauppauge, NY 11787
Digicomp Research Corp., Terrace Hill, Ithaca, NY 14850 (607) 273-5900
Digital Graphic Systems, 935 Industrial Ave., Palo Alto, CA 94303 (415) 856-2500
Digital Media, 3178 Gibraltar Ave., Costa Mesa, CA 92626 (213) 670-1085
Digital Multi-Media Control, 266 Richards Blvd., Sonoma, CA 95476 (707) 996-3197
Digital Research Computers, PO Box 401565, Garland, TX 75040
Digitex Div./Intecare, 2044 Armacost Ave., Los Angeles, CA 90025 (213) 826-4500
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 (415) 483-8770
Dual Systems Control Corp., 2530 San Pablo Ave., Berkeley, CA 94702 (415) 549-3854
Dylon Corp., 9561 Ridgehoven Ct., San Diego, CA 92123 (714) 292-5584
Dynabyte Business Computers, 521 Cottonwood Dr., Milpitas, CA 95035 (408) 263-1221
Echo Communications Corp., 1708 Stierlin Rd., Mountain View, CA 94043 (415) 969-6086
Eclipse Data Products, 4788 156th St., Laundale, CA 90260 (213) 644-7440
Educational Microcomputer Systems, Box 16115, Irvine, CA 92713 (714) 553-0133
Electralogics, Inc., 39 Durward Pl., Waterloo, Ontario, CANADA N2L 4E5 (519) 884-8200
Electronic Control Technology, 763 Ramsey Ave., Hillside, NJ 07205 (201) 686-8080
Empirical Research Group, Box 1176, Milton, WA 98354 (206) 631-4855
Exidy Systems Inc., 1234 Elko Drive, Sunnyvale, CA 94086 (408) 734-9831
Extek, 881 Cumberland Dr., Sunnyvale, CA 94087
Fischer Computer Systems, 445 Bay Street, Angwin, CA 94508 (707) 965-2414
Fulcrum Computer Products, 1771 Junction Ave., San Jose, CA 95112 (408) 295-7171
Genesis Computer Corp., 1444 Linden St., Bethlehem, PA 18018 (215) 861-0850
Graphics Development Labs., 333 Cobalt Way, Suite 106, Sunnyvale, CA 94086 (415) 549-1901
GSR Computers, 60-10 69th St., Maspeth, NY 11378
Hayes Microcomputer Products, 5923 Peachtree, Industrial Blvd., Norcross, GA 30092
Heath/Zenith Data Systems, Box 1000, St. Joseph, MI 49085 (616) 982-3200
IMS International, 2800 Lockheed Way, Carson City, NV 89701 (702) 883-7611
IMSAI Div. Fischer-Freitas, 910 81st Ave., #4, Oakland, CA 94621 (415) 635-7615
Independent Business Systems, 5915 Graham Ct., Livermore, CA 94550
Inner Access Corp., PO Box 888, Belmont, CA 94002
Integrand Research Corp., 8620 Roosevelt Ave., Visalia, CA 93277 (209) 651-1203
Intercontinental Micro Systems, 1733 S. Douglas Rd., Suite E, Anaheim, CA 92806 (714) 978-9758
I/O Technology, PO Box 2119, Canyon Country, CA 91351 (805) 252-7666
ISA Co., Ltd., Heian Bldg., 2-6-16, Okubo, Shinjuku-Ku, Tokyo 03-232-8570
Ithaca Intersystems, Box 91, Ithaca, NY 14850 (607) 273-2500
Jade Computer Products, 4901 W. Rosecrans Ave., Hawthorne, CA 90250 (213) 973-7707
JC Systems, 1075 Hiawatha Ct., Fremont, CA 94538 (415) 657-4215
J.E.S. Graphics, Box 2752, Tulsa, OK 74101 (918) 742-7104
Jones Futurex, Inc., 9700 Fair Oaks Blvd., Suite G, Fair Oaks, CA 95623 (916) 966-6836
Konan Corp., 1448 N. 27th Ave., Phoenix, AZ 85009 (602) 257-1355
Kramer Systems International, 8403 Dixon Ave., Silver Spring, MD 20910
Laboratory Computer Systems, 139 Main St., Cambridge, MA 02124 (617) 547-4738

PRESENTING: THE NO-NONSENSE BOARDS.



The RAM67

Our RAM67 static RAM offers low power for cool operation and high reliability. It is the first S100 memory of its size to offer battery back up. The RAM67 will run without wait-states with any present S100 bus CPU.

Advanced static RAM67 features:

- ☐ Low power CMOS RAM
- ☐ 100 ns access time
- ☐ No wait states with our 10 MHz *Lightning One*™
- ☐ 8/16 bit operation
- ☐ Phantom disable
- ☐ Battery back up option

If you need high performance and high reliability at an affordable price, the RAM67 is the memory for you.

128K RAM **$1200.00**
Battery back-up option **$100.00**

The Lightning One

The *Lightning One* is the fastest S100 CPU board presently available. The 8086 processor with its two co-processors, the 8087 and 8089, provide exceptional data manipulation, numeric processing and I/O handling capability.

The Lightning One features:

- ☐ 8086 or 8088 16 bit processor
- ☐ 4,5,8, or 10 MHz jumper selectable operation
- ☐ Optional 8087 and 8089 co-processors
- ☐ Onboard monitor with diagnostics
- ☐ 9 vectored interrupts expandable to 65

When you need mini-computer performance at micro-computer prices, the *Lightning One* should be your choice. Benchmarks available.
Prices start at **$395.00**

Other LDP Products

In addition to the RAM67 and *Lightning One*, Lomas Data Products offers the following fine products:

☐ ***HAZITALL System Support***
2 serial ports, 2 parallel ports, clock/calendar, 9511 or 9512 math support (option), hard disk controller host interface ..... A & T, **$325.00**

☐ ***LDP72 Floppy Disk Controller***
Single or double density operation, single or double sided disks, controls both 8″ and 5¼″ floppy drives, digital data separator for adjustment free reliable operation .... A & T, **$274.95**

For 16 bit computing on the S100 bus, come to the leader...

☐ ***LDP128/256K Dynamic RAM***
An advanced dynamic RAM with static like performance. An ideal choice for large memory configurations where cost is an important consideration. No DMA, or reset restrictions .... A & T, 128K **$795.00,** 256K **$1395.00**

☐ ***LDP88 8088 CPU Board***
Ideal for inexpensive systems requiring the processing power of a 16 bit instruction set. The LDP88 has up to 8K of on-board EPROM, 1K bytes of RAM, 1 serial RS232 port, 9 vectored interrupts, 5 MHz operation. Useable as a single board 8088 processor .... A & T, **$349.95**

Software Available

☐ ***CP/M-86****
Full track buffered BIOS, memory disk support, double density format **$300.00**

☐ ***MP/M-86****
Full MP/M-86 implementation, hard disk and floppy disk support, plus memory drive. 1, 2 and 5 user configurations.

☐ ***MS-DOS*****
The IBM Personal Computer operating system, includes macro assembler **$250.00**

☐ ***Other software:***
BASIC86, BASCOM86, FORTRAN86, C, FORTH.

**CP/M-86 & MP/M-86 trademark of Digital Research.*
***MS-DOS trademark of Microsoft.*
Lightning One trademark of Lomas Data Products, Inc.

Dealer and O.E.M. inquiries invited.

LDP

LOMAS DATA PRODUCTS, INC.

66 Hopkinton Road, Westboro, Massachusetts 01581 Telephone: (617) 366-6434

CIRCLE 248 ON READER SERVICE CARD

S-100 Product Directory continued . . .

Lehigh Valley Logic, Inc., 2503 North Court, Bethlehem, PA 18017 (215) 865-1222
Lomas Data Products, 11 Cross St., Westborough, MA 01581
Macrotech International, 22133 Cohasset St., Canoga Park, CA 91303 (213) 887-5737
Marcey Inc., 6700 Valjean Ave., Van Nuys, CA 91406 (213) 994-7734
Measurement Systems & Controls, 867 North Main St., Orange, CA 92668
Memory Merchant, 14666 Doolittle Drive, San Leandro, CA 94577 (415) 483-1008
Methode Electronics, Inc., 7444 W. Wilson Ave., Chicago, IL 60656 (800) 323-6858
Micro Designs, Box 497, Tour de la Bourse, Montreal, Canada H4Z 1J7 (514) 284-3348
Micro Dynamics Corp., Box 17577, Memphis, TN 38117 (901) 755-0619
Micro-Expander, Inc., 527 Madison Ave., New York, NY 10022 (212) 308-2328
Micromation, Inc., 1620 Montgomery St., San Francisco, CA 94111
Micro Mike's, Inc., 3015 Plans, Amarillo, TX 79102 (806) 372-3633
Mimic, Inc., Box 921, Acton, MA 01720 (617) 263-2110
Monitor Dynamics, 1121 W. 9th St., Upland, CA 91786 (714) 985-7214
Morrow Designs, 600 McCormick St., San Leandro, CA 94577 (415) 430-1970
Mullen Computer Products, Box 6214, Hayward, CA 94545
MuSys Corp., 1752 B Langley Ave., Irvine, CA 92714 (714) 662-7387
National Instruments, 12109 Technology Blvd., Austin, TX 78759 (800) 531-5066
Netronics R & D, Ltd., 333 Litchfield Road, New Milford, CT 06776 (800) 243-7428
New World Computer Co., 2805 McGraw Ave., Irvine, CA 92714 (714) 556-9320
North Star Computers, 14440 Catalina St., San Leandro, CA 94577 (415) 357-8500
Optronics Technology, 2990 Atlantic Ave., Penfield, NY 14526 (716) 377-0369
Owens Associates, 12 Shubert St., Staten Island, NY 10305 (212) 448-6283
P & E Microcomputer Systems, Box 2044, Woburn, MA 01880 (617) 944-7585
Para Dynamics Corp., 7895 E. Acoma Dr., Scottsdale, AZ 85260 (602) 991-1600
paraGraphics, Box 67, So. Eastern, MA 02375 (617) 620-9513
PCE Systems, 5232 Manzanita Ave., Carmichael, CA 95608 (916) 338-5454
Perex, Inc., 1798 Technology Dr., San Jose, CA 95110 (408) 280-7566
Pickles & Trout, Box 1206, Goleta, CA 93116 (805) 685-4641
Piiceon, 3250 Bering Dr., San Jose, CA 95131 (408) 946-8030
Polymorphic Systems, 5730 Thornwood Dr., Goleta, CA 93117 (805) 967-0468
Potomac Micro-Magic, 5201 Leesburg Pike, Suite 604, Falls Church, VA 22041 (703) 379-9660
Processor Interfaces, Inc., PO Box 154A, Elm Grove, WI 53122 (414) 785-1245
QDP Computer Systems, 10330 Breckville Rd., Cleveland, OH 44141 (216) 526--083
QT Computer Systems, 15335 S. Inglewood, Lawndale, CA 90260
Quality Computer Services, 178 Main St., Metuchen, NJ 08840 (201) 548-2135
Qantex Div., No. Atlantic, 60 Plant Ave., Hauppauge, NY 11788 (516) 582-6060
Quasar Data Products, 2515 Mitchell Dr., No. Omstead, OH 44070 (216) 526-0838
Random Factors, Ltd., Drower 2875, Durango, CO 81301 (303) 247-9306
S-100, Inc., 14425 North 79th St., Suite B, Scottsdale, AZ 85260
S.C. Digital, Box 906, Aurora, IL 60507 (312) 897-7749
Scion Corp., 12310 Pinecrest Rd., Reston, VA 22091 (703) 476-6100
Scitronics, Inc., 523 S. Clewell St., Bethlehem, PA 18015
SDSystems, Box 28810, Dallas, TX 75080 (214) 340-0303
Seattle Computer Products, 1114 Jindustry Dr., Seattle, WA 98188 (800) 426-8936
Semidisk Systems, Box GG, Beaverton, OR 97075 (503) 642-3100
Sierra Computer Products, 2864 Ray Lawyer Dr., #205-317, Placerville, CA 95667 (916) 644-5932
Sierra Data Sciences, 21162 Lorain Ave., Fairview Park, OH 44126 (216) 331-8500
Sigen Corp., 1800 Wyatt Dr. #6, Santa Clara, CA 95054 (408) 988-2527
Signum Systems, 726 Santa Monica Blvd. #217, Santa Monica, CA 90401 (213) 451-5382
Simpliway Products Co., 3754 Winston Dr., Hoffman Estates, IL 60195
Ski Electronics, 3134 Woods Way, San Jose, CA 95148 (408) 270-1680
Snow Micro Systems, Inc., PO Box 2201, Fairfax, VA 22031 (703) 378-7257
SPC Technologies, Inc., 1425 North Quincy St., Arlington, VA 22207 (703) 841-2992
SSM Microcomputer Products, 2190 Paragon Dr., San Jose, CA 95131
Static Memory Systems, Inc., 401 State Bank Ctr., Freeport, IL 61032 (815) 235-8713
Sunny International, Box 4296, Torrance, CA 90510 (213) 328-2425
Suntronics Co., 1261 Crenshaw Blvd., Hawthorne, CA 90250 (213) 644-1140
Systems Group, 1601 Orangewood Ave., Orange, CA 92668 (714) 633-4460
Tarbell Electronics, 9950 Dovlen, Ste. B, Carson, CA 90746
Tecmar, Inc., 23414 Greenlawn, Cleveland, OH 44122 (216) 464-7410
Teleram Communications Corp., 2 Corporate Park Dr., White Plains, NY 10604 (914) 694-9270
Teletek, 9767F Business Pk. Dr., Sacramento, CA 95827 (916) 361-1777
Theta Labs, Inc., 10911 Dennis #405, Dallas, TX 75229
U.S. Micro Sales, 15381 Chemical Lane, Huntington Beach, CA 92649 (714) 891-2677
Vector Electronics Co., 12460 Gladstone, Sylmar, CA 91361 (213) 365-9661
Via Video, Inc., 5155 Old Ironsides Dr., Santa Clara, CA 95050 (408) 980-8009
Wameco, Inc., 111 Glenn Way #8, Belmont, CA 94002
XCOMP, 7566 Trade St., San Diego, CA 92121 (619) 271-8730
Yang Electronic Systems, Inc., 307 Compton Ave., Laurel, MD 20707 (301) 776-0076
Zobex, 7343-J Ronsen Rd., San Diego, CA 92111 (714) 571-6971

For infromation on the products listed in our directory, check off the appropriate numbers on the reader service card enclosed with this issue. For a more immediate response, contact the companies directly.

S-100 MEMORY BOARDS

64K STATIC RAM - Jade

Uses new 2K x 8 static RAMs, fully supports IEEE 696 24 bit extended addressing, 200ns RAMs, lower 32K or entire board phantomable, 2716 EPROMs may be subbed for RAMs, any 2K segment of upper 8K may be disabled, low power typically less than 500ma.

MEM-99152B *Bare board*	$49.95
MEM-99152K *Kit less RAM*	$99.95
MEM-32152K *32K kit*	$199.95
MEM-56152K *56K kit*	$289.95
MEM-64152K *64K kit*	$299.95
Assembled & Tested	add $50.00

256 RAMDISK - SD Systems

ExpandoRAM III expandable from 64K to 256K using 64K×1 RAM chips, compatible with CP/M, MP/M, Oasis, & most other Z-80 based systems, functions as ultra-high speed disk drive when used with optional RAMDISK software.

MEM-65064A *64K A & T*	$474.95
MEM-65128A *128K A & T*	$574.95
MEM-65192A *192K A & T*	$674.95
MEM-65256A *256K A & T*	$774.95
SFC-55009000F *RAMDISK sftwr CP/M 2.2*	$44.95
SFC-55009000F *RAMDISK with EXRAM III*	$24.95

64K RAM BOARD - C.C.S.

IEEE S-100, supports front panels, bank select, fail-safe refresh 4MHz, extended addressing, list price $575.00 - less than half price!!!

MEM-64565A	$199.95

LETTER QUALITY PRINTERS

LETTER QUALITY PRINTER - COMREX

Uses standard daisy wheels and ribbon cartridges, 16 CPS bi-directional printing, semi-automatic paper loader (single sheet or fan fold), 10/12/15 pitch, up to 16" paper, built-in noise suppression cover.

PRD-11001 *Centronics parallel*	$899.95
PRD-11002 *RS-232C serial model*	$969.95
PRA-11000 *Tractor Option*	$119.95

380Z by Data Terminals & Communications

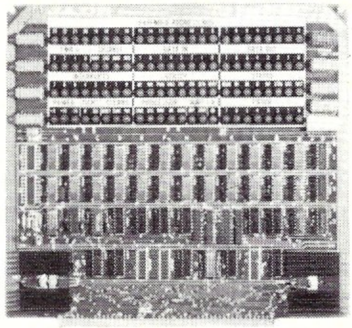
Based on the same quality mechanism as the Comrex printer the 380Z contains electronic enhancements that allow it to print at speeds up to 32 CPS. Other features include a 48K buffer, proportional spacing, and Diablo 1640/1650/630 compatible protocol. Comes with printwheel, ribbon and users manual. Serial, parallel, and IEEE 488 interfaces standard.

PRD-11300 *380Z printer*	$1295.00
PRA-11000 *Tractor option*	$169.95

32K PROM/RAM BOARD

The 32K S100 PROM/RAM board can hold up to 16 each 2716 style EPROMs, 6116 style RAMs, or 8 each style EPROMs. This board was designed to fit into older S100 systems as well as the newer IEEE-696 machines. Uses 5 volt only EPROM/RAMs, allows operation as a 2K to 32K board, meets IEEE-696 S100 proposed standard, addressable as two 16K blocks on any 64K page, supports Cromemco as well as Northstar bank select, perfect for MP/M systems.

MEM-99153B *Bare board & manual*	$49.95
MEM-99153K *Kit with No RAM*	$89.95
MEM-99153A *A & T with No RAM*	$139.95
MEM-16153K *Kit with 16K RAM*	$129.95
MEM-16153A *A & T with 16K RAM*	$179.95
MEM-32153K *Kit with 32K RAM*	$179.95
MEM—32153A *A & T with 32K RAM*	$229.95
Call Us for Lowest Prices on EPROMs - 2732s	***$4.90***



S-100 I/O BOARDS

THE BUS PROBE - Jade

Inexpensive S-100 Diagnostic Analyzer

So your computer is down. And you don't have an oscilloscope. And you don't have a front panel... You're not alone - most computers have their occasional bad days. But without diagnostic equipment such as an oscilloscope (expensive!) or a front panel (expensive!), it can be very difficult to pinpoint the problem. Even if you have an extender board with a superfast logic probe, you can't see more than one signal at a time. You're stuck, right?

Not anymore; Jade is proud to offer our cost-effective solution to the problems mentioned above: ***THE BUS PROBE.***

Whether you're a hobbyist with a cantankerous kluge or a field technician with an anxious computer owner breathing down your neck, you'll find THE BUS PROBE speeds your repair time remarkably. Just plug in THE BUS PROBE and you'll be able to see all the IEEE S-100 signals in action. THE BUS PROBE allows you to see inputs, outputs, memory reads and writes, instruction fetches, DMA channels vectored interrupts, 8 or 16 bit wide data transfers, plus the three bus supply voltages.

TSX-200B *Bare board*	$59.95
TSX-200K *Kit*	129.95
TSX-200A *A & T*	$159.95

I/O-4 - SSM Microcomputer

2 serial I/O ports plus 2 parallel I/O ports.

IOI-1010B *Bare board w/manual*	$35.95
IOI-1010K *Kit with Manual*	$179.95
IOI-1010A *A & T*	$249.95

I/O-5 - SSM Microcomputer

Two serial & 3 parallel ports, 110-19.2K Baud

IOI-1015A *A & T*	$289.95

INTERFACER 4 - CompuPro

3 serial, 1 parallel, 1 Centronics parallel.

IOI-1840A *A & T*	$314.95
IOI-1830C *CSC*	$414.95

S-100 EPROM BOARDS

PB-1 - SSM Microcomputer

2708, 2716 EPROM board with on-board programmer.

MEM-99510K *Kit with manual*	$154.95
MEM-99510A *A & T with manual*	$219.95

PROM-100 - SD Systems

2708, 2716, 2732 EPROM programmer with softrware.

MEM-99520K *Kit with software*	$189.95
MEM-99520A *A & T with software*	$249.95

DUAL DISK SUB-SYSTEMS

Disk Sub-Systems - Jade

Handsome metal cabinet with proportionally balanced air flow system, rugged dual drive power supply, power cable kit, power switch, line coard, fuse holder, cooling fan, never-mar rubber feet, all necessary hardware to mount 2-8" disk drives, power supply, and fan, does not include signal cable.

Dual 8" Sub-Assembly Cabinet

END-000420 *Bare cabinet*	$49.95
END-000421 *Cabinet kit*	$199.95
END-000431 *A & T*	$249.95

8" Sub-Systems - Single Sided, Double Density

END-000423 *Kit w/2 FD100-8Ds*	$650.00
END-000424 *A & T w/2 FD100-8Ds*	$695.00
END-000433 *Kit w/2 SA-801Rs*	$999.95
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2 or 4 MHz Z-80 CPU with serial IO port & on board monitor PROM, front panel compatible.

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Both 8 & 16 bit CPUs, standard 8 bit S-100 bus, up to 8 MHz, accesses 16 Megabytes of memory.

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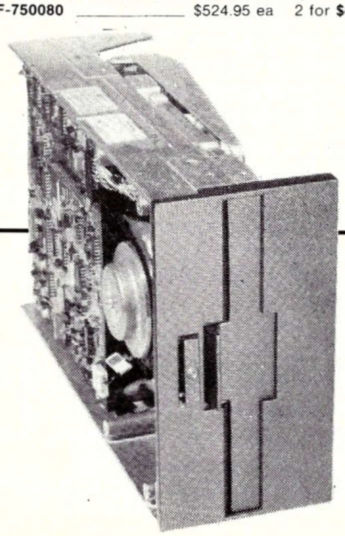

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1200 and 300 baud, all the features of the standard Smartmodem plus 1200 baud, 212 compatible, full or half duplex.

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IOM-5241A	*300 baud 103 Smart Cat*	**$229.95**
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1 5 the size of ordinary modems, Bell 103, manual or auto-answer, automatic answer/originate, direct conect, built-in self-test, two LED's and audio "beeps" provide complete status information.

IOM-5261A	*Novation*	**$149.95**

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CPC-30800A	*A & T*	**$724.95**
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- ***Console I/O re-direction***
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- ***Designed for application programmers***
- ***Resident system extensions***

SFC-55009057F	*CP/M 3.0 8" with manual*	**$200.00**
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CIRCLE 16 ON READER SERVICE CARD

Will Solid State Drives Replace the Hard Disk?

by Bob Weidemann

If you are looking for the fastest secondary storage device, stop looking at hard disk drives. Look, instead, at solid-state drives. SSDs outperform mechanical storage devices by a significant factor.

This article will not only explain the advantages and disadvantages of SSDs, but will also tell you how you can implement one on your own S-100 machine without a lot of hassle.

What is an SSD?

A solid-state drive is a simulated disk drive that uses memory instead of disks. The CP/M BIOS is easily configured to "fool" the BDOS into "thinking" that it is conversing with a disk drive, while in reality it is talking to a group of one or more memory boards. The size of the SSD is limited only by your available S-100 socket space and your budget.

I must warn you at the outset though, that SSDs are addictive and that you will have a craving for larger doses of memory as you habitually use your computer.

What applications does an SSD have?

The floppy disk drive opened the door to a relatively inexpensive way for the hobbyist to do fancy computer work. It enables one to use just about any compiler that mainframe computer users have, and to use that compiler in very serious problem-solving applications. However, one big difference between the large computers and our beloved micros is in how long it takes to perform operations such as compiling and sorting.

My use of computers includes the compilation of medium-sized Pascal programs that can take from 10 to 20 minutes to compile and link. During that period my floppy disk drives are in constant action. To speed that compilation, I naturally explored many hardware and software devices. The most successful in terms of cost versus speed has been the "triple-density" method of recording to floppy disks, described in "Triple-Density Floppy Disks," *Microsystems*, February 1983.

Another obvious device is the hard disk. The hard disk is supposed to be faster than floppies, and it is. But the cost/speed ratio is terrible, simply because the speed is only slightly better. Hard disks, for micros, pick up speed only in disk access time—not in data transfer time, which is the greater portion of the overall cycle. Mainframe computer disk drives have smarter controllers that connect to CPUs on special high-speed data buses for DMA transfers. In the future our hard disk controllers may be able to do similar tricks, but cannot do them yet.

Fortunately, there is another device that will enable the micro owner to speed up his operation. It is the ordinary memory board. The only thing special about the memory boards used for SSDs, as described in this article, is that they must be bank selected, either by extended memory addressing or by output port latches; almost all memory boards made today are of this type. Another system of SSDs could use memory that is not connected to the bus, but transfers data in and out through a parallel port. That type is more universally marketable since an S-100 bus is not a prerequisite. It would probably be more expensive and not as fast.

SSDs will speed up any operation that is currently disk bound. You can expect to see a gain proportional to the amount of time your use involves reading and writing to a disk. Even operations involving editing, as with WORDSTAR, speed up, since overlays do not have to be read from a real disk, and larger source programs don't have to be scrolled on and off a temporary disk file.

Operating with an SSD is similar to working with a hard disk in that operation is silent. Furthermore, there are no BDOS read or write errors. There are no diskettes to wear out after heavy usage as in compiling or sorting. New computer buyers may opt to buy only one floppy drive and one SSD, keeping the cost reasonable.

Don't expect to use SSDs in commercial environments, as, for example, to speed up access to large data bases. SSDs are ordinary volatile memory and as such forget everything if the power is pulled. Unless you are using uninterruptible power sources, SSDs shouldn't be used to replace ordinary disk drives, where loss of data would be a disaster. Furthermore, the cost of memory is still higher, per byte, than a hard disk drive, so unless speed is of paramount importance, memory drives are best suited to the hobbyist and the computer scientist interested in speeding up particular applications.

Why must CP/M be fooled into thinking memory is a disk?

Nobody writes compilers or other programs for 8080- and Z80-based computers that anticipate a TPA bigger than 54 to 56K. I won't, simply because I'd be limiting my potential market. Others didn't because, until recently, memory was expensive and floppies could easily be used to contain a large compiler by breaking it down into overlays that could fit into the existing TPA.

Since compilers were written to be used on disk drives, it is easy to make them work with memory banks instead. The only overhead is that there is the "'Von Weidemann' Bottleneck" effect when data transfers take place between the SSD and the CP/M designated "DMA address." This is because data that comes or goes to banked memory must be funnelled through a "common" memory area first. Data read from an SSD must first be transferred from the SSD to the common memory, and then transferred

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from the common memory to the "DMA address" in main memory. Writing to the SSD requires a similar operation. This bottleneck would not occur using the 8086, since it contains more address lines.

Implementing the solid-state drive

The two areas of concern in the implementation of an SSD are hardware and software.

The hardware needed consists of additional memory boards over and above the normal memory used in a CP/M environment. Boards of 64K or more are the only way to go. You should have one 64K card for main memory and additional cards for the solid-state drive. Alternately, you could use a 256K card, if you are lucky enough to find one that is compatible with your computer.

The 64K card should be able to address the lower 48K as one bank, and the other 16K should be part of another bank. That is because you need to have a common memory area that is *never* banked. It is easiest to work with 16K of common memory. If the card doesn't put what would normally be the upper 16K into another bank at one of the three lower quarters of memory, then that 16K would go to waste.

The memory that I used with complete success is the S&D Expandoram II. It is inexpensive and works with my Zobex CPU and disk controller. It is supposed to be upgradable to 256K by using 64K chips, but I haven't been able to get it to work with those chips, yet. I am currently using three 64K cards, with 128K available for the SSD. Frankly, that is not enough. I am unable to do complete compilations on the SSD, and must resort to help from a disk drive. That is because the typical Pascal compiler, with overlays, requires more memory than 128K. It is apparent that 256K for the solid-state drive alone is a good compromise between too little memory and too much money spent.

Implementing the software requires some minor changes to your BIOS. If you have ever altered a BIOS, you know that you must be careful when you make changes. If you are careful, adding an SSD is really not a big job.

Three current BIOS routines must be altered and one routine must be added. These changes are included in this article. You must also add a disk parameter block for the new "drive."

The general idea of the SSD read routine is to take

CP/M SSD Driver Portion of BIOS

```
The following is the software required:
;First the dpb:
SSD
     defw 128    ;sectors/trk
     defb 3      ;shift factor
     defb 7      ;block mask
     defb 0      ;extent mask
     defw 127    ;SSD size -1
     defw 63     ;dir entries
     defb 0c0h   ;alloc 0
     defb 00     ;alloc 1
     defw 00     ;check size
     defw 00     ;reserved tracks
```

SSDRIVER:

```
;Now the driver:
;Using the S&D boards with the SSD banks switch set for 2, 3.
;Each 16k is considered to be a track
;When CPM says trk 0,1 or 2; that is bank 2 at 0000,4000,or 8000
;For track 3,4,5; its bank 3, at 0000,4000,8000
;for track 6,7; its bank 4, at 0000 or 4000
;I don't use the stack in this program
;Your BIOS settrack and setsector routines must save trk and sec
;at memory locations cpmtrk and cpmsec, if it doesn't already.
;Your Read and Write routines must trap the C drive
;and jmp to this routine with a 0 or 1 in b (for read or write)
;First compute the board number and the quarter
        ld      a,(cpmtrk)      ;A contains CPMs trk no.
        ld      hl,sdtable      ;point to beg of table
        add     a,a             ;double a, since there's
        ld      d,0             ;2 bytes per table entry
        ld      e,a             ;set de for adding to hl
        add     hl,de           ;hl points to tab entry
        ld      a,(hl)          ;get bank first
        ld      c,a             ;c gets the reqbank for speed
        ld      (reqbank),a     ;needed for sdwrite
        inc     hl              ;get correct 16k portion
        ld      d,(hl)          ;d gets high address
;now get rest of address into hl
        ld      a,(cpmsec)
        ld      e,0             ;de will be added to hl
        ld      h,0             ;need hl for mult
        ld      l,a             ;l now contains sec
        add     hl,hl
        add     hl,hl
        add     hl,hl
        add     hl,hl
        add     hl,hl
        add     hl,hl
        add     hl,hl           ;multiply hl by 128 bytes/sec
```

EXTRA

EXTRA

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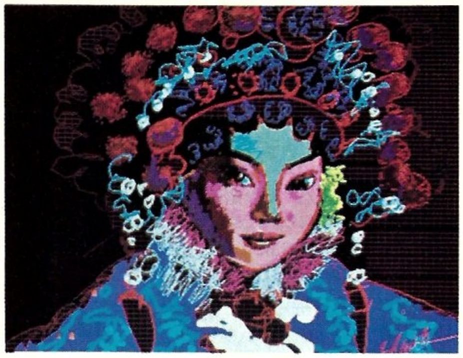


Image achieved by DGS' CAT 1600 Series color video graphic workstation. Picture courtesy of Digital Graphic Systems, Inc. See story below.

GRAPHICS: NOW MAX-IMIZED

CANOGA PARK—March 30, 1983—The decreasing costs and increasing density of memory made possible the present boom in digital graphics. Graphic systems designers are now able to take another major step with the introduction of MAX-M, a one megabyte memory board for $1983. As large size system memory and multi-megabyte Virtual Disk, MAX-M opens up major new low cost implementations.

Wayne Maw, Director of R&D for RGB Dynamics, Salt Lake City, Utah, reports, "My application is dependent on speed. With the Macrotech dynamic board, I have the needed speed." The RGB system is a Z80-based, high resolution color directory system for shopping malls, due for April release.

Empirical Research Group of Kent, Washington, creates a state-of-the-art high resolution color video graphics system by integrating their fast 68000 computer, Macrotech system memory, and the color video image processor from Digital Graphic Systems, Inc., Palo Alto, California. Radcliffe Goddard of Digital Graphics states, "High speed image processing requires large system memory to provide instantaneous display frame paging."

The demand for MAX-M by the graphics industry was nearly instantaneous following the initial Macrotech announcement.

MAX—256K to 1M S-100 Memory

CANOGA PARK—March 30, 1983—Mike Pelkey, Macrotech International president, today released details of the revolutionary MAX line of S-100 memory boards. Pelkey stated: "IEEE-696 now has a new standard for dynamic memory. The MAX product line offers 256K to 1M, at a price that ranges down to less than $0.00023 per bit." Pelkey continued, "The MI product line now includes our ultra fast (70 ns) 128K static memory, with battery backup capability, plus the 150 ns dynamic memories—in every 128K step from 256K through 1M (1024K) bytes, and add-on kits to permit field upgrade of sizes."

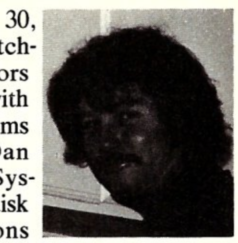
The extreme density of the MAX family is made possible through the use of proprietary PALs (programmable array logic). Also stated as available for add-on to any size MAX is Macrotech's popular M³ memory mapping architecture. M³ permits the 16-bit address space of an 8-bit processor to be dynamically mapped in 4K pages into as much as 16 megabytes of physical memory.

Parity error detection and 8/16 bit data transfer capabilities are provided as standard on the MAX series memory board.

PRICE INDEX

	SIZE	P/N	PRICE
Static Memory	128K	128-ST	$1232
Dynamic Memory	256K	MAX-256	$1108
24-bit	384K	MAX-384	1292
Addressing	512K	MAX-512	1647
	768K	MAX-768	1815
	896K	MAX-896	1899
	1M	MAX-M	1983
With 16-bit M³ Addressing option, add $91			
	FROM/TO	**P/N**	**PRICE**
Upgrade Kits	256K/384K	MKT-2/3	$ 192
	256K/512K	MKT-2/5	692
	256K/768K	MKT-2/7	876
	256K/896K	MKT-2/8	967
	256K/1M	MKT-2/M	1060
	384K/512K	MKT-3/5	600
	384K/768K	MKT-3/7	784
	384K/896K	MKT-3/8	876
	384K/1M	MKT-3/M	968
	512K/768K	MKT-5/7	284
	512K/896K	MKT-5/8	376
	512K/1M	MKT-5/M	468
	768K/896K	MKT-7/8	192
	768K/1M	MKT-7/M	284
	896K/1M	MKT-8/M	192
M³ option		MKT-M3	121
Software (provided on 8" disk) Virtual Disk for MP/M II* and CP/M 2.2, CP/M 3.0* Bios modules, CP/M memory tests			$ 25
Manuals (sold separately)			
128/ST			$ 15
MAX Technical Manual			15

Software for M³ Available



BURBANK—March 30, 1983—"M³ bank switching for 8-bit processors is much more useful with the new creative systems programs," states Dan West of Westcom Systems Inc. MP/M II* disk intensive applications are greatly improved with the new Virtual Disk routines now available through Macrotech OEM's and dealers for their M³ memory boards.

Westcom Systems, as the software consulting firm for Macrotech, has also provided subroutine listings to easily incorporate M³ mapping into the new CP/M 3.0* (CP/M Plus*) Bios module. The advantages of CP/M 3.0* with disk buffering, hashed directories, and user program expansion go hand in hand with Macrotech's flexible "bank switched" memory capabilities.

All Macrotech software and manuals are available through Dan West's Compuserve account #70250,102.
Leave comments/questions as E-Mail.

These new techniques can combine the above features with custom needs of the future, such as printer buffering, multi-page display and memory-intensive graphics displays.

The software listings are included in the Macrotech memory board manuals and are optionally available on 8" diskettes.

*CP/M 3.0, CP/M Plus, and MP/M II are registered trademarks of Digital Research Inc.

CIRCLE 28 ON READER SERVICE CARD

the three variables (track, sector, and DMA address) that CP/M supplies; convert the first two variables to bank and address; and then move data from the SSD bank to the common memory to the DMA address. The write routine is essentially the reverse.

Using the SSD

When you first turn on the computer, the SSD is full of garbage. CP/M requires "disks" to be formatted with E5's, at least in the directory area. I could have had the BIOS "format" the solid-state drive upon cold boot; but I felt that this would not do. There may be times when I want to hit the reset button and not lose data in that drive.

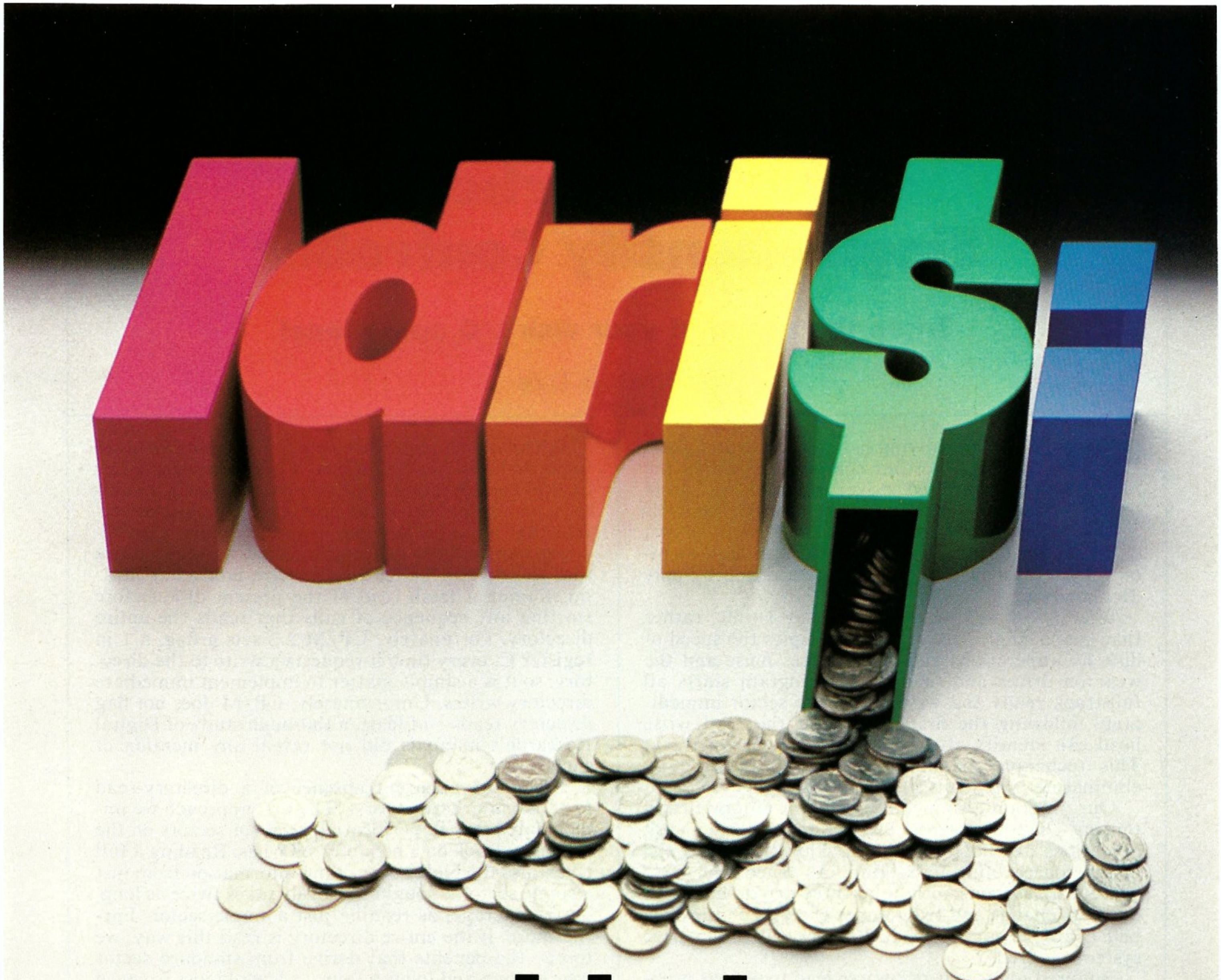
The first time I do a cold boot, I also use a COM program to initialize the SSD by writing 2000 bytes of E5 to the directory area of the "drive." After that, I PIP over any programs that I need, such as a text editor or compiler. When I have finished my session, I must remember to PIP whatever I want to save back to a real disk. This hasn't presented a problem, and I haven't accidently turned off the machine with unbacked data in the SSD. That's probably because I am used to backing up everything on at least two disks normally; but certainly, nonvolatile memory would really be a winner for this application. Too bad the price is too high.

Future implementations involving SSD

To carry this concept further, I am contemplating putting CPM and other commonly used utility programs onto ROM on a banked ROM board. This would eliminate the need to read a floppy during warm or cold boots. The TPA would be maximized. The floppy could then be turned off except to load an SSD or to back it up. Electrically alterable ROMS would be ideal for this application.

There is no doubt that memory prices will continue to drop. Large SSDs will certainly have a very effective cost/speed ratio and will undoubtedly be a part of mine and many other computer systems. The days of the two floppy disk system are numbered in a direct proportion to the price of memory. Wouldn't you really rather have solid state?

```
        add     hl,de               ;de has the base add
        ld      (bankadd),HL        ;save bank address
;separate between read and write
        ld      a,b                 ;get the command
        cp      a,sdwrtcmd          ;is it a write
        jp      z,sdwrite           ;if so jmp over
sdread:                             ;if not do a read
;switch the banks from main to correct mbank
        ld      a,c                 ;get reqbank from c
        out     0ffh,a              ;turn on correct mbank
;hl still contains bankadd
        ld      de,sdbuffer
        ld      bc,128
        ldir                        ;move from bank to main
;switch back to main bank
        xor     a                   ;zero a
        out     0ffh,a              ;turn bank off, main on
;move from main to dma
        ld      hl,sdbuffer
        ld      de,(cpmdma)
        ld      bc,128
        ldir                        ;move mdbuffer to dma
;done with read
        ret                         ;exit subroutine
sdwrite:
;move dma to sdbuffer
        ld      hl,(cpmdma)
        ld      de,sdbuffer
        ld      bc,128
        ldir
;switch on bank
        ld      a,(reqbank)
        out     0ffh,a              ;turn off main,  sd on
;move sdbuffer to bank
        ld      hl,sdbuffer
        ld      de,(bankadd)
        ld      bc,128
        ldir
;switch on main
        xor     a                   ;put 0 to a
        out     0ffh,a              ;turn off sd, main on
;done with write
        ret
sdtable:
        defb    2,0,2,40h,2,80h
        defb    3,0,3,40h,3,80h
        defb    4,0,4,40h
reqbank: defs   1
bankadd: defs   2
```



Track-Buffered I/O Routines for the Tarbell Single-Density Controller

Triple the speed of your disk I/O operations!

by Robert J. Lurie

The accompanying listing is excerpted from the BIOS for our computer. It shows the track-buffered driver routines we wrote for our Tarbell single-density disk controller and CP/M 2.2. The track is placed in a 3.25K buffer located above the BIOS in high memory. The transient program area is reduced by only 3K, however.

Reading or writing a full track at a time, rather than just a single sector, roughly triples the speed of disk I/O operations and also reduces noise and the wear on drives and media. Our program starts all full-track reads and writes with the sector immediately following the first sector that the read/write head can identify after it reaches the correct track. This technique maximizes the speed increase by eliminating practically all rotational latency.

Our program also includes code for automatically turning off power to the stepper motors when disk operations are not in progress. This eliminates the major source of heat buildup. As listed, the code works with systems with up to three drives, but, with one byte change and two jumper changes on the Tarbell board, it can be made to work with four-drive systems as well.

Buffered reads and writes can lead to serious problems unless considerable care is taken in implementing them. Among the difficulties that can be encountered are: failure to update a disk; reading the buffered contents of one disk, but mistaking it for the contents of another; or—most serious of all—overwriting one disk with data that was intended to be written to a different disk.

Two factors combine to create these potential problems. First, floppy disks are removable media that CP/M permits the user to exchange any time that disk operations are not in progress, without giving the computer prior notice. Second, reads and writes themselves may not physically take place at the time the READ and WRITE subroutines are called. In the case of reads, the sector to be read may already be present in the track buffer. In the case of writes, the track containing the sector to be written to may first have to be read into the track buffer: the actual writing of the sector to the disk may not take place until some later call to READ or WRITE is received that references a different drive or a different track than the one that is currently residing in the buffer.

Robert J. Lurie, 8 Tingley Road, Morristown, NJ 07960

If attention is confined solely to the events involved in normal disk file operations, it becomes clear, after careful consideration, that two precautions are sufficient to circumvent these problems: first, make certain that all calls to write to the directory are executed immediately and not deferred; second, ensure that the current buffer contents are labeled as invalid, forcing a fresh read of the present disk, before starting any sequence of calls that reads the entire directory. Fortunately, CP/M 2.2 sets a flag, a 1 in register C, every time it requests a write to the directory, so it is a simple matter to implement immediate directory writes. Unfortunately, CP/M does not flag directory reads—at least, a thorough study of Digital Research's manuals did not reveal any mention of such a flag.

Given the apparent absence of a directory-read flag, two alternatives exist. The first approach we implemented was to perform all reads of sectors on the directory track on a nondeferred basis. Reading a full track into the buffer every time information from just a single sector is sought obviously takes twice as long, on the average, as reading just a single sector. Furthermore, if the entire directory is read this way, we forego the benefits that derive from standard sector interleaving and incur a four- to fivefold loss in speed as compared with normal single-sector reads. Therefore, this approach required that our BIOS contain facilities for both single-sector and multiple-sector reads. Even with both capabilities installed, we found that single-sector reads of the directory track resulted in an overall speed improvement that was significantly less than we had hoped for. The reason for this is that directory reads are by far the most common disk operation.

These facts prompted us to implement a second alternative. With the help of our friend Ed Eibling, we added some circuitry to our Tarbell controller board that enabled us to read the status of line 12 coming out of a Shugart-compatible 8″ drive. This line goes true whenever a drive is selected if the drive door was opened at any time before the selection operation. With this hardware installed, it was possible to detect disk changes and to tailor the software to force an immediate buffer refresh whenever a new disk appeared to be in place. Figure 1 shows the changes that Ed Eibling made to our disk controller board.

Only after doing all this work did we discover, quite by accident, that CP/M 2.2 does in fact provide a clue that a full directory read is about to take place. We happened to be in touch with Digital Research on quite a different matter when we received from them a copy of their suggested track-buffering routines for CP/M-86. The first thing that struck us about this listing was some rather curious code embedded in their BIOS's HOME routine—code that appeared to proclaim an imminent directory read. On the off-chance that CP/M 2.2 might work the same way, we did some experimenting and discovered that, sure enough, CP/M 2.2 *issues a dummy call to HOME prior to reading the directory*. What a strange way to pass a parameter! And what a disgraceful way to have to learn about such a vital fact! The BIOS listed below uses the same "flag" as CP/M-86 to guarantee that it is reading the right disk. It works nearly as fast as the BIOS that involved reading the status of line 12, and it has the advantage of not requiring any hardware modifications. We are quite pleased with it. Nevertheless we find it hard to forgive Digital Research for their utter failure in documentation and for the amount of wasted time and effort it cost us. Perhaps they are ashamed of the peculiar way their BDOS works!

The version of BDOS contained in the MOVCPM.COM file on your CP/M distribution diskette contains a bug that must be corrected before you can use this BIOS. To correct it, use DDT to alter the 5 bytes starting at location 1CD2h from DCR C! DCR C! JNZ 12DFh to NOP! NOP! LXI H,0. Make sure that the CPMxx.COM file that you use to generate your new BIOS is derived from this corrected version of MOVCPM.COM. This patch guarantees that a file change that results in no change to the length of a file will nevertheless cause BDOS to issue a call to write to the directory when the file is closed. Hence it guarantees that the file will be updated on the disk. Without it there is the possibility that the file will not be updated, and that the next disk placed in the drive will be corrupted.

This BIOS works well with all so-called CP/M-compatible programs that access your READ and WRITE subroutines indirectly via standard BDOS calls. However, you should anticipate possible problems with certain systems-level programs that bypass BDOS and access your READ and WRITE routines directly via calls to your BIOS jump table. Programs that access BIOS subroutines directly are generally not considered to be CP/M-compatible in the strict sense of the word. We agree completely with this assessment despite the fact that one of the most widely used programs distributed by Digital Research itself falls into this category.

Examples of such programs are utilities for fast disk copying, disk formatting, unerasing erased files, directly altering disk data, running disk diagnostics, and so on. The thing to be concerned about in running such programs is whether or not all disk writes are actually performed as requested. These programs can generally be made to work as designed, provided that you discipline yourself to type a control-C upon completion of the program and *before* you remove the disk from the drive. The subsequent warm boot begins with a buffered read of track zero, and, so long as the last disk operation requested by the utility program was not a write to a sector on track zero (a highly unlikely situation), a physical update of the disk will be the first thing to take place.

The Digital Research program to which we referred is SYSGEN.COM. You can use SYGEN with this BIOS, but to do so you *must* respond to the *second* appearance of the prompt "DESTINATION

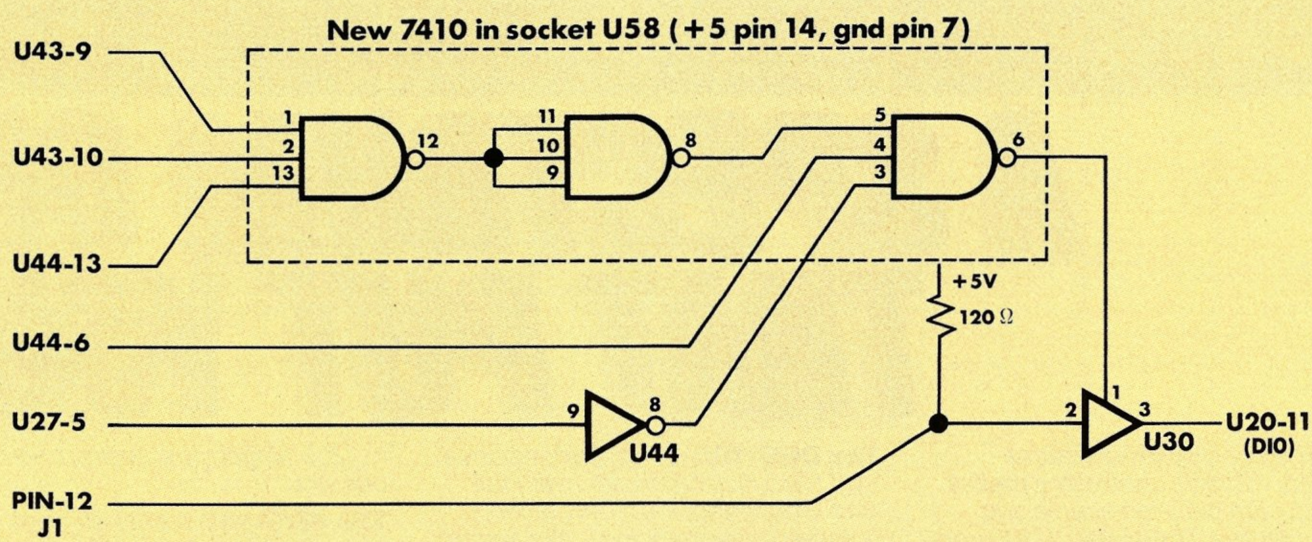
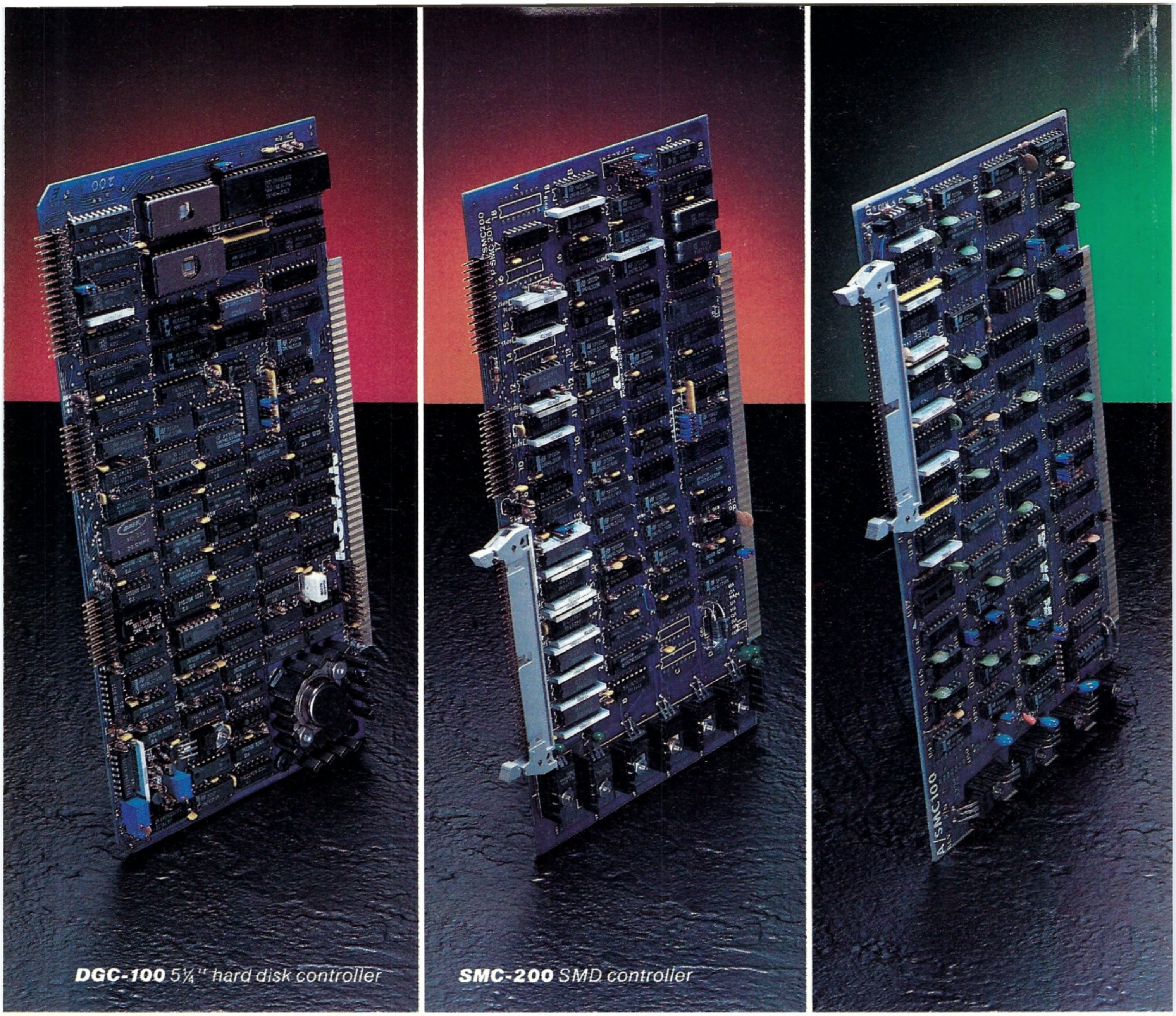


Figure 1. *Modifications to the Tarbell single-density disk controller board to permit reading the status of line 12 from a Shugart 800-compatible 8" drive. The status is read from port xD hex, where x is determined by the setting of switch S1 on the controller board. The status bit is bit 0. Bit 0 = 0 if the drive door has been opened since the previous drive-select. (Note: Pin-pair labeled "DC" on a Shugart 800 drive must be jumpered in order to activate line 12.)*



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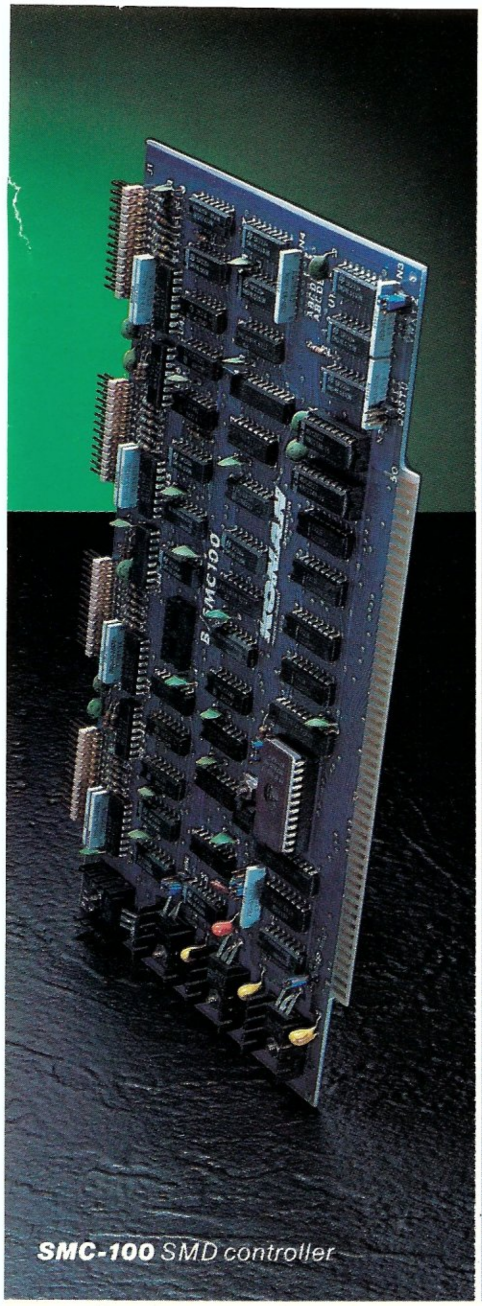
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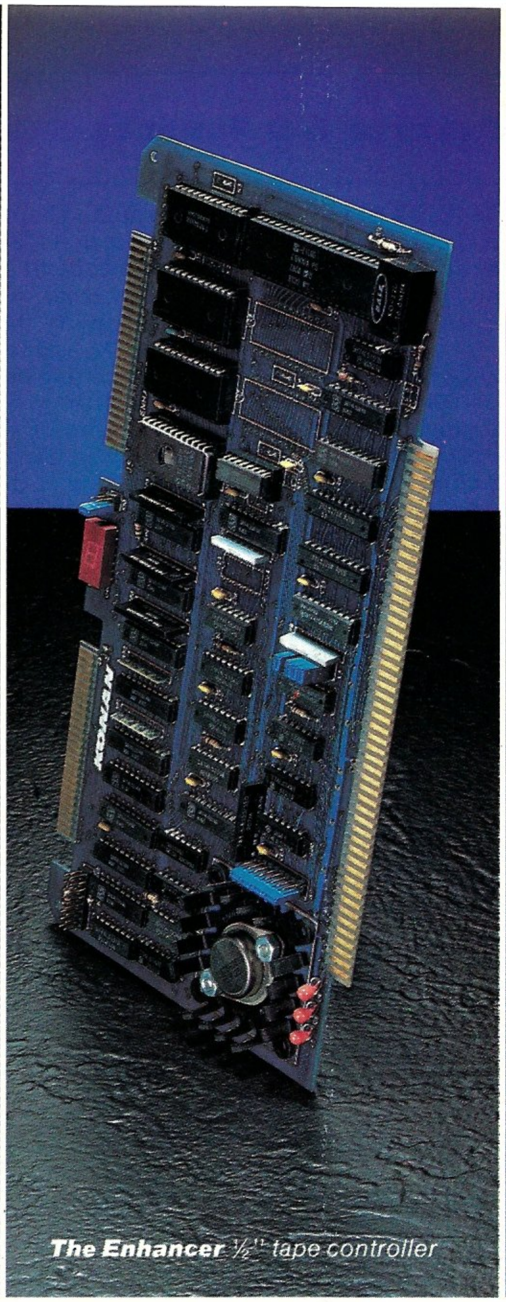
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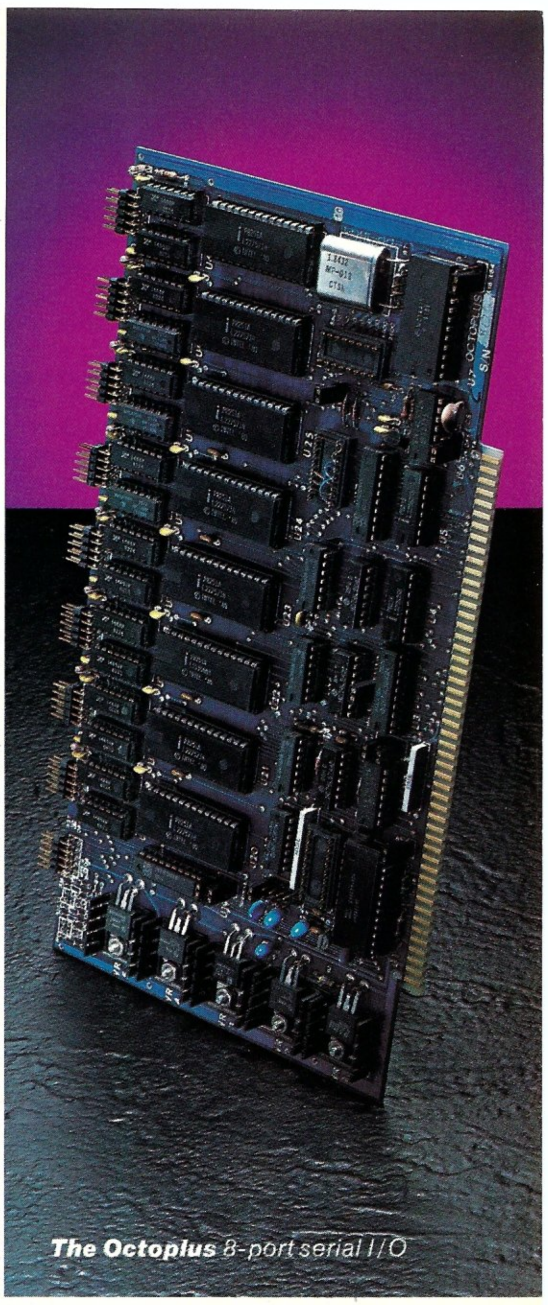
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DRIVE NAME (OR RETURN TO REBOOT)" with a carriage return. The warm boot that follows is what actually causes the second system track (track 1) to be written out to the disk. You can no longer use a single invocation of SYSGEN to sysgen more than one disk on the same drive.

Our program makes extensive use of self-modifying code and was structured to use as few bytes as possible. BIOS space on standard 8" single-density CP/M disks is rather limited, and we often find ourselves running out of room despite our efforts at tight coding. In our opinion, the major virtue of CP/M lies in its acceptance of a user-configurable interface between itself and the hardware that supports it. In fact, it is unlikely that we would ever consider buying any microcomputer, including one based on CP/M, whose I/O routines were hidden, or whose higher-level software, including the operating system itself, knew as much about the underlying I/O software as we did.

Our feelings about this matter are based on the fact that the I/O interface, situated as it is at the bottom of the program hierarchy, is the ideal place from which to exercise continuous real-time control over one's computer, and in this context control implies the absence of contention. We use our BIOS to perform background hardware diagnostics, and also as the site of a low-level interpreter that permits us to execute a variety of system functions at any time from any program environment using a uniform command syntax. The major weakness of CP/M, in our opinion, lies in its failure to provide the user with any software means to save or restore its state—to preserve its internal variables, in other words. If it had such a capability then it would be possible, in effect, to run CP/M as a task under CP/M, and it would be fairly easy to implement from the BIOS the approximate equivalent to what Digital Research is now calling concurrent CP/M.

We seem to have wandered a bit. . . . The point we are making is that it is pretty easy to run out of BIOS space, particularly if you use your BIOS, as we do, to enhance the functionality of your computer. If you do run out of space, then consider loading part of your BIOS from a command file on system start-up using the console command processor's auto-load capability. In our warm boot subroutine, we show how we disable CCP's auto-load facility on system restarts so as to eliminate unnecessary rereads of the auto-load file.

Bob Lurie is a chemical engineer turned lens designer and precision optician. His computer interests include the development of arithmetic software and systems programming. He is the author of DPFUN, a double-precision transcendental function subroutine package distributed by Lifeboat Associates, and IBIOS, an interactive BIOS for CP/M distributed by the Miken Optical Co.

```
                 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                 ;                                                           ;
                 ; A TRACK-BUFFERED BIOS FOR THE TARBELL SINGLE-DENSITY      ;
                 ;          DISK CONTROLLER AND CP/M 2.2                     ;
                 ;                                                           ;
                 ;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
                         ;
                 ; Copyright (c) 1982, Robert J. Lurie.  All rights reserved.
                 ; Language: Digital Research ASM
                         ;
ØØ4Ø =           totmem  equ     64        ;total contiguous memory, kilobytes
ØØ3D =           memsiz  equ     totmem-3 ;CP/M system size
                         ;
ØØF8 =           disk    equ     ØF8h      ;Tarbell board base port address
ØØF8 =           dcom    equ     disk+Ø    ;1771 command port (out)
ØØF8 =           dstat   equ     disk+Ø    ;1771 status port (in)
ØØF9 =           track   equ     disk+1    ;1771 track port (in/out)
ØØFA =           sector  equ     disk+2    ;1771 sector port (in/out)
ØØFB =           ddata   equ     disk+3    ;1771 data port (in/out)
ØØFC =           wait    equ     disk+4    ;Tarbell wait port (in)
ØØFC =           drive   equ     disk+4    ;drive-select port (out)
ØØØA =           rtcnt   equ     1Ø        ;retry count for read or write
                         ;
D8ØØ =           ccp     equ     (memsiz-2Ø)*1Ø24+34ØØh
EØØ6 =           bdos    equ     ccp+8Ø6h
EEØØ =           bios    equ     ccp+16ØØh
                         ;
EEØØ                     org     bios
ØØ2C =           nsects  equ     ($-ccp)/128 ;sectors in CCP plus BDOS
                         ;
                 ; Jump table to the I/O subroutines:
                         ;
EEØØ C3D3EF              jmp     boot
EEØ3 C3F8EF              jmp     wboot
EEØ6 C339FØ              jmp     const
EEØ9 C326FØ              jmp     conin
EEØC C339FØ              jmp     conout
EEØF C339FØ              jmp     list
EE12 C339FØ              jmp     punch
EE15 C339FØ              jmp     reader
EE18 C394EE              jmp     home
EE1B C381EE              jmp     seldsk
EE1E C3A1EE              jmp     settrk
EE21 C3A6EE              jmp     setsec
EE24 C3ABEE              jmp     setdma
EE27 C3B1EE              jmp     read
EE2A C3ØCEF              jmp     write
EE2D C339FØ              jmp     listst
EE3Ø C37CEE              jmp     sectran
                         ;
                 ; Disk parameter headers.
                         ;
```

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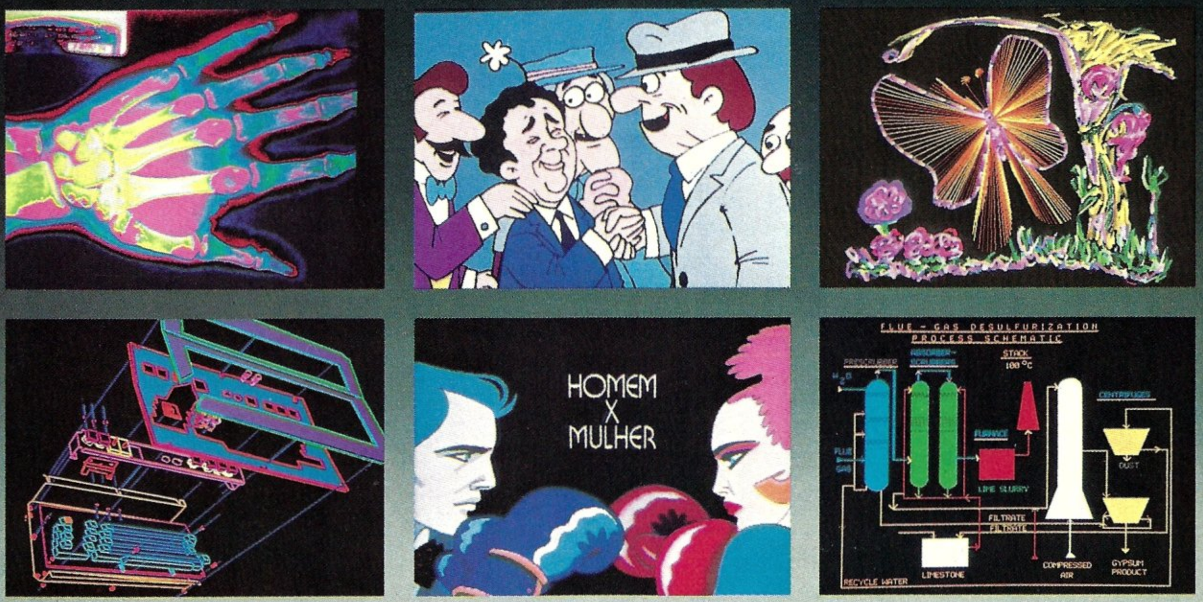

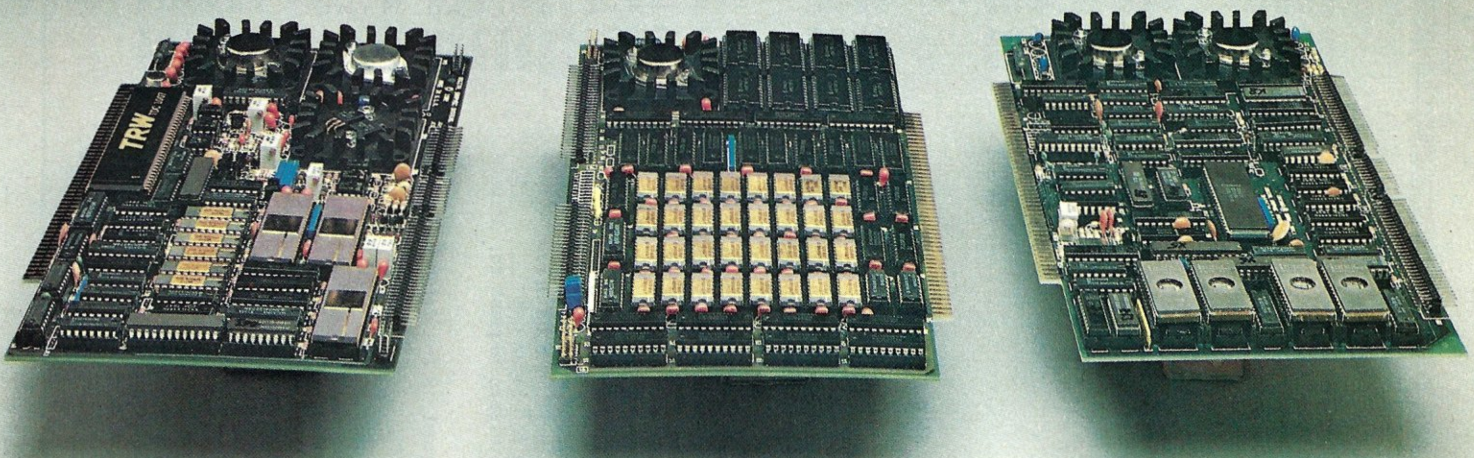

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```
EE33 53EE000000dphdra: dw      trans,0,0,0,dirbf,dpblk,chk00,all00 ;drive A
EE43 53EE000000dphdrb: dw      trans,0,0,0,dirbf,dpblk,chk01,all01 ;drive B
                        ;
                ; Sector translation table.  Data are for standard 8-inch
                ; single-density CP/M disks.
                        ;
EE53 01070D1319trans:   db      1,7,13,19,25,5,11,17,23,3,9,15,21
EE60 02080E141A         db      2,8,14,20,26,6,12,18,24,4,10,16,22
                        ;
                ; Disk parameter block.  Data are for standard 8-inch single-
                ; density CP/M disks.
                        ;
EE6D 1A00       dpblk:  dw      26
EE6F 030700             db      3,7,0
EE72 F2003F00           dw      242,63
EE76 C000               db      192,0
EE78 10000200           dw      16,2
                        ;
                ; Translate the sector in bc using the translation table
                ; addressed by de.  Return value in hl.
                        ;
EE7C EB         sectran:xchg            ;hl -> trans
EE7D 09                 dad     b       ;hl -> trans(sect)
EE7E 6E                 mov     l,m     ;l=trans(sect)
EE7F 60                 mov     h,b     ;hl=trans(sect) since b=h=0
EE80 C9                 ret
                        ;
                ; Select drive for the next sector read or write.  Drive number
                ; (A=0, B=1) in c on entry.  Return hl=disk parameter header
                ; address, or, if no such drive, hl=0.  This routine is for two
                ; drives only.
                        ;
EE81 210000     seldsk: lxi     h,0     ;anticipate error
EE84 79                 mov     a,c
EE85 FE02               cpi     2       ;number of drives
EE87 D0                 rnc             ;return if no such drive
EE88 32B9EE             sta     nxtdrv  ;save for later use
EE8B 2133EE             lxi     h,dphdra ;anticipate request for drive A
EE8E B7                 ora     a
EE8F C8                 rz
EE90 2143EE             lxi     h,dphdrb ;request is for drive B
EE93 C9                 ret
                        ;
                ; Home.  BDOS issues a dummy call to this routine just before
                ; the start of a full directory read.  We take advantage of
                ; this important, but undocumented, flag-like use of home to
                ; mark the buffer as invalid if it has not been altered by a
                ; write.  This forces a physical read of the directory track.
                ; It's a guarantee against the potential disaster of mistaking
                ; the buffered directory of an old disk for the directory of a
                ; newly inserted disk.
                        ;
EE94 0E00       home:   mvi     c,0     ;home means settrk 0
EE96 3AC5EE             lda     bnfflg  ;load buffer-needs-flushing flag
EE99 B7                 ora     a       ;test it
EE9A C2A1EE             jnz     settrk  ;jump if buffer needs flushing, else
EE9D 2F                 cma             ; set drive-currently-in-buffer = 255,
EE9E 32B7EE             sta     drvcib  ; forcing its refresh; fall through
                        ;
                ; Set track, in c on entry, for the next read or write.
                        ;
EEA1 79         settrk: mov     a,c
EEA2 32C0EE             sta     nxttrk  ;save for later use
EEA5 C9                 ret
                        ;
                ; Set sector, in c on entry, for the next read or write.
                        ;
EEA6 79         setsec: mov     a,c
EEA7 32F1EE             sta     nxtsec  ;save for later use
EEAA C9                 ret
                        ;
                ; Set the memory address, in bc on entry, for the start of the
                ; next sector read or write.
                        ;
EEAB 69         setdma: mov     l,c
EEAC 60                 mov     h,b
EEAD 22FDEE             shld    dmaadr  ;save for later use
EEB0 C9                 ret
                        ;
                ; Read a sector into memory.  Return a=0 if read is ok, else
                ; return a=1.
                        ;
EEB1 3EEB       read:   mvi     a,xchg  ;set up movsec for read
                        ;
EEB3 32FFEE     share:  sta     rwopt   ;share remaining code with write
EEB6 3EFF               mvi     a,255   ;compare drive/track-currently-in-
EEB7 =          drvcib  equ     $-1     ; buffer against next-drive/track
EEB8 FE00               cpi     0       ;(drive-currently-in-buffer initially
EEB9 =          nxtdrv  equ     $-1     ; set to non-existent drive number 255
EEBA C2C4EE             jnz     iflush  ; to force buffer fill on startup)
EEBD 3E00               mvi     a,0
EEBE =          trkcib  equ     $-1
EEBF FE00               cpi     0
EEC0 =          nxttrk  equ     $-1
EEC1 CAF0EE             jz      movsec  ;jump if they are the same, else:
                        ;
EEC4 3E00       iflush: mvi     a,0     ;load buffer-needs-flushing-? flag
EEC5 =          bnfflg  equ     $-1     ;bnfflg initially set false
EEC6 B7                 ora     a       ;test flag; flush if buffer has been
EEC7 C421EF             cnz     flush   ; written into from system memory
EECA C0                 rnz             ;return if write error
                        ;
EECB 3AB9EE             lda     nxtdrv  ;fill buffer from nxtdrv/nxttrk:
EECE 3245EF             sta     sddrive ;set sddrive and drvcib = nxtdrv, and
EED1 32B7EE             sta     drvcib  ; sdtrack and trkcib = nxttrk,
EED4 3AC0EE             lda     nxttrk  ; preparing for and anticipating
EED7 325EEF             sta     sdtrack ; completion of read
EEDA 32BEEE             sta     trkcib
```

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CIRCLE 183 ON READER SERVICE CARD

```
EEDD 218FEF          lxi    h,rwinst ;load read instructions into movbuf
EEEØ 36DB            mvi    m,in
EEE2 23              inx    h
EEE3 36FB            mvi    m,ddata
EEE5 23              inx    h
EEE6 3677            mvi    m,77h    ;77h = mov m,a
EEE8 1688            mvi    d,88h    ;load 1771 read-w/o-head-load command
EEEA 3E9F            mvi    a,9Fh    ;load read-error mask
EEEC CD3FEF          call   movbuf   ;read track into buffer from disk
EEEF CØ              rnz             ;return if read error
                     ;
EEFØ 3EØØ    movsec: mvi    a,Ø      ;move 128-byte sector to/from system
EEF1 =       nxtsec  equ    $-1      ; memory from/to track buffer:
EEF2 1F              rar             ;multiply nxtsec by 128 for offset
EEF3 67              mov    h,a      ;note carry bit is clear on entry
EEF4 3EØØ            mvi    a,Ø      ;shift left (-1 + 8)
EEF6 1F              rar
EEF7 6F              mov    l,a      ;product in hl
EEF8 11DEF1          lxi    d,trkbuf-128 ;-128 because first sector number
EEFB 19              dad    d        ; is 1, not Ø; add offset
EEFC 11ØØØØ          lxi    d,Ø      ;hl -> sector in track buffer
EEFD =       dmaadr  equ    $-2      ;de = disk memory access address
EEFF         rwopt:  ds     1        ;xchg if read, nop if write
EFØØ ØE8Ø            mvi    c,128    ;bytes/sector
EFØ2 1A      movloop:ldax   d        ;move 128 bytes with hl -> destination
EFØ3 77              mov    m,a      ; (c.f. read call in wboot)
EFØ4 13              inx    d
EFØ5 23              inx    h
EFØ6 ØD              dcr    c
EFØ7 C2Ø2EF          jnz    movloop
EFØA AF              xra    a        ;set a=Ø and z-flag
EFØB C9              ret
                     ;
             ; Write a sector from memory.  Return a=Ø if write is ok, else
             ; return a=1.
                     ;
EFØC 3EØ1    write:  mvi    a,1      ;are we writing to the directory?
EFØE B9              cmp    c
EFØF CA1DEF          jz     dwrite   ;jump if we are, else fall through
                     ;
EF12 AF      ndwrite:xra    a        ;set up movsec for write (a=Ø=nop)
EF13 CDB3EE          call   share    ;see read routine above
EF16 CØ              rnz             ;return if read or write error, else
EF17 21C5EE          lxi    h,bnfflg; set buffer-needs-flushing flag true
EF1A 36FF            mvi    m,ØFFh  ; since movsec just altered buffer
EF1C C9              ret
                     ;
EF1D CD12EF  dwrite: call   ndwrite ;see non-directory write routine above
EF2Ø CØ              rnz             ;return if r/w error else fall through
                     ;
             ; Flush buffer to drive/track-currently-in-buffer.
                     ;
EF21 3AB7EE  flush:  lda    drvcib  ;set sddrive = drvcib
EF24 3245EF          sta    sddrive
EF27 3ABEEE          lda    trkcib  ;set sdtrack = trkcib
EF2A 325EEF          sta    sdtrack
EF2D 218FEF          lxi    h,rwinst ;load write instructions into movbuf
EF3Ø 367E            mvi    m,7Eh   ;7Eh = mov a,m
EF32 23              inx    h
EF33 36D3            mvi    m,out
EF35 23              inx    h
EF36 36FB            mvi    m,ddata
EF38 16A8            mvi    d,ØA8h  ;load 1771 write-w/o-head-load command
EF3A AF              xra    a       ;set buffer-needs-flushing flag false,
EF3B 32C5EE          sta    bnfflg  ; anticipating successful write
EF3E 2F              cma            ;write-error mask = ØFFh; fall through
                     ;
             ; Procedure common to buffer-fill and buffer-flush routines.
             ; All physical disk activity and all 8Ø8Ø/Tarbell controller
             ; board interaction takes place in this bios segment (but see
             ; conin subroutine below).  Returns a=Ø and z-flag set if
             ; read/write ok, else returns a=1 and z-flag reset.
                     ;
EF3F 3299EF  movbuf: sta    ermask  ;save error mask
EF42 1EØA            mvi    e,rtcnt ;set e = retry count
                     ;
EF44 3EØØ            mvi    a,Ø     ;load source/destination drive number
EF45 =       sddrive equ    $-1
EF46 FEØØ            cpi    Ø       ;compare it to the number of the
EF47 =       ladrive equ    $-1     ; last-active drive
EF48 CA5DEF          jz     seek    ;jump if they are the same
                     ;
EF4B 3247EF          sta    ladrive ;update ladrive to sddrive
EF4E 2F              cma            ;create byte representing sddrive to
EF4F 87              add    a       ; send to the drive-select port
EF5Ø 87              add    a
EF51 87              add    a
EF52 3C              inr    a
EF53 87              add    a
EF54 D3FC            out    drive   ;activate sddrive
                     ;
EF56 CDB4EF  retry:  call   rdhdr   ;get present track no. by reading next
EF59 CØ              rnz            ; sector header; exit on hard error
EF5A 78              mov    a,b     ;tell 1771 what track it is on
EF5B D3F9            out    track
                     ;
EF5D 3EØØ    seek:   mvi    a,Ø     ;load source/destination track number
EF5E =       sdtrack equ    $-1
EF5F D3FB            out    ddata   ;seek-operand belongs in data register
EF61 3E18            mvi    a,18h   ;seek with head loaded, 6 ms/step, do
EF63 D3F8            out    dcom    ; not verify (r/w will, and faster)
EF65 DBFC            in     wait    ;wait until 1771 signals completion
                     ;
EF67 CDB4EF          call   rdhdr   ;get present sector number by reading
EF6A CØ              rnz            ; next header and 1771 sector register;
EF6B DBFA            in     sector  ; exit on hard error
EF6D ØE1A            mvi    c,26    ;number of sectors to transmit in c
EF6F B9              cmp    c       ;eliminate rotational latency by adding
```

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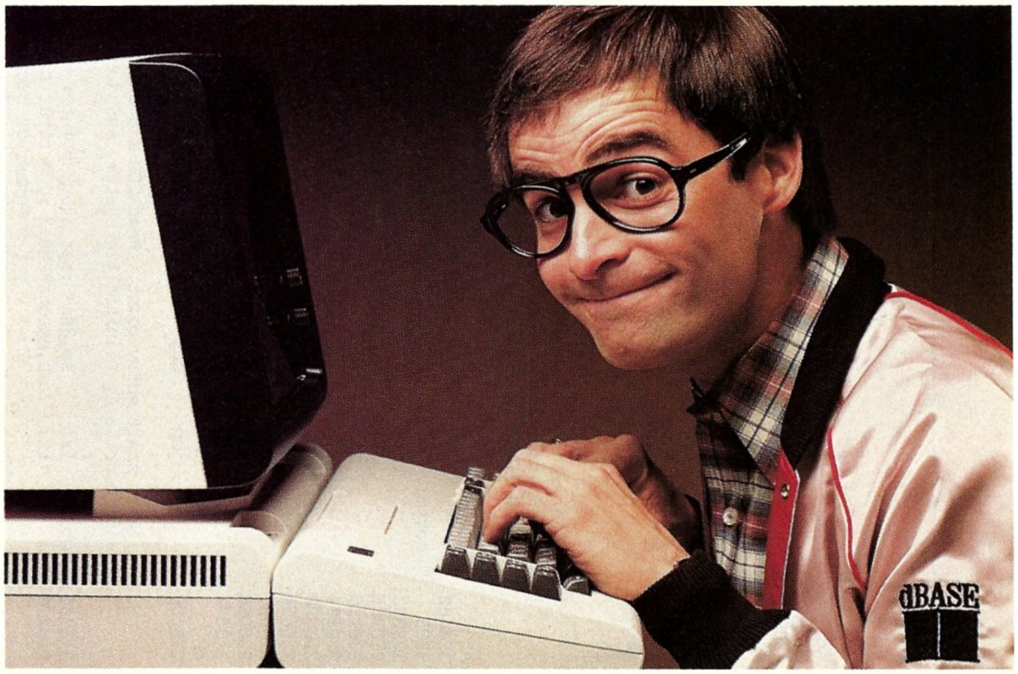

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CIRCLE 182 ON READER SERVICE CARD

```
EF7Ø C274EF            jnz     nomod   ; 1 mod 26 to the present sector number
EF73 AF                xra     a       ; to obtain the number of the first
EF74 3C       nomod:   inr     a       ; sector to transmit
EF75 47                mov     b,a     ;number of first sector to xmit in b
EF76 B7                ora     a       ;clear carry
EF77 1F                rar             ;multiply sector number by 128
EF78 67                mov     h,a
EF79 3EØØ              mvi     a,Ø
EF7B 1F                rar
EF7C 6F                mov     l,a     ;result in hl
EF7D D5                push    d       ;preserve 1771 command and retry count
EF7E 11DEF1            lxi     d,trkbuf-128
EF81 19                dad     d       ;hl -> location in the track buffer
EF82 D1                pop     d       ; of the first sector to transmit
                       ;
EF83 78       trkloop:mov      a,b     ;send sector number to 1771 sector
EF84 D3FA              out     sector  ; register
EF86 7A                mov     a,d     ;send read or write command to 1771
EF87 D3F8              out     dcom    ; command register
EF89 DBFC     secloop:in       wait    ;transmit a sector
EF8B B7                ora     a
EF8C F296EF            jp      rwchk   ;exit secloop on 1771 intrq signal
EF8F          rwinst: ds       1       ;space for read or write instructions
EF9Ø                   ds      1       ; loaded earlier
EF91                   ds      1
EF92 23                inx     h
EF93 C389EF            jmp     secloop ;loop until sector transfer is complete
EF96 DBF8     rwchk:   in      dstat   ;check for errors
EF98 E6ØØ              ani     Ø
EF99 =        ermask   equ     $-1
EF9A C2ADEF            jnz     rwerr   ;jump if read/write error
EF9D ØD                dcr     c       ;decrement sector count
EF9E C8                rz              ;exit with a=Ø and z-flag set if c=Ø
EF9F 3E1A              mvi     a,26    ;increment sector number mod 26
EFA1 9Ø                sub     b
EFA2 C2A9EF            jnz     nowrap
EFA5 47                mov     b,a
EFA6 215EF2            lxi     h,trkbuf ;track buffer starts with sector 1
EFA9 Ø4       nowrap:  inr     b
EFAA C383EF            jmp     trkloop ;loop until track transfer is complete
                       ;
EFAD 1D       rwerr:   dcr     e       ;decrement retry count
EFAE C256EF            jnz     retry   ;reload track-reg and try again if e<>Ø
EFB1 AF                xra     a       ;exit with a=1 and z-flag reset on hard
EFB2 3C                inr     a       ; error
EFB3 C9                ret
                       ;
EFB4 3EC4     rdhdr:   mvi     a,ØC4h  ;load head and read first byte
EFB6 D3F8              out     dcom    ;(track number) from next sector
EFB8 DBFC              in      wait    ; header
EFBA DBFB              in      ddata
EFBC 47                mov     b,a     ;save track number in register b
EFBD DBFC     rbird:   in      wait    ;read, but ignore, remaining data
EFBF B7                ora     a
EFCØ F2C8EF            jp      hdrred  ;quit when header has been read
EFC3 DBFB              in      ddata
EFC5 C3BDEF            jmp     rbird
EFC8 DBF8     hdrred:  in      dstat   ;check for errors
EFCA B7                ora     a       ;return with track no. in b and sector
EFCB C8                rz              ; no. in 1771 sector reg. if no errors
EFCC 1D                dcr     e       ;decrement retry count
EFCD C2B4EF            jnz     rdhdr   ;loop if count <> Ø
EFDØ AF                xra     a       ;return a=1 and z-flag reset on hard
EFD1 3C                inr     a       ; error
EFD2 C9                ret
                       ;
              ; Entry to the operating system after the coldstart loader on
              ; sector 1, track Ø, drive A has read all of CP/M (CCP, BDOS,
              ; and BIOS) into memory, and printed the sign-on message.
                       ;
EFD3 AF       boot:    xra     a       ;mark drive A as the current drive
EFD4 3204ØØ            sta     4
EFD7 3EC3     gocpm:   mvi     a,jmp   ;put jump to wboot at address ØØØØ
EFD9 32ØØØØ            sta     Ø
EFDC 21Ø3EE            lxi     h,bios+3
EFDF 22Ø1ØØ            shld    1
EFE2 32Ø5ØØ            sta     5       ;put jump to bdos at address ØØØ5
EFE5 21Ø6EØ            lxi     h,bdos
EFE8 22Ø6ØØ            shld    6
EFEB 218ØØØ            lxi     h,8Øh   ;set dmaadr
EFEE 22FDEE            shld    dmaadr
EFF1 3AØ4ØØ            lda     4       ;pass current drive to CCP in reg-c
EFF4 4F                mov     c,a
EFF5 C3ØØD8            jmp     ccp     ;go to console command processor
                       ;
              ; Warm start entry point.  Read CCP and BDOS back into memory
              ; from drive A, reinitialize system, and jump to CCP.
                       ;
EFF8 318ØØØ   wboot:   lxi     sp,8Øh  ;set stack pointer
EFFB Ø1Ø22C            lxi     b,nsects*256+2 ;c = first sector to load
                                       ; b = number of sectors to load
EFFE 21ØØD8            lxi     h,ccp   ;first memory address to load
FØØ1 AF                xra     a       ;zero accumulator
FØØ2 32B9EE            sta     nxtdrv  ;select drive A
FØØ5 32CØEE   rdtrkl:  sta     nxttrk  ;select track
FØØ8 CDA6EE   rdtrk:   call    setsec  ;select sector
FØØB 22FDEE            shld    dmaadr  ;select load address
FØØE C5                push    b       ;preserve bc
FØØF CDB1EE            call    read    ;read conditions z-flag and returns
FØ12 C1                pop     b       ; hl pointing to start of next sector
FØ13 C2F8EF            jnz     wboot   ;loop forever on error (no BDOS trap)
FØ16 Ø5                dcr     b       ;decrement sector count
FØ17 CAD7EF            jz      gocpm   ;done reading if zero; reinitialize
FØ1A ØC                inr     c       ;increment sector number
FØ1B 3E1B              mvi     a,27    ;done with track Ø?
FØ1D 91                sub     c
FØ1E C2Ø8FØ            jnz     rdtrk   ;loop if not done
                     ; (sta    ccp+7   ;this defeats CCP auto-load on wboot)
```

Track-Buffered I/O Routines continued . . .

```
F021 3C                 inr     a         ;continue reading from track 1,
F022 4F                 mov     c,a       ; sector 1
F023 C305F0             jmp     rdtrkl
                        ;
             ; The following code shows how we keep our two Shugart 800/801
             ; drives cool by automatically turning off their 24-volt-dc
             ; stepper motors when a request for a keyboard character is
             ; received.  For further heat reduction, incorporate the first
             ; three lines of conin into the list, punch, and reader
             ; subroutines.
                        ;
             ; Console input subroutine.  Return next keyboard character in
             ; register-a with the high-order bit set to 0.
                        ;
0001 =       kdport     equ     1         ;keyboard data port
                        ;
F026 3EC2    conin:     mvi     a,0C2h    ;Tarbell-board latch code for drive D
F028 D3FC               out     drive     ;turn off drive A/B(/C) stepper motors
F02A 3247EF             sta     ladrive   ;force next r/w to activate one of them
F02D CD39F0  crloop:    call    const     ;call console status subroutine
F030 B7                 ora     a         ;check reg-a for keyboard status
F031 CA2DF0             jz      crloop    ;loop until a character is ready
F034 DB01               in      kdport    ;read the character
F036 E67F               ani     7Fh       ;set bit 80h = 0
F038 C9                 ret
                        ;
             ; Remaining code to be filled in by the user:
                        ;
F039 =       const      equ     $
F039 =       conout     equ     $
F039 =       list       equ     $
F039 =       punch      equ     $
F039 =       reader     equ     $
F039 =       listst     equ     $
                        ;
F038 =       end$of$bios$load$from$disk equ $-1  ; *
                        ;
             ; * Seven sectors are allotted to BIOS on standard 8-inch
             ;   single-density CP/M disks.  Therefore the address at this
             ;   location must not exceed bios+37Fh.
                        ;
F180                    org     bios+(7*128)     ;uninitialized RAM area
                                ; (org'ed just to show free space above end)
                        ;
F180         dirbf:     ds      128
F200         all00:     ds      31
F21F         all01:     ds      31
F23E         chk00:     ds      16
F24E         chk01:     ds      16
                        ;
F25E         trkbuf:    ds      26*128   ;one track = 26 128-byte sectors
                        ;
FF5E                    end
```

SID Patches

64-Character-Wide DDT, or SID "Dump" Display Patch

by Kelly Smith and Eddie Currie

Are you one of the "poor unfortunates" who has to contend with a 64-character-wide screen display? (You bash your head against the CRT in front of you while mumbling "Why did I ever buy this #'!%&$ thing . . . it botches up the DDT "Dump" display so badly, I can't even use it!") Well, no more tears on the keyboard, my friend! Just put these patches into DDT or SID, and as if by magic (at no time do my fingers leave my hands), voilà: a 64-character-wide "Dump" that you can actually read! Follow along.

Users of DDT.COM version 1.4 or 2.2 should make the following substitution:

```
A>ddt ddt.com<cr>     <--- patch DDT.COM using DDT
DDT VER 2.2           <--- DDT announcing itself
NEXT  PC
1400 0100             <--- DDT telling us it's used 19 pages
-sa17<cr>             <--- Substitute at address 0A17 hex...
0A17 05 08<cr>        <--- ...08 instead of 05!
0A18 08 .<cr>         <--- end the substitution
-g0<cr>               <--- exit DDT and return to CP/M
A>save 19 ddt64.com<cr> <--- save the 64 wide DDT.COM
```

And users of SID.COM:

```
A>sid sid.com<cr>   <--- patch SID.COM using SID
SID VER 1.4         <--- SID announcing itself
NEXT  PC  END
2D00 0100 B3FF      <--- SID telling us it's used 44 pages
#saa5<cr>           <--- Substitute at address 0AA5 hex...
0AA5 93 96<cr>      <--- ...96 instead of 93!
0AA6 08 .<cr>       <--- end the substitution
#g0<cr>             <--- exit SID and return to CP/M
A>save 44 sid64.com<cr><--- save the 64 wide SID.COM
```

What these patches do is throw out the space characters between each display of the hexadecimal representation of each memory content of the DDT or SID "Dump" display. This crunches the display format, and makes it *readable!*

Reprinted from *CP/M-Net News*

Kelly Smith, 3055 Waco St., Simi Valley, CA 93063

Kelly Smith is a senior engineer/programmer with Pertec Computer Corporation, developing diagnostic software for systems and system peripherals. He is the vice president of the Valley Computer Club (Burbank, CA) and system operator of the CP/M-Net Remote CP/M System, in addition to being editor and publisher of the *CP/M-Net News*. Activities and interests include contributing software to the SIG/M User Group library and West Coast SIG/M software distributor via modem.

SID Patch for 64 Columns

by Robert J. Lurie

The following patch for SID.COM version 1.4

changes its (D)ump command output to a format that is better suited to a 16- x 64-character video display:

```
A>SID
SID VERS 1.4
#SA51
0A51 F0 F8
0A52 6F
0A53 11
0A54 BF 5F
0A55 00 .
#SAA3
0AA3 0F 7
0AA4 C2 .
#G0

A>SAVE 28 SID.COM
```

Bob Lurie is a chemical engineer turned lens designer and precision optician. His computer interests include the development of arithmetic software and systems programming. He is the author of DPFUN, a double-precision transcendental function subroutine package distributed by Lifeboat Associates, and IBIOS, an interactive BIOS for CP/M that is distributed by the Miken Optical Co.

Robert J. Lurie, 8 Tingley Rd., Morristown, NJ 07960

Using Microsoft's VARPTR for Machine Language Subprograms

by David L. Wolpert

Microsoft Basic-80 is a powerful interpretive language for 8080 and Z80-based microcomputers. It is available for a wide variety of computers, including CP/M based machines. I have been using this language for programming a turnkey system, and most of what I need to do is available in the language without resorting to machine-language programming. However, there may be cases in which such capability might be useful.

The USR Function

Basic-80 gives several possible ways of linking to user-written machine language subprograms or functions. The USR function can be used to call functions that return an argument, and the CALL statement can be used for subprograms that do not explicitly return a value. I have used the CALL statement to link to the CP/M operating system to perform functions that were not included in Basic-80 (my copy is version 5.21).

The VARPTR Function

In looking through the Microsoft Basic-80 manual, I found a function called "VARPTR (<variable name>)" that "is usually used to obtain the address of a variable or array so it may be passed to an assembly language subroutine." "Well," I thought, "why not let this variable (a string variable) actually *be* the machine language subroutine?" That is, set up a string variable with Z80 machine code (using the CHR$ function with concatenation), and do a CALL to the first element of the string. That certainly seems like a simple way to do it, and it would avoid trying to reserve memory space for the subroutine.

So I tried it, and after a few false starts, I was successful in calling the CP/M FDOS to do simple functions. Presented here is a program that changes the logged disk drive to "B:".

```
110 REM SELECT DISK DRIVE TEST
120 REM
130 REM EXECUTING A$ AS A MACHINE-LANGUAGE SUBPROGRAM
140 REM   WILL DO A CALL TO CPM'S FDOS:
150 REM SELECT DISK IS FUNCTION 14 (0E HEX)
160 REM CALL WITH FUNCTION CODE IN REG. C
170 REM             PARAMETER IN REG. E
180 REM FDOS RETURNS TO THE BASIC PROGRAM AFTER EXECUTION
190 A$=CHR$(0) :REM NOP
200 A$=A$+CHR$(14)+CHR$(14) 'LD C,$0E
210 A$=A$+CHR$(30)+CHR$(1) 'LD E,$01
220 A$=A$+CHR$(195)+CHR$(5)+CHR$(0) 'JP $0005
230 REM
240 A=VARPTR(A$) 'POINTER TO LENGTH OF STRING
250 A=PEEK(A+1)+256*PEEK(A+2) 'ADDRESS OF STRING
260 CALL A 'SELECT DISK B:
270 PRINT "RETURNED OK" 'TEST FOR RETURN
280 FILES 'TEST FOR DISK SELECTED
290 END
```

I wrote a few short programs to test the operation of VARPTR, and found that the manual is somewhat misleading. The value returned by VARPTR is *not* the address of the first byte of the string variable, but a pointer to the *pointer* to the string variable. The memory seems to be organized like this:

```
<value returned by VARPTR> : <length of string>
                 <value+1> : <LSB of address of string>
                 <value+2> : <MSB of address of string>

    <value+2>*256+<value+1> : <first byte of string>
  <value+2>*256+<value+1>+1 : <next byte of string>
                            : etc.
```

This was found by trial and error, and may not be true of all implementations of Basic-80; but I suspect it is the way most of them are organized—at least, for versions 5.0 and later, "string space is allocated dynamically."

Of course, this is a rather simple example, and I could have just typed "B: . . . " before all my file names, but it was good to be able to write this little program, if only for the joy of doing it (and knowing it can be done). Comments are welcome.

David Wolpert finished school about the time microprocessors were introduced, and has been working with them ever since. He works for Hewlett-Packard in Loveland, CO, designing interfaces for instruments and application programs.

Note: *Z80 is a trademark of Zilog; Basic-80 is a trademark of Microsoft.*

David L. Wolpert, 3008 Custer Ave., Loveland, CO 80537

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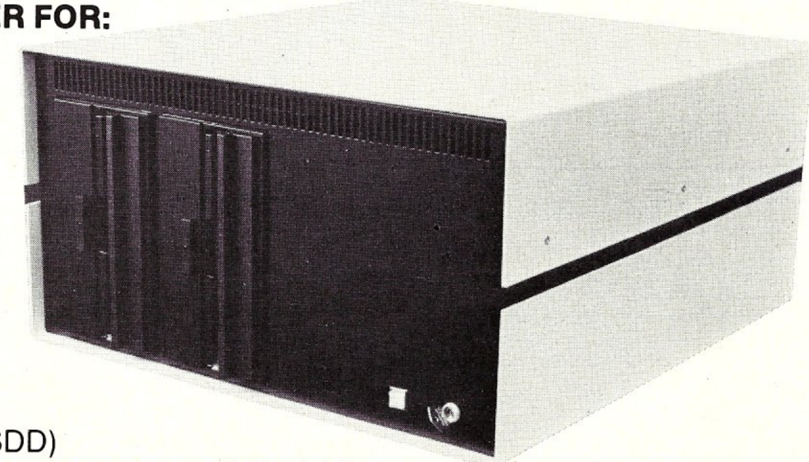

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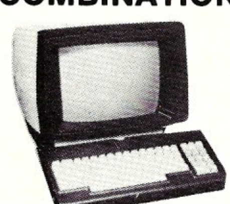

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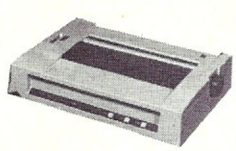

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CIRCLE 173 ON READER SERVICE CARD

NorthStar™ Topics

Double Your North Star RAM

by Richard Feldman

A simple hardware modification, which costs less than $90, converts a 32K North Star RAM-32 memory board to a 64K memory board, with 4K deselected at E000-EFFF hex. The modification calls for replacing the RAM chips provided by North Star with 4116s, and the addition of a 74LS20 to facilitate the deselection of 4K.

When introduced, the North Star RAM-32 was among the highest-density memory boards available for the S-100 bus. It took advantage of the new 4116 high-density dynamic memory chips that have since become a standard. At that time, 4116s were expensive and unavailable in reliable quantities. However, manufacturing dropouts, generically known as 4108s, were economical and available. The 4108 is a half-certified, or half-functional 4116. It is used as an 8K x 1 memory, whereas the 4116 is truly a 16K x 1 memory. North Star used 40 of the 4108s to create an array of 32K x 9 bits. Actually, the board consists of four somewhat independent 8K blocks of memory

Richard Feldman, Information Systems, El Paso Natural Gas Co., Box 1492, El Paso, TX 79978

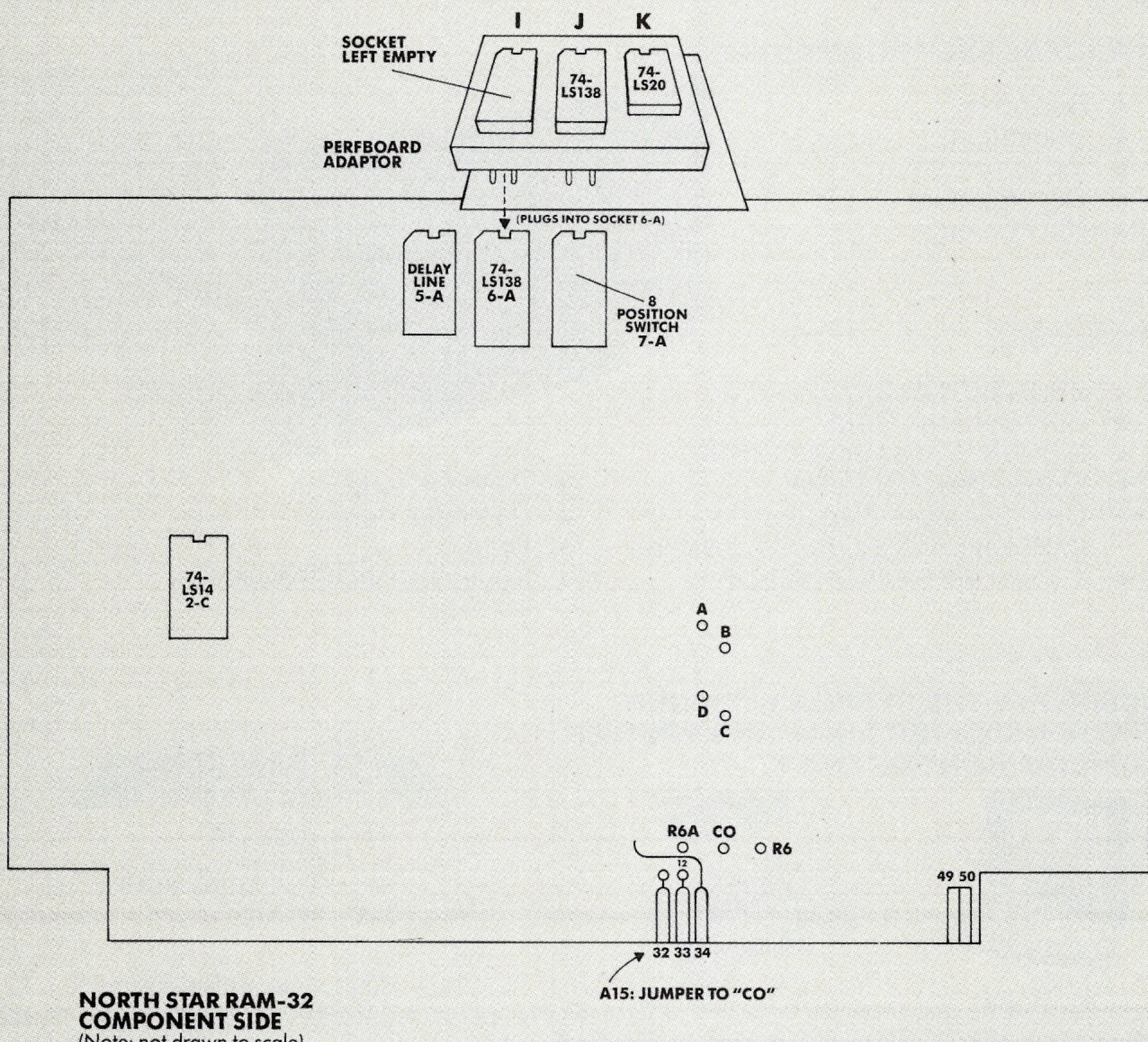

Figure 1. Memory board and adaptor layout

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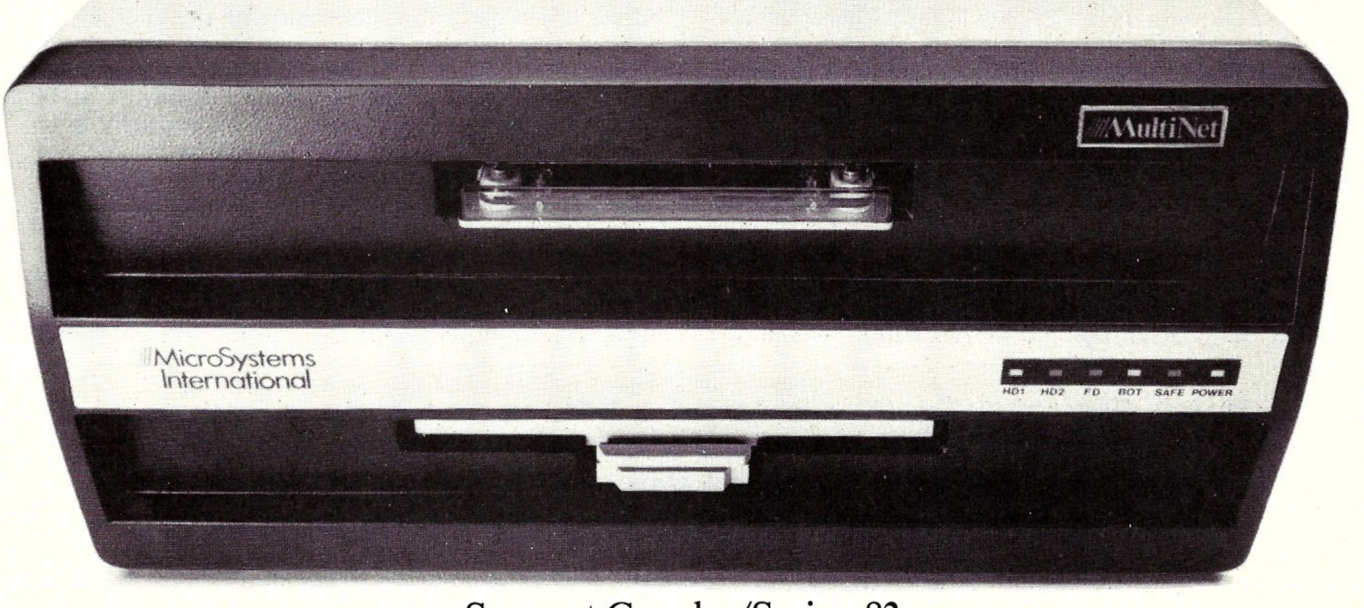

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CIRCLE 247 ON READER SERVICE CARD

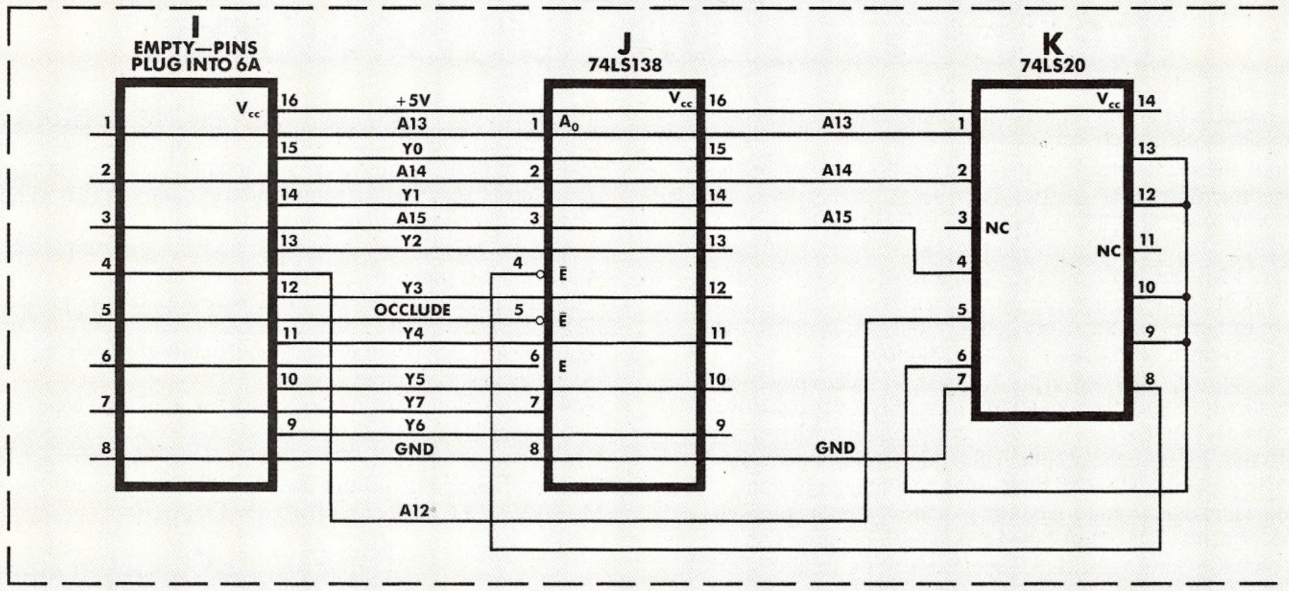


Figure 2. Perfboard adapter wiring

9 bits wide. The ninth bit is used strictly for parity, which is generated and checked on board.

The cost of 4116s has become very reasonable ($2.50 apiece or less for the 200 ns version). 4108s are not available. In fact, when 4108s need to be replaced, most often a 4116 is substituted.

Fortunately for owners of North Star RAM-32 memory boards, North Star practically designed a 64K memory board when it designed this product. In fact, were it not necessary to provide a "hole" for memory-mapped devices such as the North Star floppy disk controller or floating point board, the RAM-32 could be turned into a 64K memory board for the cost of replacing the 4108s with 4116s, and a jumper wire.

Two schemes are obvious: (1) Have the memory-mapped devices assert PHANTOM* when they are accessed, and (2) have the memory board respond to PHANTOM* by ignoring memory requests (or modify the memory board to provide a "hole" in its 64K space for these devices). Both ways have been tried, and both work. The PHANTOM* method is probably the simpler of the two, but requires modification of at least two boards (disk controller and RAM-32). To complicate matters, North Star has been providing gold fingers on the card edge only for those signals used by a particular board. On later versions, PHANTOM* is not available to the disk controller. Thus, implementation of PHANTOM* would require a wire connecting the disk controller to some other board with PHANTOM*.

The second method requires a little wirewrap "kluge" board that conveniently piggybacks onto the memory board. The modified board will necessarily occupy two S-100 slots, or the first slot of the Horizon (which has lots of clearance). Probably, a short length of ribbon cable would allow the "kluge" board to mount elsewhere.

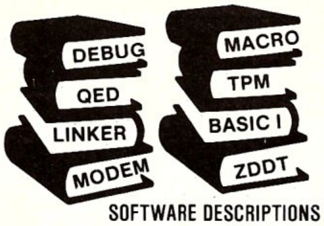
The remainder of this article describes the construction and installation of this simple adapter.

Theory of operation

North Star supported various versions of the 4108 (National 5298 and INTEL 2109). In each case, the "good" half of the chip was selected by tying an address line high or low, depending on the characteristics of the memory device. You should address the board for the low 32K Z80 address space and use A15, the high bit of the 16-bit address on the S-100 bus, to drive the appropriate "half" of a fully functional 4116. Thus when A15 is high (when the processor is referencing memory in the high 32K of address space), the "high" 32 block of memory is activated. When A15 is low, the "low" 32K block of memory is activated.

To deactivate the board during bus references to addresses in the region E000-EFFF hex, you must trap the condition where the high four bits of the ad-

North Star practically designed a 64K memory board when it designed the RAM-32. Were it not necessary to provide a "hole" for memory-mapped devices, the RAM-32 could be turned into 64K merely by replacing the 4108s with 4116s.



Z80 Software

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dress are 1110 (A15-A12) binary. To do this, use a spare inverter on the board and introduce a quad-input NAND gate to perform the comparison. Use the NAND of A15, A14, A13 and the inverted A12 to drive an **enable** input of the 74LS138 decoder. This will cause the board to ignore bus references to memory in the deselected area.

Procedure

RAM-32 board modifications

—Configure the board for MOSTEK 4108s by making certain the following jumpers are installed, or board traces intact (see Figures 1 and 2):

D-C B-A 12-R6A 13-CS

—Cut any existing jumper or trace connecting CO to "G" or "H." Add a jumper connecting CO to bus pin 32 (A-15). There is a feedthrough hole at pin 32 that can be used for this purpose.

—If the 74LS138 at board location 6-A is not socketed, unsolder the IC and install a socket. Be sure to use a socket that will accomodate wirewrap posts (which we will plug into the socket, in place of the 74LS138).

—Cut the trace connecting pin 4 and pin 8 at board location 6-A.

—Jumper R6 to pin 11 at 2-C.

—Jumper pin 10 of 2-C to pin 4 of 6-A.

—Replace 4108 RAM chips with 4116s of at least 250 ns speed.

—Set DIP switches at 7-A as follows:

ON: 1 2 3 4 OFF: 5 6 7 8

—Construct perfboard adaptor circuit. Plug it into the socket at 6-A.

—Test memory.

Perfboard adaptor construction

Materials

3 wirewrap sockets:
- 2 16-pin
- 1 14-pin

2 ICs:
- 74LS138 (removed from RAM-32)
- 74LS20

a piece of perfboard (phenolic type, *not* copper clad!), about 1 x 1.5"

wrap wire and tool; wire cutters

Instructions

Place sockets on perfboard as indicated in Figure 1. Pin 1 of each socket is in the upper left. The 14-pin socket is to the right of the two 16-pin sockets.

—The leftmost (16-pin) socket is I.

—The middle socket is J; the 14-pin socket is K.

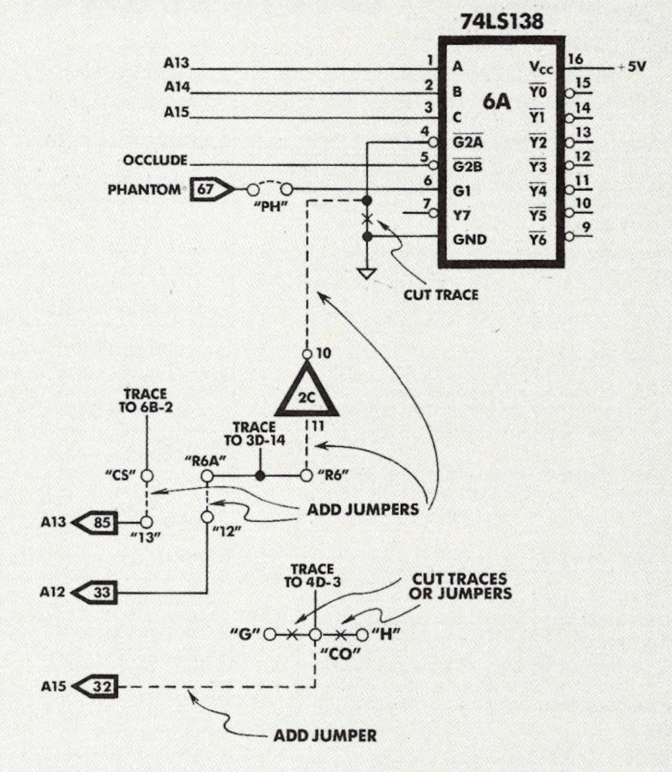

Figure 3. Memory board wiring changes

The 74LS138 will plug into J, and the 74LS20 will plug into K.

—Turn the board over so that the wrapping posts are face up, and pin 14 of K is in the upper left-hand corner. Make the following connections (as shown in Figure 3):

—Connect all pins of 1 to corresponding pins of J, except pin 4. (That is, pin 1 of I to pin 1 of J; pin 2 to pin 2; pin 3 to pin 3; pin 5 to pin 5; etc.

—Connect J-8 to K-7, J-16 to K-14.

—Connect I-4 to K-5.

—Connect K-6 to K-9 to K-10 to K-12 to K-13 (tie them together).

—Connect K-8 to J-4.

—Clip posts of J and K as short as connections will allow.

—Install the 74LS138 (removed from the RAM-32) at J.

—Install the 74LS20 at K.

The perfboard adaptor is now ready for installation onto the memory board.

Sample Test 1

```
RAMTEST3
MMMMMMMM MMMM**MM MMMMMMMM MMMMMMMM MMMMMMMM MMMMMMMM MMMMMMMM --P-MMMM
RAMTEST5
MMMMMMMM MMMMMMMM MMMM**MM MMMMMMMM MMMMMMMM MMMMMMMM MMMMMMMM --P-MMMM
```

Sample Test 2

```
MMMMMMMM -------- MMMM**MM MMMMMMMM MMMMMMMM -------- MMMMMMMM --P-MMMM
\............LOW 32K............../ \..............HIGH 32K.........../
```

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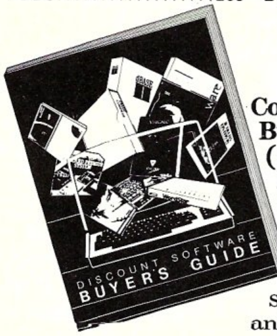

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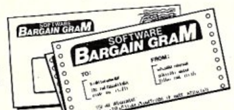

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North Star RAM continued . . .

Debugging

If the adaptor does not work the first time, try to boot a North Star DOS. Usually either 4.0 or 5.2 will boot. Run one of the memory tests supplied with 5.2 (RAMTEST3 or RAMTEST5) to determine the memory array. IF you do not own a copy of DOS 5.2 and the RAMTEST programs, acquire them! In a Horizon with only a CPU (no EPROM option enabled), a double- or single-density floppy disk controller, and the modified RAM-32, the test pattern, shown in Sample Test 1, should appear.

If any question marks (?) appear where "M" should, suspect a bad 4116. If the error occurs in the low 32K, locate the failed chip as if switches 1, 2, 3, 4 were ON. If the failure is in the high 32K, assume switches 5, 6, 7, 8 are ON. Follow diagnostic procedure as outlined by North Star. (The asterisks ** identify the area where the memory test program is running).

If a complete block of memory appears as --------, a wiring error is likely. Often, an 8K-block in the low 32K and an 8K block in the high 32K will fail to show up, creating the pattern seen in Sample Test 2.

If a wiring fault cannot be found, be sure the DIP switches at 7-A are correctly set (only 1, 2, 3, 4 ON) and make certain the perfboard adapter is properly seated.

I have used the adapter in my own Horizon for more than two years now with no failures, and I have installed the adaptor in at least a dozen other North Stars with similar results.

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Pascal Under UNIX
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An ideal introduction to structured programming, this handbook demonstrates the use of Pascal under the UNIX operating system. Filled with sample programs, application tips, and hints on avoiding common errors, it will have you preparing working programs almost immediately!

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Extremely up-to-date and well written, *Voice Technology* offers a comprehensive overview of the state of the art in this exciting new field. Step by step, the manual explores the key elements of man/machine communications: voice input technology, voice synthesis, and voice-controlled systems.

Pascal Programming Structures
By George Cherry

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UCSD Pascal: A Beginner's Guide to Programming Microcomputers
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CIRCLE 176 ON READER SERVICE CARD

Restoring Unsaved MBasic Programs

Delving into the workings of MBasic reveals techniques for recovery from many kinds of disaster

by Jon Lindsay

Somewhere in the past or the future can be found the following scenarios: The labors of your past hour(s) of debugging or writing of a special program have finally produced a product of value. Perhaps the wee hours of the morning and the concentrated mental focus are responsible for your somnambulistic action. You are looking at your screen, unable to believe what you are seeing. For reasons known only to greater powers that be, perhaps in your satisfaction and relief with your success, you have mindlessly exited Basic and have returned to your CP/M disk operating system. Only one small problem: You did not save your program.

Paradise lost

That's right! All that time spent is lost in just one foolish, thoughtless instant. Perhaps you made a mistake. No, the CP/M command level prompt is glaring out at you from under a screen full of blood, sweat and code. You are out of Basic and you lost your program. You may be thinking about the effort that is lost, of your aching back, of your derailed progress. It all starts to sink in.

Or perhaps the following: You have suavely moved through several disks, extracting program fragments as needed to create a larger, more sophisticated program. You have done this in order to save time and effort. It is starting to look good. You have run it and can now sense its power. It is going to be a good one. Just a little more tuning in the morning and another jewel will have been formed. You save it.

BDOS Err On A: R/O

What? What's that, you're thinking? You look again but you know. You forgot to RESET the last disk you switched. Your Basic lost its way in this alien directory. The program is lost, but you still cannot believe it.

The second coming

Can that program be resurrected? A resounding "Yes!" is the answer. First, it never really died. In the following discussion, we shall see that programs executing in memory most frequently reside at the level of memory used by Basic to store user programs. In CP/M, most .COM files are less than 18K (the approximate size of MBasic version 4.51) and therefore would not in themselves overwrite the program area. Of course, to execute any file, including MBasic, could destroy the volatile memory location of our sacred program, the one destined for the second coming. So, since time is of the essence, the first thing you are *not* going to do is execute any valid program: It may result in laying the "lost" program to rest permanently.

Established at this time are internal pointers within CP/M's Console Command Processor (CCP) that are already pointing to the location in memory of MBasic and its associated user program. These can be accessed by forcing the CCP to read a nonvalid file, which by default will force a rereading of the original program's pointers. Crudely said, the computer jumps back to the Basic interpreter. If you have listed the directory or any other valid program, the pointers are reset and another means will have to be used to recapture your program.

The technique used to revive the lost Basic program is to create an empty file and then read it. A friend suggested that such a program be appropriately named RERUN.COM. It is created by simply typing into the CCP:

SAVE 0 RERUN.COM.

Then type RERUN. If all goes well, MBasic should return with the prompt "ok". Listing the program should bring a sigh of relief. Nothing in the Basic interpreter or the user program should have been changed, and you should be able to continue as if nothing happened. Again, this procedure must be executed immediately after the accident in order to ensure recovery of your program. As a matter of convenience, it is not necessary that the file RERUN.COM already exist at the time of the accident, though it may. Creating it when it is needed will suffice.

Born again

But you forgot and already listed out the directory. And only then did you remember that recapture was possible. Or maybe your fingers developed a spasm and suddenly, involuntarily typed NEW. Now you are still residing in Basic but the listing is gone! Lost? No way. It's still there, but your program line pointer has been reset. What needs to be done is to determine what and where these pointers are and then to *regenerate* them.

Listing 1 is a short program that will be used as an example. It is this program that we shall examine in memory, but only at its operative location. Using the CP/M utility, DDT, it is easy to access memory and examine it. If MBasic has been loaded and the program in Listing 1 entered, then type SYSTEM to return to CP/M command level. Now type DDT (see

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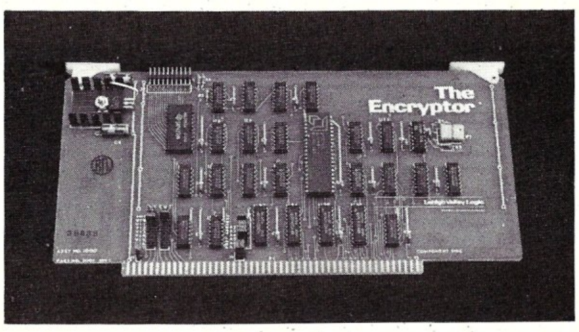

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CIRCLE 243 ON READER SERVICE CARD

Need a utility package that outperforms the rest . . . ?

The MicroTools are UNIX-like utilities for CP/M offering a range of features conspicuously absent in similar programs. This is the package you've been waiting for if you're interested in:

- Powerful UNIX-like syntax.
- Extensive program options with logical defaults.
- The ability to specify a program's input and output on the command line that invokes the program (input/output redirection).
- Wildcard file references — MicroTools that can operate on a list of files accept wildcards (a file exclusion operator is also supported).
- A handy mechanism for interconnecting programs (you can "pipe" the MicroTools or any other programs that support input/output redirection, such as C/80 programs).
- Compatibility with MicroShell (New Generation Systems' popular command interpreter).
- Complete easy-to-read documentation, including general information, command descriptions, and many useful examples.

The MicroTools make up a versatile utility package that not only covers your text-processing needs but also simplifies programming tasks and is flexible enough to handle odd jobs like maintaining mailing lists and formatting address lists for printing on label stock. The MicroTools package consists of 25 commands that perform these tasks:

cat	—	Concatenates files, optionally showing nonprintable characters in a visible manner.
col	—	Prints a file in multicolumn format.
com	—	Strips or reports lines common to two sorted files.
cut	—	Vertical file cutting: removes specified columns or fields.
crypt	—	Encrypts and decrypts files.
deform	—	Removes text-formatting commands from a file, including WordStar-to-normal text option, word-per-line option, etc.
diff	—	Compares text files with resynchronization.
echo	—	Prints arguments for messages from submit or shell files.
find	—	Finds a pattern in one or more text files with optional line boundary crossing, optional line numbering, etc.
get	—	Saves current drive or user number for later restoration under MicroShell.
grep	—	Searches for a regular expression pattern in one or more files.
ln	—	Creates or deletes file links.
merge	—	Merges sorted files with options to compare on a specific field, specify field delimiters, etc.
next	—	Allows looping on a list of items (e.g., file names or user numbers) under MicroShell.
p	—	Simulates "pipe" features when not running MicroShell.
paste	—	Inverse of cut, concatenates files vertically.
pr	—	Print formatter with 18 options including headings, page numbers, line numbers, offsets, single-page mode, multiple copies, printer control, etc.
rec	—	Reformats single-line, multifield records into multiline records (user-defined field delimiters).
sleep	—	Delays processing for a user-specified period.
sort	—	Sorts a file in memory with options to sort on a specific field, specify field delimiters, etc.
spl	—	Splits a file into user-specified-size chunks.
str	—	Displays printable strings in any file, e.g., *.com files.
tee	—	Saves intermediate pipeline results in a file.
uniq	—	Strips or reports duplicate lines in a sorted file.
wc	—	Counts lines, words, and characters in one or more files.

The MicroTools are supplied as CP/M *.com files (most are between 5 and 10K bytes) and are available for $150.00 ($25.00 manual only). Most disk formats can be accommodated. VISA and MasterCard are accepted. Virginia residents add 4%; add $20.00 for overseas air mail. Distributed by the creators of MicroShell:

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CIRCLE 225 ON READER SERVICE CARD

Listing 2). Type D4990 and observe the printout on your screen. At memory location 4997H you should find 00. This is the start of your program. If this is not zero, a syntax error would be issued if an attempt to run the program were made. Locations 4998H and 4999H represent the "next line" pointer of the current line. They indicate the beginning of the next line of the Basic program. The following two bytes, locations 499AH and 499BH, are the line numbers. All of the fiddling with such numbers and renumbering occurs within the interpreter, but the product is ultimately deposited here to be read by the interpreter at subsequent program runs. That which follows is a combination of single-byte codes representing commands and any ASCII text you may have entered. The single-byte codes are drawn from a table within Basic and are one of the reasons why Microsoft's MBasic is such a fast interpreter. Finally, after entering your line, you have to type a carriage return. This is manifested by the 00 byte at the end of the line.

What the interpreter looks for

No matter what has been entered as a program, the interpreter is looking for the following format: a zero (which happens by design to start the program), the "next line" pointer, the current line number, the command codes and text, and the ending zero. You may wish to consider this zero the line start in order to be consistent with the beginning of the program. In any case, that which follows this particular zero will be the "next line" pointer. This pattern repeats itself until the "next line" pointer is 00 00. That terminates the program. Simple.

Referring to Listing 3, when a program has been "cleared" by typing NEW while in Basic, the only thing that happens to the program is the resetting of the first "next line" pointer. It is set to 00 00, thus emulating an end-of-program status. The particular block of memory in which your program resides can then be overwritten. The contents of that block have no bearing on subsequent Basic operations, other than as a container of newer programs.

As to the Basic itself, it is changed when the NEW command is executed. Besides the user program being reset, the Basic scratch pad area is apparently reset at the same time. Because of this, special care must be exercised in the following technique for reinstatement of your program.

Paradise regained

Having dropped out of your program, whether still in Basic or not, you should now go to the CP/M command level. Enter DDT and display a block of memory starting at 4990H. Examine locations 4998H and 4999H and note their contents. If they are not zero, record the bytes on paper. If zero (indicating that the program had been cleared by the NEW command), then look past the next two bytes (the line number) or location 499BH. The first occurrence of 00 will mark the start of the new line (or the finish of the old one). The location of the next two bytes will be the bytes found in 4998H and 4999H. Remember that the least significant byte is placed first (i.e., in location 4998H). In Listing 3, this memory location is 49ACH. Therefore ACH (the least significant byte) goes into memory location 4998H and 49H into location 4999H. It will do no good to put them in now since reloading Basic will reset them. Please note that the contents of locations 49ACH and 49ADH, that is, D1H and 49H, represent the "next line" pointer for the following line and are of no importance to us at all. The body of the program should remain unchanged. It is only the beginning that has been modified or reset.

Having recorded the proper bytes on paper, type GO or control-C to exit DDT. Then load MBasic only. When the Basic command level prompt "ok" is given, you are ready to enter the "next line" codes. Still in the direct mode, type POKE &H4998, &HAC, and hit RETURN. That pokes the first byte or least significant byte into memory. Next type POKE &H4999, &H49. That reconstructs the second, or most significant, byte.

Cautions

You are walking on eggs at this point. Try listing the program. If all goes well, your program will list out as it did originally. Do not attempt to run this program! To do so will guarantee its loss. Basic is incapable of running it because its internal pointers have been reset. It will simply rewrite the program for you. However, you can list it out all day without damage. Once convinced that this is the complete wayward program, save it in the following manner: SAVE <program name>,A. That is, save it in the ASCII format. It cannot be saved in any other manner. Once safely on the disk, reload it. It will now operate normally, since Basic pointers have been properly adjusted for the born-again program.

This whole procedure is really an emergency procedure. As with all emergencies, keep a cool head and think it through carefully before acting senselessly and doing irreparable damage. Unless you have any memory defects or power outages, you should have close to 100% recovery on all such accidents.

Jon Lindsay is an oral surgeon in Monterey, California. His association with computers spans a five-year period, beginning in 1977 when he acquired an S-100 system. Interested mainly in programming, he has studied both high-level and low-level languages.

Can that lost program be resurrected?
Yes! It never really died.
As with all emergencies, keep a cool head and think before you act.

```
10 REM  Test program
20 PRINT "It is easier to recapture a "
30 PRINT "lost program than you think."
40 REM  Test calculation
50 LET A=23
60 LET B=67
70 PRINT A+B,A*B
```

Listing 1.

```
DDT
DDT VERS 2.0
-D4990
4990 FF FF FF FF FF FF FF 00 AC 49 0A 00 8F 20 20 54 .........I...  T
49A0 65 73 74 20 70 72 6F 67 72 61 6D 00 D1 49 14 00 est program..I..
49B0 91 20 22 49 74 20 69 73 20 65 61 73 69 65 72 20 . "It is easier
49C0 74 6F 20 72 65 63 61 70 74 75 72 65 20 61 20 22 to recapture a "
49D0 00 F6 49 1E 00 91 20 22 6C 6F 73 74 20 70 72 6F ..I... "lost pro
49E0 67 72 61 6D 20 74 68 61 6E 20 79 6F 75 20 74 68 gram than you th
49F0 69 6E 6B 2E 22 00 0E 4A 28 00 8F 20 20 54 65 73 ink."..J(..  Tes
4A00 74 20 63 61 6C 63 75 6C 61 74 69 6F 6E 00 19 4A t calculation..J
4A10 32 00 88 20 41 F0 0F 17 00 24 4A 3C 00 88 20 42 2.. A....$J<.. B
4A20 F0 0F 43 00 32 4A 46 00 91 20 41 F2 42 2C 41 F4 ..C.2JF.. A.B,A.
4A30 42 00 00 00 FF FF FF FF FF FF FF FF FF FF FF FF B..............
4A40 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ................
-
```

Listing 2.

```
DDT
DDT VERS 2.0
-D4990
4990 FF FF FF FF FF FF FF 00 00 00 0A 00 8F 20 20 54 ............  T.
49A0 65 73 74 20 70 72 6F 67 72 61 6D 00 D1 49 14 00 est program..I..
49B0 91 20 22 49 74 20 69 73 20 65 61 73 69 65 72 20 . "It is easier
49C0 74 6F 20 72 65 63 61 70 74 75 72 65 20 61 20 22 to recapture a "
49D0 00 F6 49 1E 00 91 20 22 6C 6F 73 74 20 70 72 6F ..I... "lost pro
49E0 67 72 61 6D 20 74 68 61 6E 20 79 6F 75 20 74 68 gram than you th
49F0 69 6E 6B 2E 22 00 0E 4A 28 00 8F 20 20 54 65 73 ink."..J(..  Tes
4A00 74 20 63 61 6C 63 75 6C 61 74 69 6F 6E 00 19 4A t calculation..J
4A10 32 00 88 20 41 F0 0F 17 00 24 4A 3C 00 88 20 42 2.. A....$J<.. B
4A20 F0 0F 43 00 32 4A 46 00 91 20 41 F2 42 2C 41 F4 ..C.2JF.. A.B,A.
4A30 42 00 00 00 FF FF FF FF FF FF FF FF FF FF FF FF B..............
4A40 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ................
-
```

Listing 3. The configuration after the command NEW was typed while still in basic.

NorthStar™ Topics

SCAN, RENUMBER, and CRUNCH Commands for North Star Basic

Find any variable or string in your Basic program; reorganize parts of your program; squeeze your program while keeping it readable.

by Randy Reitz

Three programs that enhance the N*Basic interpreter are offered by E.T. Software Services. The first, SCAN, finds all occurrences of any variable, string, line number, or whatever within a Basic program. SCAN can also be used to find and replace. The second, RENUMBER, provides an enhanced line-renumbering capability as well as the ability to reorganize parts of a program as subroutines. Finally, CRUNCH is used to reduce the memory requirements (both in RAM and on the disk) of N*Basic programs. These programs are not separate Basic programs—they are three immediate commands the Basic interpreter can use. The method of distribution is compatible with both single- and double-density systems, and the installation is easy.

These three enhanced commands are each distributed as machine code programs on a single-density disk (double density if specified). The user clears the machine's RAM memory, loads his personalized copy of N*Basic, leaves Basic with the BYE command, and then runs the appropriate machine code program by typing "GO SCAN" or "GO RENUMBER", for example. Each of these machine code programs contains the patches required in the N*Basic interpreter as well as a loader that determines where the N*Basic interpreter is running (e.g., at E00H or 2D00H, or wherever). The self-contained loader will patch in the modifications and code required to make the selected enhanced command work. For example, the enhanced RENUMBER command will replace N*Basic's REN command, while the SCAN command uses the MEMSET slot (MEMSET is restored in the SCAN code). After the patches are made, the new version of Basic is automatically saved on the disk under a new directory entry depending on the enhanced command just installed (e.g., "GO SCAN" produces "Basic-S").

The command ends by leaving you in the Basic interpreter with the "READY" prompt. You can exit Basic with the "BYE" command and proceed to install another enhanced command by typing another "GO" command. All three patches can be installed in this fashion in less than a minute. The new version of N*Basic can then be copied onto other working disks.

Randy Reitz, 26 Maple St., Chatham Twp., NJ 07928

If this installation procedure fails for some reason, enough information is saved on the disk to allow Jim Bailey at E.T. Software Services to analyze and correct the problem if the disk is returned to him.

The SCAN command

The SCAN command will look for occurrences of a variable (if a single character is given as an argument) or of a group of characters. Since SCAN is implemented in machine language, it produces results quickly. The output may be directed to a printer by using the syntax SCAN#1. The SCAN command can be used to find a quick cross-reference for any variable; but the additional feature of allowing test replacement provides more utility.

Enhanced RENUMBER command

The enhanced RENUMBER command does line renumbering of the entire Basic program as the old REN command, but it also offers new capabilities. First, selected sections of the Basic program can be renumbered. This allows subroutines to be given a unique range of numbers so that a library of subroutines can be developed. Subroutines that are spotted during program development can be created using the keywords "GOTO" or "GOSUB" that the new REN command supports. Using the syntax with the REN command that renumbers a selected range of line numbers, the keyword "GOTO" at the end the command will renumber the lines and leave a "GOTO" statement at the location of the original lines. The keyword "GOSUB" will leave a "GOSUB" behind as well as create the required RETURN at the end of the newly renumbered lines. Finally, the keyword "RETURN" will add a "RETURN" statement to the end of the renumbered group of lines, but without leaving a "GOSUB" statement behind.

Enhanced CRUNCH command

Finally, the CRUNCH command can be used to squeeze unnecessary spaces from a N*Basic program. I have used a "COMPRESS" program in the past to reduce the size of a N*Basic program, but the results are necessarily unreadable. This had led me to keep two copies of a program, one in "readable" form, and the other in the "squeezed" form. This doesn't help solve the disk storage problem. The

CRUNCH continued . . .

"CRUNCH" command is a very clever solution to the problem of compressing a N*Basic program and still have a "readable" program to work with. Running the CRUNCH command leaves a blank after the last line of the program that is a flag to the LIST command to "format" the crunched program. The formatting performed by the LIST command restores spaces around operators and variables so the program is more readable. Of course, all the REM statements have been removed and will not reappear. The CRUNCH command does more than remove unnecessary spaces and REM statements—it also saves space by combining multiple statement on one line. The formatted LIST command breaks up multiple lines and displays crunched lines as many formatted lines. Only the original line has a line number. The formatted listing has a pleasing appearance, since most all those annoying line numbers are gone.

I tried CRUNCH on some old programs and found it "saves" anywhere from 20% to 30%. It really CRUNCHes. A lot of this savings is gained by combining multiple lines. The line length of these "new" lines can be controlled by using the N*Basic "LINE" command to set the length of the line for device number 7. The maximum length allowed by N*Basic is 165. Using the maximum, the number of program lines is reduced by a factor of four or more. CRUNCH is also fast. On a program of about 15,000 bytes, CRUNCH ran in less than 10 seconds! Editing a line up to 165 characters long can be difficult, so "UNCRUNCH" is available to give each line its own line number. As you may have guessed, UNCRUNCH is also fast.

Enhanced PSIZE command

There is an enhanced "PSIZE" command to go along with CRUNCH. It reports program size in disk blocks (like the old one does), as well as in bytes and number of lines. The last line number of the program is reported so the line with the formatting "space" can be found and removed if desired. If the space is removed, the LIST command will produce the unreadable listing expected in a compressed program.

These enhanced commands are well documented, with "manual" pages suitable for including in the *North Star System Software Manual*. All documentation is included on the distribution disk. These programs are inexpensive and offer significant enhancements to the N*Basic interpreter.

SCAN, RENUMBER, and CRUNCH are available from:

E.T. Software Services
1072 Casitas Pass Road
Carpinteria, CA 93013

SCAN sells for $29.50 and RENUMBER sells for $39.50. There is no price announced for CRUNCH at this time. There is a $2 shipping charge for each program when ordered separately, otherwise both SCAN and RENUMBER can be purchased on the same diskette for only $65 ppd. California residents are reminded to add 6% sales tax.

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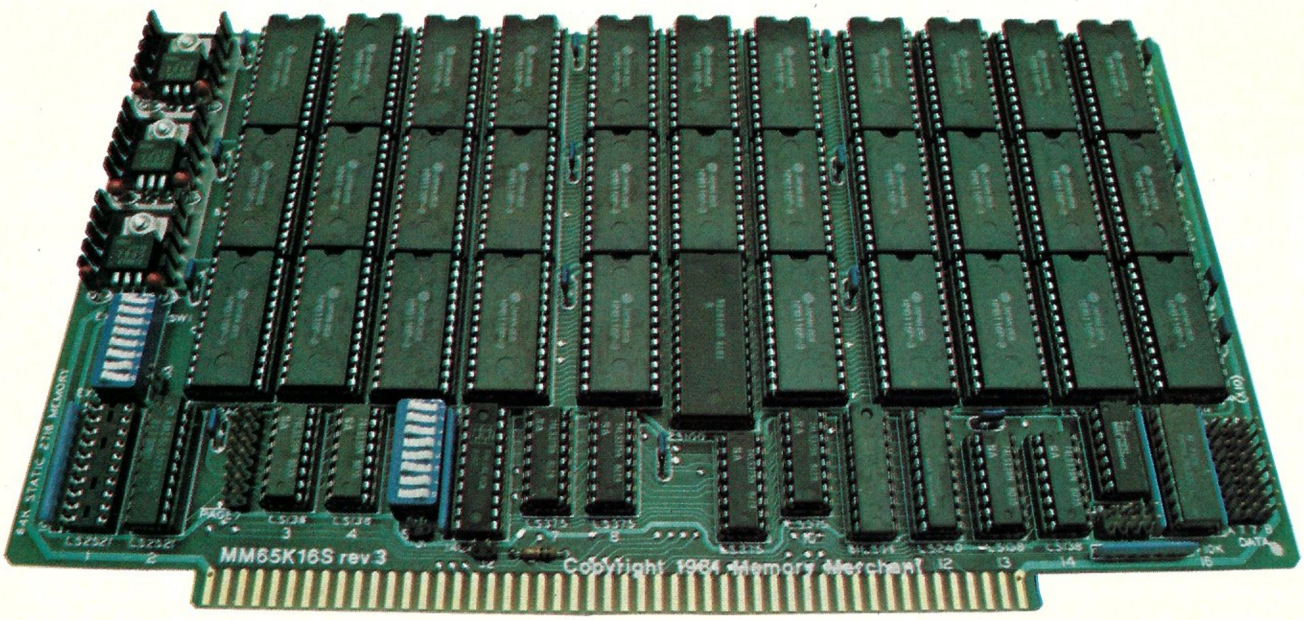

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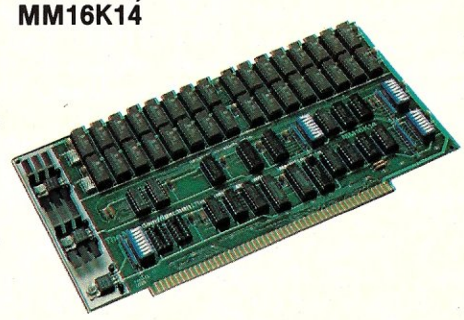

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UCSD Pascal Disk Scanner

by Jon Bondy

I have been an avid UCSD Pascal user for years, and I joined the UCSD p-System Users Society (USUS) at its first meeting in the summer of 1980. USUS has grown quite a bit since it started, and one area of growth has been the use of electronic mail systems and bulletin boards for informal society communications. I now belong to two such systems: one on TeleMail, the other run as a SIG under MicroNet's CompuServe. Both systems generate a lot of messages, but the CompuServe system (called MUSUS for MicroNet USUS) generates the most—as many as 40 messages in one day. (If you want more information on USUS, write to USUS at Box 1148, La Jolla, CA, 92038.)

Many of the msasages I read are of no importance to me at the time, but I upload all messages and store them on UCSD archive disks; I have 10 currently. I was talking with a friend of mine, mentioning some of the stuff that I had been reading on the networks, and he indicated an interest in one of the topics. I had no real idea when the information had been put on the bulletin boards, or even exactly how many messages there were concerning the topic. I thought about using my text editor to go through all 10 disks looking for some keywords, and decided that anything was better than that—even writing a program!

The problem I had to solve was scanning an entire disk volume to look for character patterns and report their presence (and if possible, the name of the file in which they occurred). To make the program as flexible as possible, I had it read a file to obtain the keyword patterns to be searched for. This allowed me to specify a number of similar patterns for the search. For instance, you might not know if my name were on disk as "Bondy" or as "BONDY", so you might include both patterns just to be safe.

Reading portions of the disk into memory was fairly easy using the UNITREAD system intrinsic, which allows you to read random blocks on a disk. The UNITREAD intrinsic is called with parameters of the form

```
UNITREAD(unit_umber, buffer,
    SIZEOF(buffer), block_num);
```

where "unit_number" is the disk number (like CP/M "A:" or "B:", only under UCSD Pascal it is "4" or "5"), "buffer" is the array into which data is to be read, "SIZEOF(buffer)" uses the intrinsic SIZEOF to compute the length of the buffer array in bytes, and "block_num" is the starting block number for the read.

Since I could not hold the entire disk in memory at one time, I had to read it as a series of buffers and scan each buffer after it was read. The format for text files in the UCSD system is such that at times lines can span disk blocks. If a keyword were to lie half in one disk block and half in the next one, and if these two blocks represented the final block of one buffer and the initial block of the next buffer, I might not find that word. To prevent this, I reread the last block of a buffer again as the first block of the next buffer.

Jon Bondy, Box 148, Ardmore, PA 19003

Scanning was easy in principle, but it took a while to get it right. UCSD Pascal supplies a SCAN intrinsic that performs rapid character searches in blocks of text. The SCAN function is used as follows:

```
k := SCAN(length, =ch, buffer[i]);
        or
k := SCAN(length, <>ch, buffer[i]);
```

where "length" is the maximum scan length, the second parameter is a partial character comparison expression, and "buffer[i]" is the starting location of the scan. The first example would scan starting at the "i-th" element of "buffer" searching for a character equal to the value of "ch", and would terminate the search if it were unable to find a match before "length" characters had been searched. If the search fails, then the value returned by the function is equal to "length"; if the search succeeds, the value returned is the offset from the start of scan of the character found (and is less than "length"). I used the SCAN intrinsic to find all occurances of the initial character in my keyword patterns, and then compared the remaining characters "manually" in a FOR loop.

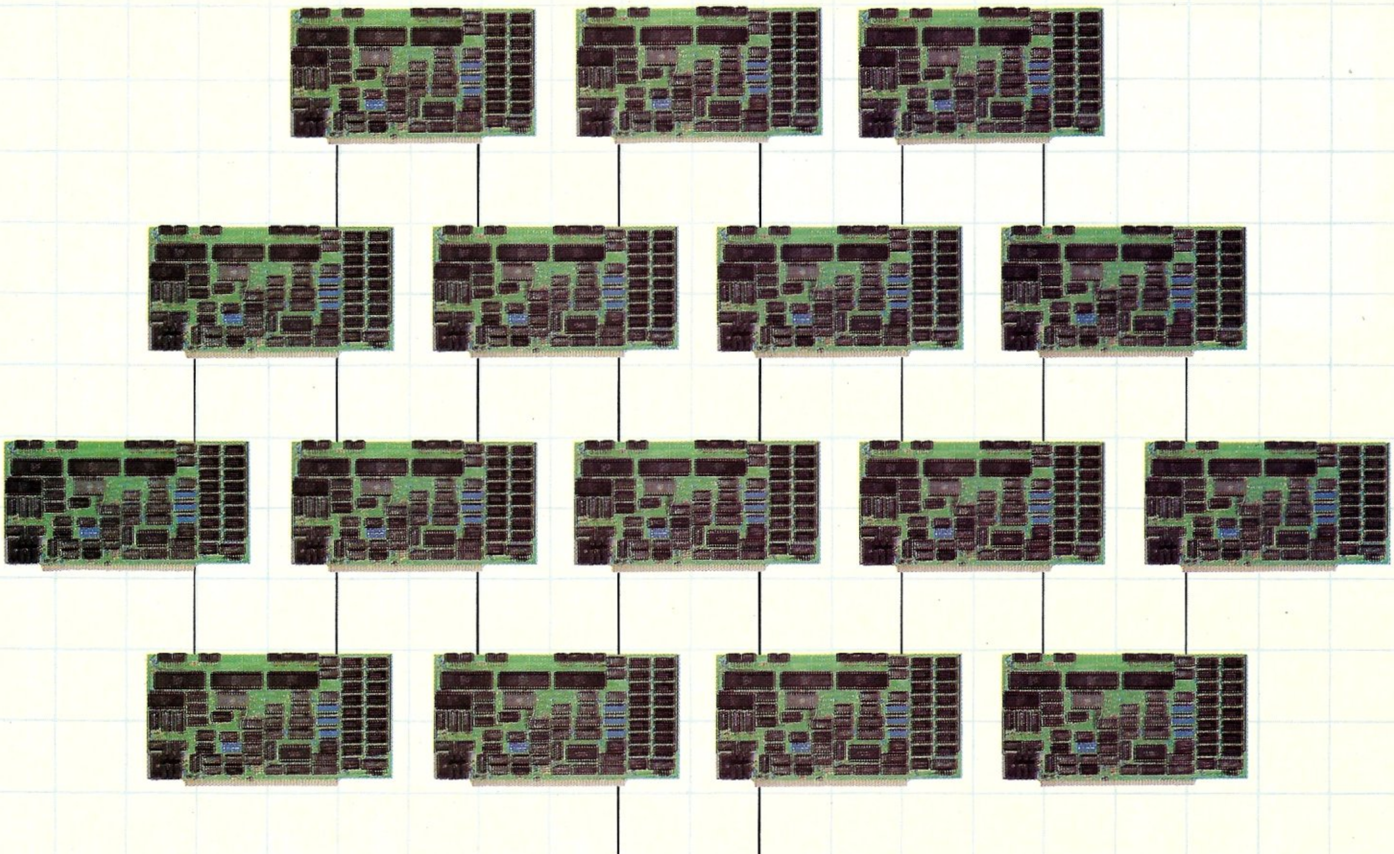
Once a keyword pattern was found, I knew the location of the keyword in the buffer, but that was not very useful to me. By dividing by 512 I could figure out the block offset in the buffer, and by adding the block number of the initial block that was read off disk for that buffer, I could figure out the disk block number where the string had been found.

To determine in which file the string lay, I had to read in the disk directory and scan it. Each directory entry contains a starting block number and an ending block number: If the disk block I had found lay between the two block limits for a given file entry, then the keyword I had found was in that file. If I could not find a file for which this was true, then the keyword lay outside of a file. (For more information on the structure of UCSD disk directories, please see my article "Reading UCSD Pascal Disk Directories" on page 49 of *Microsystems,* Vol. 2, No. 1, January/February 1981.)

To make the program output more useful, whenever I find a keyword, I print two lines. The first line contains the absolute block number on the disk where the keyword was found, the file name in which it was found (if such a file exists), and a "v" character. The second line contains the 35 characters that preceeded the keyword and the 35 characters that followed the start of the keyword, positioned so that the "v" in the previous line points to the start of the keyword. Control characters or characters that are not in the buffer (if the keyword is near the end of the buffer) are printed as asterisks ("*"). A sample output would look like this:

```
Block: 132 File: GUMBO.TEXT         v
of the most interesting ones*was by
Bondy in Microsystems.*Sincerely*Tom
```

Now Our Family Tree Is Complete



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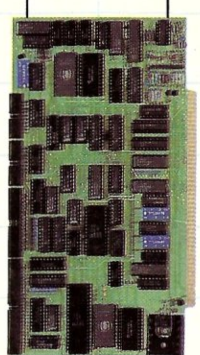

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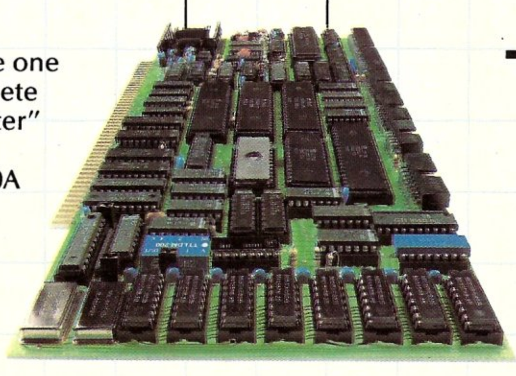

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Note the "*"s which indicated carriage returns in this fictitous message. The final program is given in the listing that follows.

Jon Bondy is a Data Systems Engineer with General Electric's Space Division in King of Prussia, PA. He has worked with hardware, firmware (microprogramming), and software on projects ranging from a microcomputer-driven zero-gravity mass measuring device to a smart CID star-tracker to a nuclear power plant monitoring system. His current work is on a distributed processing architecture for fault-tolerant spacecraft of the mid-to-late 1980s.

Note: *UCSD Pascal is a trademark of the Regents of the University of California.*

```
program scanner;

  { the declarations relating to disk directories is copyright 1979 by
    the Regents of the University of California at San Diego, and is
    used with their permission }

  CONST
      { disk directory stuff }
      MAXDIR = 77;             (*MAX NUMBER OF ENTRIES IN A DIRECTORY*)
      MAXUNIT = 12;            (*MAX NUMBER OF UNITS *)
      VIDLENG = 7;             (*NUMBER OF CHARS IN A VOLUME ID*)
      TIDLENG = 15;            (*NUMBER OF CHARS IN TITLE ID*)
      FBLKSIZE = 512;          (*STANDARD DISK BLOCK LENGTH*)
      DIRBLK = 2;              (*DISK ADDR OF DIRECTORY*)

      max_entries = 10;
      read_unit = 5;             { unit where disk is read }
      buffer_length = 16383; { starts at zero }

  TYPE
      { disk directory stuff }
      DATEREC = PACKED RECORD
          MONTH: 0..12;          (*0 IMPLIES DATE NOT MEANINGFUL*)
          DAY: 0..31;            (*DAY OF MONTH*)
          YEAR: 0..100           (*100 IS TEMP DISK FLAG*)
        END (*DATEREC*) ;
      UNITNUM = 0..MAXUNIT;
      VID = STRING[VIDLENG]; { volume name (I.D.) }
      DIRRANGE = 0..MAXDIR; { number of entries (files) in a directory }
      TID = STRING[TIDLENG]; { title (file name) I.D. }
      FILEKIND = (UNTYPEDFILE,XDSKFILE,CODEFILE,TEXTFILE,
                  INFOFILE,DATAFILE,GRAFFILE,FOTOFILE,SECUREDIR);
      DIRENTRY = RECORD
        DFIRSTBLK: INTEGER;           (*FIRST PHYSICAL DISK ADDR*)
        DLASTBLK: INTEGER;            (*POINTS AT BLOCK FOLLOWING*)
        CASE DFKIND: FILEKIND OF
          SECUREDIR,
          UNTYPEDFILE: (*ONLY IN DIR[0]...VOLUME INFO*)
             (DVID: VID;              (*NAME OF DISK VOLUME*)
              DEOVBLK: INTEGER;       (*LASTBLK OF VOLUME*)
              DNUMFILES: DIRRANGE;    (*NUM FILES IN DIR*)
              DLOADTIME: INTEGER;     (*TIME OF LAST ACCESS*)
              DLASTBOOT: DATEREC);    (*MOST RECENT DATE SETTING*)
          XDSKFILE,CODEFILE,TEXTFILE,INFOFILE,
          DATAFILE,GRAFFILE,FOTOFILE:
             (DTID: TID;              (*TITLE OF FILE*)
              DLASTBYTE: 1..FBLKSIZE; (*NUM BYTES IN LAST BLOCK*)
              DACCESS: DATEREC)       (*LAST MODIFICATION DATE*)
       END (*DIRENTRY*) ;
  var
     DIRECTORY : ARRAY [DIRRANGE] OF DIRENTRY;
     infile : text;
     dict : array[1..max_entries] of string;
     num_entries : integer;
     buffer : packed array [0..buffer_length] of char;
     i, j, k, l : integer;
     start_char, start_block, num_blocks, chars_read, len : integer;
     found, done : boolean;

procedure tell_found;
   var
      i, block : integer;
      found : boolean;
   begin
   block := start_block + (start_char div 512);
   write('Block: ', block:3, ' ');

   { search for block in a file in disk directory }
   found := false;
   for i := 1 to directory[0].dnumfiles do
      with directory[i] do
         if (block >= dfirstblk) and (block < dlastblk) then begin
            write('File: ', dtid, ' ':(16-length(dtid)));
            found := true; end;
   if not found then write('Not found in a file.  ');
   { indicate location of key-word on next line }
   writeln('    v');

   { display context of text found: control characters are '*'s }
   for i := -35 to 35 do
     if (start_char+i-2 >= 0) and
        (start_char+i-1 < chars_read) then
        if (buffer[start_char+i-2] in [' '..'"']) then
```

```
          write(buffer[start_char+i-2])
        else write('*')
      else write('*');
    writeln; writeln;
    end; { tell_found }

begin
writeln('Disk Scanner Program.  Jon Bondy.  Jan 1982.');

{ read in key-word patterns to be sought }
reset(infile,'scan.data.text');
num_entries := 1;
while not eof(infile) and (num_entries <= max_entries) do begin
   readln(infile,dict[num_entries]);
   writeln(num_entries:2, ': "', dict[num_entries], '"');
   num_entries := num_entries + 1;
   end;
num_entries := num_entries - 1;

write('Enter <CR> when disk is in Unit 5.'); readln;
unitread(read_unit,directory,sizeof(directory),dirblk,0);
with directory[0] do
   writeln('Volume ', dvid, '; scanning ', deovblk,' blocks.');

start_block := 10;
while (start_block <= directory[0].deovblk) do begin

   { read in buffer of data from disk }
   num_blocks := directory[0].deovblk - start_block;

if (num_blocks > 32) then num_blocks := 32;
chars_read := num_blocks * 512;
unitread(read_unit, buffer, chars_read, start_block);

for j := 1 to num_entries do begin { scan for each key-word entry }
   start_char := 0; len := chars_read - 1; done := false;
   repeat { until not found in buffer }
      k := scan(len,=dict[j,1],buffer[start_char]);
      start_char := start_char + k + 1;
      if (k < len) then begin { found initial char }
         l := 2; found := true;
         while (l <= length(dict[j])) and found do begin{ finish compare }
            if (dict[j][l] <> buffer[start_char+l-2]) then
               found := false;
            l := l + 1;
            end; { while }
         if found then tell_found;
         end { if }
      else done := true;
      len := len - k - 1;
      until done;
   end; { for j }
{ re-scan last block in case key word ran across block boundary }
start_block := start_block + 31;
end; { for i }
end.
```

CompuPro MPX-1 Multiplexer Channel

An S-100 multiplexer board that relieves the system CPU of having to spend any time handling I/O

by Dennis Thovson

Most microcomputers use the system central processing unit (CPU) to handle all input/output (I/O) to peripheral devices such as printers and CRT terminals. This is usually accomplished in either of two ways: programmed I/O or interrupt I/O. Programmed I/O is the less efficient because the system CPU, not knowing when the peripheral device is ready, is required to wait in a status check program loop, or make repeated calls to the peripheral device until it sets its status to ready. Interrupt I/O is usually more efficient in using CPU time (assuming the plication program or operating system is designed to take advantage of the interrupt capability) because the CPU does not have to continually check the I/O device status; therefore the CPU needs to service an I/O device only when that device requests attention via an interrupt.

For example, consider a multiuser system with a number of active consoles attached. Using program I/O, the CPU will have to poll all consoles periodically (every few milliseconds) to see if any key has been pressed. With interrupt I/O, the CPU can execute the various user application programs until an interrupt is sensed from one of the consoles. Only then will the CPU stop execution of the application program, jump to an interrupt handling program routine, get the keyboard character, store it in a buffer, then return to the application program and resume execution.

No time is wasted in polling the console keyboards looking for a key press, which happens very infrequently in terms of CPU execution time. Is there a still more efficient way to handle I/O without wasting main CPU time? Godbout Electronics has taken a page from the large mainframe computer book and developed a multiplexer board that very nearly relieves the system CPU of having to spend any time handling I/O chores. This board is the MPX-1, for the IEEE-696/S-100 bus.

Overview of the MPX-1

The MPX-1 contains a 6MHz 8085 processor, 16K of RAM, 2 to 8K of EPROM, and an 8259A interrupt controller. The RAM and EPROM are local to the MPX-1 and thus do not occupy any address space in the main system memory on the S-100 bus. The MPX-1 is a complete computer that can run independently of, and in parallel with, the main system CPU.

Dennis Thovson, 243 McMane Ave., Berkeley Heights, NJ 07933

However, it does not itself have any I/O capability; that is, it does not have on-board USARTs, PIAs, or the like with which to communicate with the I/O devices. So, you ask, what good is a computer that can't talk to anything? Pay attention now, I didn't say the MPX-1 couldn't perform any I/O—only that it couldn't perform I/O by itself.

What the MPX-1 does is to steal the bus for a cycle or two when it needs to access I/O or other devices on the system bus. It does this by becoming a temporary master and executing a direct memory access (DMA) cycle on the system bus in accordance with protocol defined in the IEEE-696/S-100 specification. Thus, the MPX-1 has access to the system bus and all the attached resources such as main memory and I/O ports. Only one problem remains: How do the main system CPU and the I/O devices get the attention of the MPX-1? It's really quite simple: they interrupt it.

When the main system CPU needs to get the attention of the MPX-1—to output a character to a console or printer for example—it can place the character in a selected location in system memory and cause an interrupt to the 8085 by executing an OUT instruction to a specified port called the ATTN port. The OUT instruction triggers a hardware interrupt to the 8085 (the MPX-1 uses the restart 7.5 interrupt input unique to the 8085). The 8085, upon acknowledging the interrupt, executes a program which, in this example, initiates a DMA cycle and reads the character to be output from system memory into local memory. When the console or printer is ready, it issues an interrupt, and the MPX-1 initiates another DMA cycle and outputs the character to the I/O device port on the system bus. All of this happens independently of the system CPU except for the bus cycles "stolen" by the MPX-1 when it needs to access the system bus.

The 8259A interrupt controller on the MPX-1 is connected to the eight vectored interrupt lines defined on the S-100 bus. This allows any device that can generate an interrupt, such as a video terminal or printer, to directly get the attention of the 8259A and subsequently the 8085 on the MPX-1 board. A console keyboard may, for example, generate an interrupt on one of the vectored interrupt lines that will cause the MPX-1 to input the character and store it in a buffer until the system CPU reads it out. Note that the main system CPU does not need to know about the interrupt being processed by the MPX-1 board.

In some applications it may be necessary for the MPX-1 to get the immediate attention of the main

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CompuPro MPX-1 Multiplexer Channel continued . . .

system CPU. This can be accomplished by connecting one of the eight vectored interrupt lines to the interrupt input of the system CPU and configuring the MPX-1 to generate an interrupt on that line. Also, as described above, the MPX-1 can pass status or other types of information to the system CPU, on a program basis, by writing to system memory.

Selected details

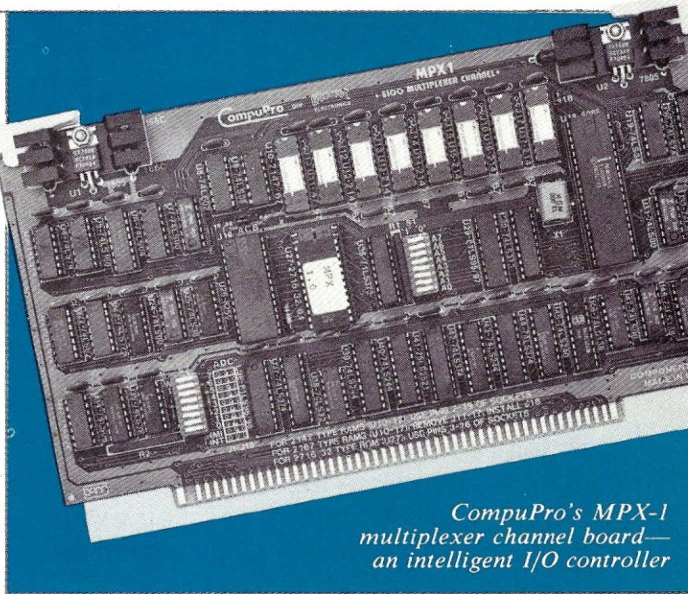
Communication between the MPX-1 and the system CPU takes place through a 100H byte window which the MPX-1 can place anywhere in the main system address space, including extended address memory. Through this window, the MPX-1 can read from, write to, or even execute code resident in the system memory. To understand how this is accomplished by the MPX-1, let us first take a look at its local memory map:

0000H	to	3FFFH	RAM
4000H	to	7FFFH	EPROM
8000H	to	8001H	8259A Registers
8002H			Set Interrupts Latch
8004H			DMA Address Bits 8-15
8005H			DMA Address Bits 16-23
8007H			Interrupt Response Byte
C000H	to	FFFFH	External window

Note that any local address above C000H accesses the external window. But if the window is only 100H, which 100H page within the external window is accessed? The 100H page accessed is that page selected by the DMA address bytes stored at 8004H and 8005H, which represent address bits 8–15 and bits 16–23, respectively. Any memory above C000H addressed by the 8085 will be within the 100H page, starting at at the previously selected DMA address. The careful reader will note that only the low byte of the local address above C000H has any meaning for external memory address selection. The MPX-1 uses the high byte as an indication to trigger a DMA cycle for access to the system memory addressed by the DMA address (bits 8–23) and the low order byte (bits 0–7) of the local address.

Since the MPX-1 does not have any I/O ports itself, an 'IN' or 'OUT' instruction executed by the 8085 will cause the MPX-1 to trigger a DMA cycle to access any ports available on the system bus. Thus the MPX-1 has full access to all the I/O resources on the system bus at a very small time penalty to the system CPU (a stolen bus cycle).

It is beyond the scope of this review to discuss the 8259A interrupt controller in any depth. However, a few remarks may be of assistance to anyone considering integrating the MPX-1 into their system. The 8259A can be connected directly to any or all of the eight vectored interrupt lines defined on the S-100 bus via user-configurable jumpers on a DIP header. The 8259A must be initialized to the desired configuration before it can be used. This is accomplished by writing a sequence of "initialization" and "control"



CompuPro's MPX-1 multiplexer channel board— an intelligent I/O controller

words to the 8259A registers memory-mapped to 8000H and 8001H.

An interrupt detected by the 8259A will, after resolving any priority disputes caused by simultaneous interrupts, provide an interrupt to the 8085. It will also provide, during the 8085 interrupt acknowledge cycle, a vector (memory address) to a jump table containing pointers to interrupt handling routines. The 8085 executes the interrupt program routine, tells the 8259A when it is done by writing a byte to the appropriate 8259A register, and then returns to whatever program it was executing prior to the interrupt. All of the above takes place locally on the MPX-1, independent of the system CPU.

As previously mentioned, the MPX-1 also has the capability of providing an interrupt to the system CPU. This is accomplished by jumpering the serial output data (SOD) lead from the 8085 to one of the eight vectored interrupt lines. A "1" written to the SOD port will then cause an interrupt input to the system CPU, assuming it is connected to the proper vectored interrupt line. The MPX-1 will respond to a system bus interrupt acknowledge cycle by writing the byte previously stored at local address 8007H to the system data bus.

MPX-1 programming

As delivered, the MPX-1 comes equipped with a 2716 EPROM programmed with an initializing routine and a number of utilities. Since the 8085 starts execution at address 0 (unitialized RAM), the MPX-1 uses a hardware trick which in effect exchanges the EPROM located at 4000H with RAM at 0 during a RESET or SLAVE CLR. After the first 3 bytes of the EPROM are read by the 8085 (which contain a jump to the starting address of the initializing routine), the EPROM is restored to its normal base address of 4000H.

Godbout Electronics has taken a page from the large mainframe computer book and developed a multiplexer board, the MPX-1, which very nearly relieves the CPU of handling I/O chores.

The MPX-1 utilities furnished include 8259A initializing routines as previously discussed and routines dealing with 8259A status and control, loading MPX-1 RAM with a program from system RAM, executing a program in MPX-1 RAM, and moving a block of memory from one location to another in system RAM. The system CPU can cause the MPX-1 to execute any of the utilities by issuing an OUT instruction to the ATTN port and passing a corresponding command byte and any required parameters through the system "window." The manual says that these utilities are ". . . partly tutorial and partly a useful way to get 'up and running' with the MPX in a minimum amount of time." While I might argue with the "minimum amount of time" statement, the utilities are certainly useful and do help the programmer to understand the functioning of the MPX-1 board. Full source code for the utilities is furnished in the manual.

The ability to execute programs in MPX-1 local RAM loaded from system RAM enables the user to configure the MPX-1 for a specific application at the time of system initialization. It also enables a programmer to try out and debug routines in RAM before they are burned into EPROM. It is in this latter mode that I have spent many hours alternately praising and cursing the MPX-1.

Practical experience with the MPX-1

The basic idea was to program the MXP-1 to handle all I/O chores for my single user 6MHz CompuPro Z80 system. The I/O devices consist of an old TDL video board that requires a lot of software but can emulate most any terminal, a Visual 50 video terminal, a Diablo 1620 printer, which also requires a lot of software to print bidirectionally at 1200 baud, and a 1200 baud 212 type modem. The last three devices are driven by a CompuPro Interfacer 4 I/O board.

The most difficult part of programming the MPX-1 arises because all debugging must be done indirectly—there is no direct access to the 8085 or the MPX-1 local memory. The 8085 runs its programs in splendid isolation from the system (as it is supposed to do). The technique I used was to first develop and run the programs on the main system to uncover and correct any logic errors. This is only partially useful, since one cannot normally simulate all of the hardware features and software interactions of the MPX-1, to say nothing about the timing interactions of a full interrupt system.

The timing interactions are particularly troublesome because they are completely asynchronous to the system—even more so than with a conventional interrupt system. There are two levels of synchronization to contend with: the interrupt programs on the MPX-1 board itself, and the communication between the system CPU and the MPX-1. The I/O routines written for the MPX-1 require a thorough understanding of the 8259A interrupt controller and the particular features of the ATTN port implementation. Since interrupts generated by the ATTN port are directed to the 8085 RST 7.5 input, and those generated by the 8259A are directed to the main 8085 INTR input, these interrupts are independent of one another. (Remember that the 8259A by itself can handle up to eight interrupt requests all occurring independently of one another.)

It is necessary to thoroughly think through the logic of what happens when each interrupt occurs, as well as when and when not to re-enable interrupts during the processing of any given interrupt. I learned this lesson the hard way! At various times during MPX-1 program development for the Diablo 1620 driver, it would print alternate characters, or print every character twice, or go into hyperspace without any clue as to why. This was after the program had been tested and worked perfectly on the main system!

Most of these problems occurred when passing a character to output from the system CPU to the MPX-1 via the ATTN port. I used a software handshake to tell the system CPU when the MPX-1 program had accepted a character and was ready for another one; i.e., the MPX-1 program placed a status byte in system memory. The program timing of this handshake is critical, since the ATTN port interrupt to the 8085, which is disabled whenever an OUT instruction from the system CPU is processed, must be re-enabled.

One must be very careful that the sequence and timing of setting the status byte to ready and rearming the ATTN port interrupt does not permit some unexpected event or time delay to occur in between the two, which would allow the system CPU to send another character or command to the MPX-1 when it should not. This condition arises because the action of setting the status byte and rearming the ATTN interrupt are separate program steps that cannot occur simultaneously. The most foolproof method may be to use the output of the MPX-1 8085 SOD port to interrupt the system CPU as an indication that the MPX-1 is ready. This would, in effect, amount to a hardware handshake and get around the problem of the system CPU knowing when the MPX-1 is ready to accept another character or command. However, with careful attention to program timing detail, I have not found this to be necessary in the programs that have been developed so far.

Summary

The MPX-1 is an elegant concept, flexible in the extreme and a pain in the posterior to program—but then a good challenge is always rewarding when finally met. The first page of the manual states: "The manual is intended to guide the sophisticated systems integrator or OEM through hardware features of the MPX-1. This manual is not intended for novice or inexperienced users." Amen! It further goes on to say

The MPX-1 is an elegant concept, flexible in the extreme and a pain in the posterior to program—but then a good challenge is always rewarding when finally met.

Compupro continued . . .

that you should not expect any applications assistance from either CompuPro or your dealer beyond the contents of the manual. The manual itself is typically CompuPro: complete but terse—you have to read it very carefully to extract the nuggets from the ore. The message is clear: Don't buy this board unless you are an experienced assembly language programmer and can understand the hardware concepts involved.

This product will be of most value to the system integrator who can afford the time and effort necessary to adapt the MPX-1 to one particular hardware configuration and then sell many of them. It should be ideal for handling I/O chores in a multiuser system. Another possible application might be a print spooler—the capability exists on the board; all that's missing is the software. And, for very large systems, more than one MPX-1 can be used, since the necessary DMA priority and arbitration hardware are included on the board. Even the dyed-in-the-wool hardware/software hacker may find the MPX-1 board useful to improve the performance of a single-user system. I have concluded, after spending two months developing programs and using the MPX-1, that my system would be incomplete without this board.

The MPX-1 is available in 16K only; for information contact CompuPro Div., Godbout Electronics (Oakland Airport, CA 94614; (415) 562-0636). List price is $649 A&T, $749 SCS (Certified System Component high reliability); however, some dealers are advertising substantial discounts.

SOFTWARE REVIEW

The AUTODIFF Package

Utility programs useful for file maintenance

by Anthony Skjellum

AUTODIFF is a package of three utilities by Morton Goldberg, originally distributed by Digital Constructs. This company is no longer operating, but the package is marketed by The Software Toolworks. AUTODIFF requires a CP/M system of 48K or more, with TPA starting at 100H.

The DIF Utilities

The three DIF programs provide three ways to compare file versions for changes and updates. The first, ADIF, handles ASCII comparisons. The second, BDIF, is for generalized comparisons involving ASCII or binary data. The third is CDIF, which handles ASCII data and produces a marked output file that shows where the changes are located. These programs have clear prompts and an interactive help mode available at all prompt levels. This makes operation convenient, especially for the occasional or novice user. The DIF utilities can optionally send their output to the console or list device instead of a file through use of the $CON or $LST names. This is a nice addition, which makes operation more general.

The AUTODIFF manual is well written. It explains, in simple terms, how to use the programs. It has an introductory section and relegates the more technical material to the end. The 12 figures are placed at the end of the manual, which makes them easier to find. Appendices describe some additional practical points and summarize the on-line help information. Two application notes are provided that discuss specific ways to use CDIF and BDIF respectively.

The ADIF program has four built-in input filters, selected at execution time, which affect the way in which input text is interpreted. They are U, V, W, and X, and act as follows:

U: Treat only printing characters as significant.
X: Exact mode: treat all characters as significant.
V: Same as X but make control characters visible.
W: (default) Remove all white-space (non-printing) characters.

These options cover a wide variety of possible applications usable for ASCII type file difference comparisons.

The most difficult part of using the DIF utilities involves the "sync window." The sync window is the window for resynchronization after a difference is located during execution. The user must determine empirically what window size to use, as this will vary between files of different types. Choice of the sync window size affects the quality of the resynchronization capabilities of the programs as well as the speed of execution. I am confident that users will develop a feeling for how to set the sync window after repeated use of the program. Some hints are also included in the documentation.

The user may interrupt file comparison with any control character. The DIF programs then ask whether to abort execution or resume. This feature is very convenient.

Comments on DIF Utilities

During execution of the DIF utilities, the user must select an output file (or device). Should the user indicate a file that already exists, the DIFs will delete/overwrite that file without asking for verification. This is not really "user-friendly" operation. The programs should ask the user for confirmation before deleting an existing file, as deletion is potentially disastrous. Furthermore, the programs should know about CP/M version 2.x read-only files, so they do not bomb by trying to delete such a file.

The DIF programs allow default values to be requested for each non-filename prompt. At most prompts, the user may request help by typing a "?." The default is displayed as part of this help output. If one wishes to select the default, a return is entered. The programs then display the default selected. It would make much more sense to display the default on the original prompt line. This would obviate the need to use the help function (which reads from a help disk file) in order to learn the default of a given prompt.

Summary

The DIF utilities are useful programs that provide powerful difference comparison capabilities and are well documented. The programs work as advertised but do not know about CP/M version 2.x extensions. They should also be more careful about overwriting existing files.

The AUTODIFF package is well documented. I discovered no bugs during the reviewing period but noted the deficiencies mentioned above. The important features of this package are the DIF programs that provide file difference matching capabilities. For information may be obtained from:

The Software Toolworks
14478 Glorietta Drive
Sherman Oaks, CA 91423

The Software Toolworks is marketing ADIF, BDIF, and CDIF under the name "Autodiff" for a retail price of $29.95. They will also distribute to dealers at an appropriate discount. Autodiff is available on selected 5¼" disk formats as well as 8" disks. It will also be available soon in a version for the HDOS operating system.

Anthony Skjellum, 1695 Shenandoah Rd.,
San Marino, CA 91108

NorthStar Topics

S.A.I.L.ing Without a Lifeboat

by Steve Leibson

Since 1978, users of North Star floppy disk and computer systems have had little choice if they wanted to use the popular Digital Research CP/M operating system. Lifeboat Associates offered the only version compatible with the North Star hardware. Some "CP/M-like" systems have become available, such as those from Computer Design Labs and Infosoft. The problem with "CP/M-like" is that "like" isn't "is." Now a new entry in the North Star-compatible CP/M arena is available from S.A.I.L.

A little history

Way back in the early days of microcomputers, around 1977, North Star Computers offered a low-cost minifloppy storage system called the MDS. Along with the hardware you received a simple disk operating system and a very good Basic interpreter. The low price made the MDS very popular, and it quickly became a best seller.

At around the same time, the Digital Research operating system CP/M was also gaining popularity, but was supported only on 8″ floppy systems. CP/M is a more powerful operating system than North Star DOS mainly because it supports dynamic file allocation. Previously, North Star owners had to be very careful not to exceed their fixed file sizes and were always compacting disks to make room for more files. Even more important, however, CP/M became the operating system of choice for public domain and commercial software.

Lifeboat Associates was founded to supply CP/M already configured for North Star MDS disk systems and the then new North Star Horizon. Converting CP/M to the North Star hardware was no easy task because North Star does not publish information on how to run their disk controller, which is built from several small-scale integrated circuits instead of a standard floppy disk controller chip. The difficulty of the task is indicated by the lack of competition Lifeboat has had with the North Star-compatible CP/M product. Until now.

S.A.I.L. CP/M

S.A.I.L. offers a version of Digital Research's CP/M 2.2 with disk drivers for the North Star disk controller and I/O drivers for the North Star Horizon computer. All the standard Digital Research utilities are included along with the S.A.I.L. utilities: COPY for disk-to-disk copying, SETSAIL for configuring the disk drivers, and FORMAT for formatting a blank disk.

There are several unique features of S.A.I.L.'s version of CP/M that differentiate it from Lifeboat's. First, the documentation has been greatly simplified. Nothing written by Digital Research remains in the S.A.I.L. manual. What the authors at S.A.I.L. have done is to rewrite the operating instructions for the operating system and utilities. Most of the customizing information pertaining to writing disk drivers has been left out. This seems to be a good step to me, since the disk drivers are what you really are buying from companies like S.A.I.L. and Lifeboat.

Steve Leibson, 4040 Greenbriar Blvd. Boulder, CO 80803

One section in the S.A.I.L. manual is a source listing of the BIOS (Basic I/O System) along with a written functional description, something Lifeboat would never give you. Also included is a description of the disk parameter tables. This information is vital to those people who want to add other mass storage peripherals such as 8″ floppy and hard drives.

S.A.I.L. disk driver software supports double-density, double-sided, and 80-track minifloppy disk drives, in any combination. Disks may also be specified as having either 35 or 40 tracks. North Star and Lifeboat have maintained the 35-track-per-side configuration, even though only the old single-density North Star drives actually were limited to 35 tracks. A minifloppy disk drive configured as a double-sided, double-density, 80-track drive can hold 820K bytes. S.A.I.L.'s CP/M 2.2 implementation does not support the single-density North Star disk format.

Hoisting the S.A.I.L.

The S.A.I.L. software is supplied as a preconfigured 24K CP/M system with I/O drivers installed for a "standard" North Star Horizon. That means you are supposed to have a terminal as a console, and it must be connected to your left serial port. If you don't have the above configuration, you will have to overcome some difficult problems to make the software operational.

Naturally, I don't have a "standard" system, so I too had to overcome these problems. This is where I became familiar with the type of support S.A.I.L. is willing to provide to its customers. Although S.A.I.L. software is not intended to operate on other I/O configurations, the personnel at S.A.I.L. were able to suggest a course of action.

Essentially, they proposed that I boot the operating system, which would result in a deaf, dumb, and blind computer but would load the program into memory. Then I could boot another system, say a 56K Lifeboat implementation or a North Star DOS 5.2 relocated to high memory. These would not overwrite the S.A.I.L. code but would allow me to patch the supplied 24K system with the I/O drivers required by my system. Execution of this sequence of steps required that S.A.I.L. provide me with the addresses of the patch locations for the I/O routines. They did.

What I did not know initially was that S.A.I.L. has placed the initialization routines in the boot loader. Thus I needed the address of this routine as well, since it too requires patching for a nonstandard system. S.A.I.L. provided this information as well.

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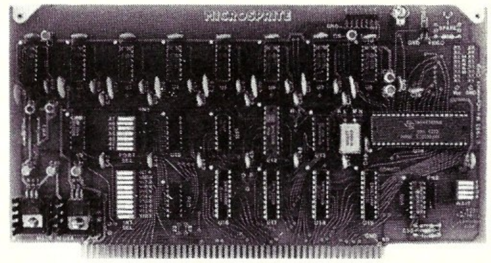

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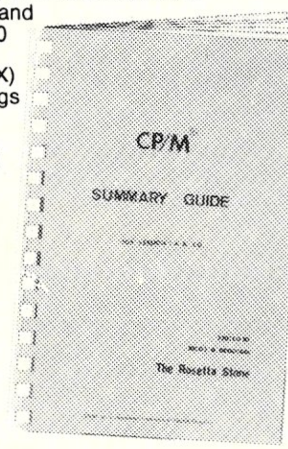

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As it turned out, I found it easier to wheel in a terminal and reconfigure my system so that it was "standard." Then I booted the S.A.I.L. implementation of CP/M and patched the BDOS and boot loader for my I/O configuration. Using this approach, S.A.I.L. CP/M was up and running on my system in a morning.

I suggested to S.A.I.L. that some sort of I/O configuration program would make the product attractive to a wider range of customers. They agreed and will offer the feature in the future. If you have a North Star Horizon with a terminal plugged into the left serial port, this discussion does not apply to you. The S.A.I.L. software will run on your system without modification.

It was during this I/O reconfiguration that I discovered that S.A.I.L. disk and I/O drivers are written in Z80 code. That means if you are one of the many owners of a hybrid Processor Technology Sol/North Star MDS system, your 8080 won't run the S.A.I.L. product. Again, S.A.I.L. had an answer. They are working with another company that offers a processor upgrade for the Sol which places a Z80 under the hood. Contact S.A.I.L. for information.

Disk drive configuration is set with the SETSAIL utility. SETSAIL is simple to use. You need only answer a few questions and the utility will create a SYSGEN image. This makes drive reconfiguration easier than with Lifeboat's CP/M, which requires hand patching. SETSAIL also allows you to specify read-after-write operation that causes the software to catch a bad sector as soon as it is written. My data is very important to me, so I selected this feature.

A second operating mode offered is "forced recalibration." CP/M frequently looks at the disk directory. With the disk drive read/write head constantly moving in and out there is a remote chance that the drive will misstep the head, causing the software disk drivers to lose track of where the head is. The only head position positively identified by the disk drive is when the head is at track 0. All other head positions are inferred from this position. Forced recalibration steps the head to track 0 before each directory access, all but eliminating the possibility of a lost head position. Since I have found that my drive gets confused every once in a while, I selected this operating mode as well.

S.A.I.L. operation

After bringing the operating system up, I tested it with my most important CP/M-based software. The first was INDEX, a utility in use by most of the members of the Denver Amateur Computer Society. INDEX combines the functions of the CP/M directory and status utilities DIR and STAT. It ran without a hitch. The big test was MicroPro's WordStar. I use this word processing program more than any other CP/M software. It too ran without problem. Both INDEX and WordStar exercised various features of the disk driver code written by S.A.I.L.

The third software package I tried on S.A.I.L.'s CP/M implementation was Matchmaker II from The SoHo Group. This package adapts the North Star Basic interpreter to CP/M and was reviewed in *Microsystems* in the May/June 1982 issue. Programs which I originally wrote for that review ran equally well under both S.A.I.L. and Lifeboat.

From these tests I concluded that S.A.I.L.'s CP/M implementation appears to be fully compatible with the files created by Lifeboat's implementation. That is critical, since almost all CP/M software available for the North Star disk format was generated by Lifeboat software. I also concluded that the S.A.I.L. software was fully functional.

S.A.I.L. utilities

One of the S.A.I.L. utilities has already been discussed: SETSAIL. That utility replaces MOVCPM and SYSGEN and makes it simple to reconfigure your system for different disk and memory configurations.

COPY is a track-by-track duplicator for copying disks. I found the operation of COPY to be the only aspect of this CP/M that was not well thought out. COPY asks which drive to copy from, and then which drive to copy to. As soon as the answer to the second question is received, the copy process starts. This means that you have to remember to put the disks into the drives before answering the second question, or a BDOS error results. Lifeboat's disk copier reminds you to insert the disks and waits for you to press the return key.

While on the subject of BDOS errors, S.A.I.L.'s error handling deserves mention. Instead of the cryptic CP/M message:

```
BDOS ERROR ON B: SELECT
```

S.A.I.L. produces the error message:

```
Disk Error on B: - Drive Door Open, Disk Not Formatted or Disk
Not 10 Hole <CR> to retry, W to Warmstart or I to Ignore:
```

That is an understandable error message in my opinion, and I would appreciate other software vendors taking note of what S.A.I.L. has done to improve an existing software product, CP/M.

FORMAT is the disk formatting utility. It is menu driven so you need only remember the name of the utility. Everything else is spelled out for you on the screen. FORMAT will format a disk using one of six disk formats: standard 35-track double density, North Star/Lifeboat 35-track quad capacity, 40-track double density, 80-track double density, 40-track quad capacity and 80-track double sided. So much for a "standard North Star" disk format.

Both COPY and FORMAT display the status of the disk during writing. For single-sided disks, series of dashes are printed, one for each track written. Double-sided writing is represented as a series of equals signs, which appears to mean a dash for each side. COPY and FORMAT write to the disks in cylinder mode. Both sides of the disk are written from one head positioning. That explains the use of the

S.A.I.L.'s implementation appears to be fully compatible with Lifeboat's, and the documentation is superior.

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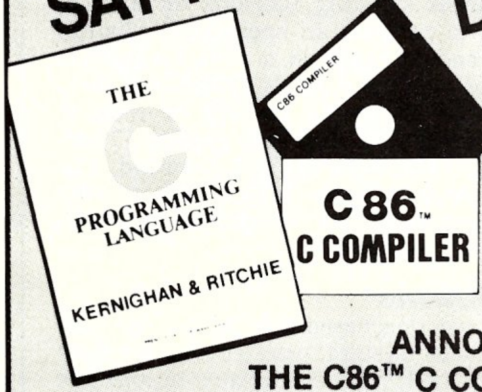

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equal signs.

In theory, if track stepping accounts for most of the time needed to perform an operation, cylinder-mode operation should result in a time savings. In practice, Lifeboat's and S.A.I.L.'s FORMAT utilities required about the same amount of time to format a double-sided disk. Lifeboat needed 57 seconds and S.A.I.L. took 1 minute and 1 second. The COPY utilities were a little farther apart, with S.A.I.L. finishing in 1 minute 35 seconds and Lifeboat in 1 minute 51 seconds.

Recommendations

If you have not yet purchased CP/M 2.2 for your North Star Horizon system, you should consider S.A.I.L. Software's CP/M 2.2 implementation. The documentation is superior to Lifeboat's and the operation is compatible. S.A.I.L.'s advantages are in the documentation and in the spectrum of drive configurations on which the software can be configured to run. If you do not have a Horizon but do have North Star drives, or if you are not running your Horizon in a "standard" configuration, it is possible to bring the S.A.I.L. software up but it is definitely not easy. Sol owners should contact S.A.I.L. to get the latest information on compatibility with their systems. S.A.I.L. CP/M is available for $165.

For more information, contact:

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SOFTWARE REVIEW

IBIOS

Use it to interrupt a program in TPA, then gracefully return to the interrupted process

by Bill Machrone

IBIOS, offered by Miken Optical Company, is an interactive BIOS for CP/M. That is, it permits you to interrupt a program running in the TPA (indeed, it interrupts CP/M itself) for purposes of debugging or using other facilities of your computer, such as a monitor program. Furthermore, it permits a graceful return to the interrupted process, if nothing that the interrupted process was using has been altered.

Because implementation of an interactive BIOS is by definition highly hardware dependent, IBIOS is provided as a booklet-sized skeletal software listing, similar to those which Digital Research supplies as part of CP/M's documentation. Much of the space in the booklet is taken up by discussions of I/O routines, re-entrancy, and interrupt-service routines. Following the skeletal BIOS listing is a complete IBIOS for a Sol-20. The Sol BIOS is interesting in that it includes some model functions, such as write protecting disks with a single keystroke, toggling printer echo at any point in any program, and using the machine in typewriter mode, where all keyboard characters are simply transmitted to the printer.

All the listings are well commented. Anyone with some exposure to assembly language and BIOS hacking can implement these techniques easily. The question is, do you need this kind of capability? If you are bringing up CP/M on new hardware, it could be a handy asset. And if you are doing assembly language programs that go where DDT cannot follow, the IBIOS techniques may enable you to stop and have a look around in memory or ports. If, however, you have never run anything but application programs and do all your programming in high-level languages, it is not likely to prove useful. The insights into how CP/M ticks and its shortcomings in handling some types of real-time applications are also instructive.

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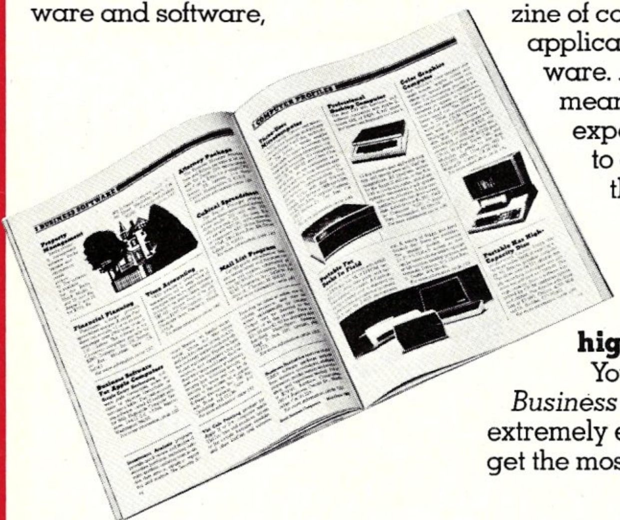

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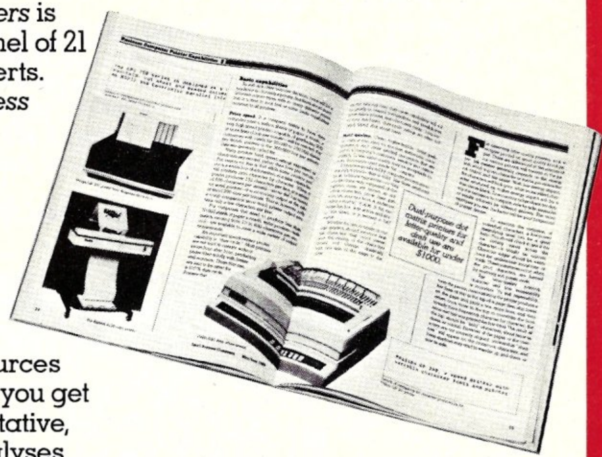

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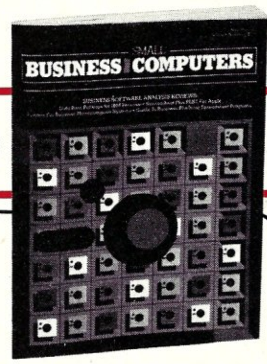

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Extended Memory for the Exidy Sorcerer

by Thomas Ceska

The Exidy Sorcerer microcomputer can be expanded internally to 48K of read/write memory (RAM). With the S-100 expansion unit and an 8K memory card, the amount of memory can be increased to 56K. Is this the limit? No. In this article I will describe how to add additional memory to the Sorcerer and how to control it using a bank select scheme. The bank select scheme requires a hardware modification to the Sorcerer that involves the addition of four ICs costing less than five dollars.

Why add more memory? The primary reason is to increase the speed in processing data. If data records are stored on disk or, worse yet, on cassette tape, it takes a long time to put data in memory, update it, and restore the records. If all data records are resident in memory, then execution times are reduced (fewer input/output processes). This is particularly important in business applications where time is important.

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The Sorcerer's memory can be expanded via its S-100 bus. Any memory card that has a bank select feature can be used for expansion. What is bank select? The Z80 microprocessor can directly access 64K of memory (2^{16} addresses). If one has an additional 64K of memory, the only way for the Z80 to address it is to fool the Z80 into thinking that it is addressing the extended memory in the same 64K window. The way to do this is to shut off the first bank and activate the second. Thus the *physical* addresses are the same but the *logical* addresses are different.

First, I will describe the necessary hardware modifications. Then, I will show how to access extended memory using two methods—a single word store/restore method, and window mapping. Access to extended memory can be accomplished at the level of

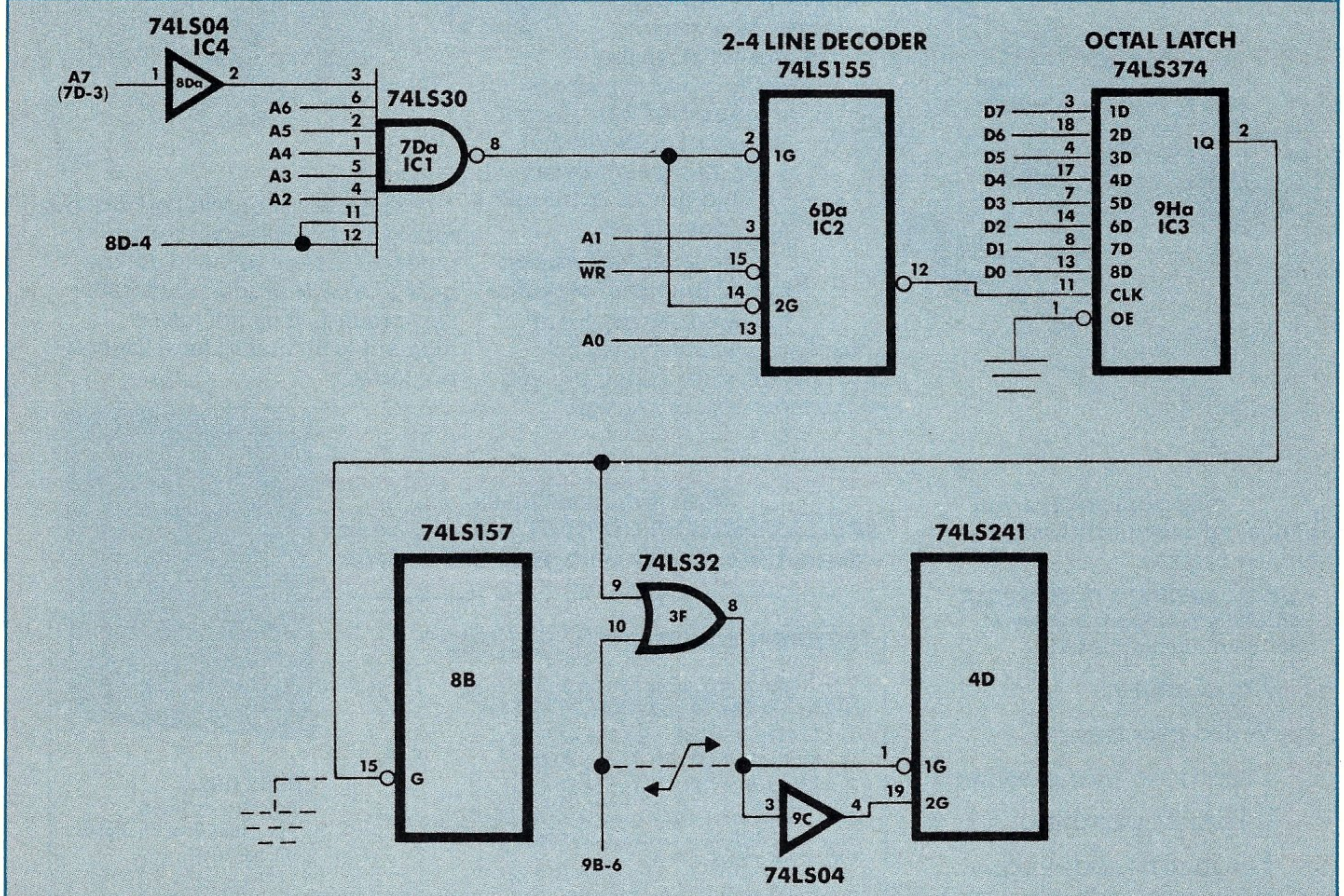

Figure 1. Circuitry to add a memory bank select circuit to the Exidy Sorcerer. Note that dashed lines represent cut traces.

assembly language or using the higher-level languages, Pascal and Basic.

Hardware modification

In order to select a memory bank on the S-100 bus, one must first be able to shut off the Sorcerer's internal memory and release the address space. An I/O port can be used to control which memory bank is selected. The Sorcerer has a user parallel port (address 0FFH) which could be used for this purpose. However, tying up the user port to control extended memory was not feasible for me since I use it to drive my printer. I therefore elected to add another parallel port with a different I/O address (see Figure 1). IC1, IC2 and IC3 were added and placed on top of their sister chips (7Da, 6Da and 9Ha).

The port address is decoded by the 74LS30 8-input AND gate (IC1). The Sorcerer's user port address is 0FFH. I selected output port address 07FH, since it requires a minimum change in the circuitry, and I could control the extended memory board via this I/O port address. IC4 inverts A7 so that 01111111B is recognized as the port address. The hex inverter (IC4) can be used to select almost any port address desired. I use the most significant bit that comes out of IC3 (bit 7, pin 2) to switch memory on and off. This signal operates on inputs to the 74LS157 (8B-15) and 74LS241 (4D-1).

IC1, 74LS30: Bend pins 3 and 8 90 degrees outward. Solder a wire wrap jumper to pin 3 of chip 7D in the Sorcerer. Carefully solder the remaining pins of the 74LS30 to its sister chip. Solder one pin at a time and allow the chip to cool down before continuing. The new 74LS30's location is now designated 7Da.

IC4, 74LS04: Bend all pins except 7 and 14 up. Solder pins 7 and 14 to pins 7 and 14 of 8D. Solder the jumper from 7D-3 (chip 7D, pin 3) to 8Da-1, which is the input to the inverter. Solder a jumper from 8Da-2 to 7Da-3.

IC2, 74LS155: Bend pins 1, 2, 4, 6, 7, 9, 10, 11, 12 and 14 up. Solder the rest of the pins to its sister chip at 6D. Jumper pin 2 to pin 14. Solder a jumper from pin 2 (6Da-2) to the output of the 74LS30 (7Da-8).

IC3, 74LS374: Bend pins 2, 5, 6, 9, 11, 12, 15, 16 and 19 up. Solder the rest of the pins to its sister chip at 9H. Connect a jumper from 6Da-12 to 9Ha-11.

Next remove pin 15 of 74LS157 (8B) from the PC board. Solder 2 jumpers to 9Ha-2, output bit 7 of the parallel port. Attach one jumper to 8B-15, the other to 3F-9, one input to a 74LS32 OR gate. Cut the trace from 9B-6 to 9C-3 (under the board). Wire a jumper from cut trace 9B-6 to the second input of the OR gate, 3F-10. A jumper from the output of the OR gate 3F-8 to the trace going to 9C-3 completes the modification.

To test the modification, power up the Sorcerer. Everything should be normal. Move the Sorcerer's stack and monitor work area so that the top of memory is 0FFFFH.

```
LXI H,0FFFFH
JMP 0E006H
```

will do this. Deselect the Sorcerer's memory by issuing the instructions

```
MVI A,0FFH
OUT 07FH
RET.
```

A system reset at this point will reboot the Sorcerer with top of memory at 0FFFFH. A dump of lower memory will show all 0FFHs. Issue the instructions

```
SUB A
OUT 07FH
RET.
```

This should reactivate memory with the data intact. These testing routines can be entered at 0FE00H.

Accessing extended memory

Extended memory can be accessed a byte at a time by using the routines EXMPUT and EXMGET shown at the bottom of Listing 1. Note that these routines must be located above C000H, so that they will still be resident after internal memory is switched off. For assembly language programming, access at this level is adequate. For Basic and associated assembly language routines for one-word access, see Listing 2 and BWORDGET/BWORDPUT in Listing 1. Note that extended memory is used as a single large array. The memory can also be accessed blocks at a time, as in Listing 3. I chose a 2048 byte block (512 floating-point words) arbitrarily. These blocks could be logical records where alphanumerical (string) and numerical data were mixed. The principle for transferring the data is the same, but the locations to where the data is transferred to/from would change. These addresses would be application dependent. A similar routine for block transfer in tiny Pascal (K. Chung & H. Yuen, see reference below) is shown in Listing 4.

Conclusion

In this article I have shown how to modify the Exidy Sorcerer so that extended memory access is possible. Routines to transfer bytes, words and blocks are given in assembly language, Basic, and Pascal to facilitate user access to this memory. Since larger memory size gives a computer more "power," the Sorcerer can now be programmed to handle copious amounts of data in memory.

I am using this extended memory in graphics applications. I did not mention that the memory board I am using is actually a graphics board. But that is another story.

Acknowledgement

I would to thank Charlie Bergren for helpful discussions about the Sorcerer's hardware modification.

Reference

The Byte Book of Pascal, B. Liffick, Editor, Byte Publications. USA 1979, pp 59–89.

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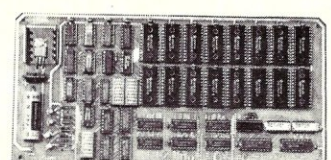

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Listing 1. Assembly language routines to access extended memory.
These utility routines illustrate methods for accessing data in extended memory. The routine BWIND allows a 512 element BASIC array to act as a window into extended memory. The bank of extended memory mapped to this window is stored at WINDIN. The routine PWIND allows similar access from Pascal or other languages. Alternatively, single words of data in extended memory may be stored or retrieved via BASIC and the routines BWORDGET and BWORDPUT. Single bytes may be transferred using the primitive routines EXMPUT and EXMGET.

```
ADDR B1 B2 B3 B4 E LINE LABEL          OPCD  OPERAND

0000                                   ORG   0B500H
B500                     * BWIND - BASIC WINDOW
B500                     *      - ACCESS DATA IN EXTENDED MEMORY FROM BASIC
B500                     *        AN ARRAY OF 512 FLOATING POINT ELEMENTS MUST
B500                     *        BE FIRST ARRAY DECLARED (DIM) IN BASIC PROGRAM
B500     B500            BWIND         EQU   $
B500 2A B9 01                          LHLD  1B9H          ;POINTS TO ARRAY SPACE
B503 11 07 00                          LXI   D,7           ;CALC ADDRESS OF 512-
B506 19                                DAD   D             ; ELEMENT ARRAY
B507 22 14 B5                          SHLD  INADR
B50A 18 0C                             JMPR  MSWAP-$       ;SWAP BLOCKS
B50C                     *
B50C                     * PWIND - PASCAL WINDOW
B50C                     *        - ACCESS DATA IN EXTENDED MEMORY FROM PASCAL
B50C 21 00 A0            PWIND         LXI   H,0A000H      ;SPECIFY ADR OF
B50F 22 14 B5                          SHLD  INADR         ; CURRENT 2K BLOCK
B512 18 04                             JMPR  MSWAP-$       ;SWAP BLOCKS
B514                     *
B514 00 00               INADR         DW    00            ;ADR OF ACTIVE BLOCK
B516 FF                  WINDIN        DB    0FFH          ;BLOCK TO GET
B517 FF                  WINDOUT       DB    0FFH          ;BLOCK IN USE
B518                     *
B518                     * MSWAP - SWAPS 2K BLOCKS OF DATA FROM INTERNAL MEMORY
B518                     *         TO EXTENDED MEMORY.  IT AUTOMATICALLY UPDATES
B518                     *         THE LAST 2K BLOCK TRANSFERED BEFORE IT
B518                     *         READS IN THE DESIRED NEW BLOCK.
B518 3A 17 B5            MSWAP         LDA   WINDOUT       ;WHICH BLOCK IN USE?
B51B A7                                ANA   A             ;IF M THEN NONE
B51C FA 29 B5                          JM    GETDAT        ; YET IN USE
B51F CD 3C B5                          CALL  TIMES2048     ;CALC ADR OF 2K BLOCK
B522 ED 5B 14 B5                       LDED  INADR         ;START SAVE FROM HERE
B526 CD 43 B5                          CALL  PUTTOEXM      ;SAVE CURRENT BLOCK
B529 3A 16 B5            GETDAT        LDA   WINDIN        ;WHICH BLOCK TO LOAD?
B52C A7                                ANA   A
B52D F8                                RM                  ;IF M THEN NONE
B52E 32 17 B5                          STA   WINDOUT       ;NEW CURRENT BLOCK
B531 CD 3C B5                          CALL  TIMES2048     ;CALC ADR OF 2K BLOCK
B534 ED 5B 14 B5                       LDED  INADR         ;LOAD BLOCK HERE
B538 CD 55 B5                          CALL  GETFEXM       ;GET BLOCK
B53B C9                                RET                 ;RETURN TO USER
B53C                     *
B53C                     * TIMES2048 - HL=A*2048
B53C 67                  TIMES2048     MOV   H,A
B53D 2E 00                             MVI   L,0           ;*256
B53F 29                                DAD   H             ;*512
B540 29                                DAD   H             ;*1024
B541 29                                DAD   H             ;*2048
B542 C9                                RET
B543                     *
B543                     * PUTTOEXM - PUT 2K BLOCK TO EXTENDED MEMORY
B543                     *
B543 06 08               PUTTOEXM      MVI   B,8           ;8 PAGES OF 256 BYTES
B545 C5                  PNEXTPAGE     PUSH  B
```

```
B58F                     * EXMPUT - PUT BYTE FROM C REGISTER TO AT HL
B58F                     *          IN EXTENDED MEMORY
B58F                                   ORG   0F010H
F010 3E FF               EXMPUT        MVI   A,0FFH        ;BANK SELECT
F012 D3 7F                             OUT   7FH           ; EXTENDED MEMORY
F014 71                                MOV   M,C           ;STORE BYTE

ADDR B1 B2 B3 B4 E LINE LABEL          OPCD  OPERAND

B54E 23                                INX   H             ;NEXT BYTE
B54F 10 F7                             DJNZ  PNEXTBYTE-$   ;REPEAT FOR EACH BYTE
B551 C1                                POP   B
B552 10 F1                             DJNZ  PNEXTPAGE-$   ;REPEAT FOR EACH PAGE
B554 C9                                RET
B555                     *
B555                     * GETFEXM - GET 2K BLOCK FROM EXTENDED MEMORY
B555                     *
B555 06 08               GETFEXM       MVI   B,8           ;8 PAGES OF 256 BYTES
B557 C5                  GNEXTPAGE     PUSH  B
B558 06 00                             MVI   B,0           ;COUNT 256 BYTES/PAGE
B55A CD 19 F0            GNEXTBYTE     CALL  EXMGET        ;GET BYTE FROM
B55D 79                                MOV   A,C           ; EXTENDED MEMORY
B55E 12                                STAX  D             ;STORE IN BLOCK
B55F 23                                INX   H
B560 13                                INX   D
B561 10 F7                             DJNZ  GNEXTBYTE-$   ;REPEAT FOR EACH BYTE
B563 C1                                POP   B
B564 10 F1                             DJNZ  GNEXTPAGE-$   ;REPEAT FOR EACH PAGE
B566 C9                                RET
B567                     *
B567                     * BWORDGET - GET BASIC WORD FROM EXTENDED MEMORY
B567                     *          - EXPECTS INDEX AT 0000H
B567                     *            RETURNS VALUE AT 1BFH
B567 2A 00 00            BWORDGET      LHLD  0000          ;GET INDEX
B56A 29                                DAD   H             ;CALC ADDRESS IN
B56B 29                                DAD   H             ; ALTERNATE MEMORY
B56C 06 04                             MVI   B,4           ;4 BYTES / BASIC WORD
B56E 11 BF 01                          LXI   D,1BFH
B571 CD 19 F0            GNXTBYTE      CALL  EXMGET        ;GET FROM
B574 79                                MOV   A,C           ; EXTENDED MEMORY
B575 12                                STAX  D             ;PUT BYTE IN
B576 23                                INX   H             ; INTERNAL MEMORY
B577 13                                INX   D
B578 10 F7                             DJNZ  GNXTBYTE-$    ;REPEAT FOR EACH BYTE
B57A C9                                RET
B57B                     *
B57B                     * BWORDPUT - PUT BASIC WORD INTO EXTENDED MEMORY
B57B                     *          - EXPECTS VALUE AT 1BFH, INDEX AT 0000H
B57B 2A 00 00            BWORDPUT      LHLD  0000          ;GET INDEX
B57E 29                                DAD   H             ;CALC ADDRESS IN
B57F 29                                DAD   H             ; ALTERNATE MEMORY
B580 06 04                             MVI   B,4           ;4 BYTES / BASIC WORD
B582 11 BF 01                          LXI   D,1BFH
B585 1A                  PNXTBYTE      LDAX  D             ;GET DATA BYTE
B586 4F                                MOV   C,A
B587 CD 10 F0                          CALL  EXMPUT        ;PUT INTO
B58A 23                                INX   H             ; EXTENDED MEMORY
B58B 13                                INX   D
B58C 10 F7                             DJNZ  PNXTBYTE-$    ;REPEAT FOR EACH BYTE
B58E C9                                RET
B58F                     *
```

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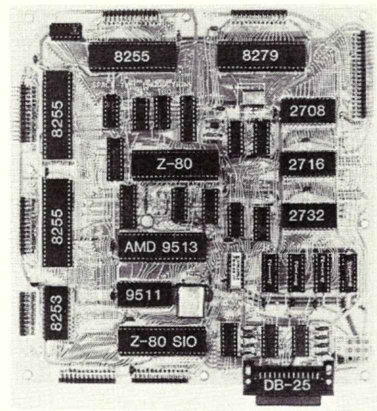

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```
B546 06 00        0530            MVI   B,0      ;COUNT 256 BYTES/PAGE
B548 1A           0540 PNEXTBYTE  LDAX  D        ;GET BYTE FROM BLOCK
B549 4F           0550            MOV   C,A
B54A CD 10 F0     0560            CALL  EXMPUT   ;PUT INTO
B54D 13           0570            INX   D        ; EXTENDED MEMORY
ADDR B1 B2 B3 B4 E LINE LABEL     OPCD  OPERAND

F015 97           1150            SUB   A        ;RESTORE
F016 D3 7F        1160            OUT   7FH      ; INTERNAL MEMORY
F018 C9           1170            RET
F019              1180 *
F019              1190 * EXMGET - GET BYTE FROM AT HL IN EXTENDED
F019              1200 *        MEMORY. RETURN BYTE IN C
F019 3E FF        1210 EXMGET     MVI   A,0FFH   ;BANK SELECT
F01B D3 7F        1220            OUT   7FH      ; EXTENDED MEMORY
F01D 4E           1230            MOV   C,M      ;GET BYTE
F01E 97           1240            SUB   A        ;RESTORE
F01F D3 7F        1250            OUT   7FH      ; INTERNAL MEMORY
F021 C9           1260            RET

ERRORS THIS ASSEMBLY  0000
```

Listing 2. BASIC single word transfer.
The word transferred is at 1BFH, the location of the USR variable. The index of the variable is POKEd into locations 0000 and 0001 of memory.

```
LIST

10 REM BASIC SINGLE WORD TRANSFER
20 INPUT "NUMBER OF VALUES TO XFER ";N
30 FOR I=1 TO N
40 INPUT "INDEX,VALUE ";IND,ELE
50 GOSUB 11000 :REM PUT VALUE INTO EXTENDED MEMORY
60 NEXT I
70 REM RETRIEVE SELECTED VALUES
80 INPUT "INDEX ";IND
90 GOSUB 12000 :REM GET VALUE
100 PRINT "          ";ELE
110 GOTO 80
120 END
11000 REM PUT WORD INTO EXTENDED MEMORY
11010 REM IND=INDEX, ELE=VALUE
11020 POKE 0,IND-INT(IND/256)*256:POKE 1,IND/256
11030 POKE 260,123:POKE 261,181
11040 Z=USR(ELE)
11050 RETURN
12000 REM GET WORD FROM EXTENDED MEMORY
12010 REM IND=INDEX, RETURNS VALUE IN ELE
12020 POKE 0,IND-INT(IND/256)*256:POKE 1,IND/256
12030 POKE 260,103:POKE 261,181
12040 ELE=USR(IND)
12050 RETURN
READY
```

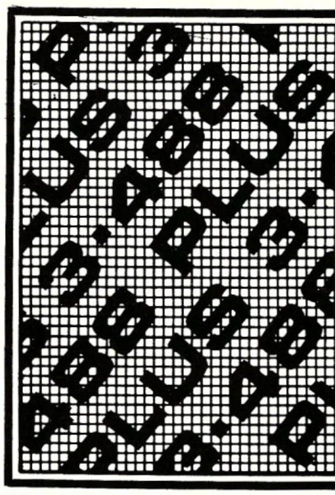
```
RUN
NUMBER OF VALUES TO XFER ? 4
INDEX,VALUE ? 0,34
INDEX,VALUE ? 1,45
INDEX,VALUE ? 2,56
INDEX,VALUE ? 3,67
INDEX ? 0
          34
INDEX ? 1
          45
INDEX ? 2
          56
INDEX ? 3
          67
INDEX ?
BREAK IN 80
READY
```

Listing 3. BASIC memory mapped transfer.
The 512 element array AR is mapped into 2K blocks in extended memory. The blocks of memory need not be accessed sequentially. The last block accessed is automatically updated before the next block is transferred.

```
LIST

10 REM BASIC WINDOW TRANSFER
20 DIM AR(512) :REM FIRST ARRAY DECLARED
30 FOR I=1 TO 512
40 AR(I)=I
50 NEXT I
60 POKE 260,0:POKE 261,181:REM GO ADDR B500H
70 POKE -19177,0:REM B517H FIRST BLOCK
80 Z=USR(Z):REM XFER 2K BLOCK
90 FOR I=1 TO 512
100 AR(I)=I+512
110 NEXT I
120 GOSUB 1000 :REM PRINT A COUPLE VALUES
130 POKE -19177,1:REM SECOND BLOCK
140 POKE -19178,0:REM B516H GET BLOCK 0
150 Z=USR(Z):REM SWAP 'EM
160 GOSUB 1000
170 POKE -19178,1:REM GET BLOCK 1
180 Z=USR(Z):REM SWAP 'EM
190 GOSUB 1000
200 END
1000 PRINT "AR(1),AR(300) ";AR(1),AR(300)
1010 RETURN
READY

RUN
AR(1),AR(300)  513          812
AR(1),AR(300)  1            300
AR(1),AR(300)  513          812
READY
```



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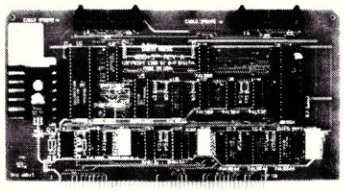

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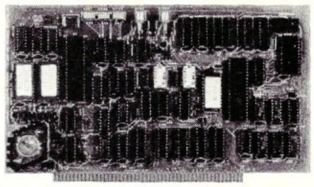

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Extended Memory for the Exidy Sorcerer continued . . .

Listing 4. Pascal memory mapped transfer.

Pascal accesses 1024 integer words from 2K windows into extended memory. A more sophisticated method, that would save the contents of internal memory before swapping into extended memory is possible. This would eliminate "wasting" of 2K bytes of internal memory.

```
CONST PWIND=%B50C;
VAR I: INTEGER;

FUNC ELEMENT(I); {0 TO 1023}
  {GETS ELEMENT FROM 2K WINDOW}
 VAR J:INTEGER;
   BEGIN
    IF I>1024 THEN BEGIN
          WRITE('ELEMENT OUT OF BOUNDS ',I#) END
    ELSE J:=I*2;
 ELEMENT:=MEM[J+%A000]+256*MEM[J+1+%A000]
   END;

BEGIN
 FOR I:=0 TO 1023 DO
     BEGIN   {INITIALIZE 2K BLOCK 1->1024}
      MEM[I*2+%A000]:=I MOD 256;
      MEM[I*2+1+%A000]:=I DIV 256
     END;
 MEM[%B517]:=0; {SET CURRENT BANK TO 0}
 CALL(PWIND); {XFER TO EXTENDED MEMORY}
 FOR I:=0 TO 1023 DO
      BEGIN   {INITIALIZE 2K BLOCK 1025->2048}
       MEM[I*2+%A000]:=(I+1024) MOD 256;
       MEM[I*2+1+%A000]:=(I+1024) DIV 256
      END;
 MEM[%B517]:=1; {SET CURRENT BLOCK TO 1}

 WRITE('ELEMENT 1,500 ',ELEMENT(1)#,' ',ELEMENT(500)#);
  WRITE(10,13); {LF CR}
 MEM[%B516]:=0; {SELECT BANK 0}
 CALL(PWIND); {SWAP MEMORY}
 WRITE('ELEMENT 1,500 ',ELEMENT(1)#,' ',ELEMENT(500)#);
  WRITE(10,13); {LF CR}
 MEM[%B516]:=1; {SELECT BANK 1}
 CALL(PWIND); {SWAP MEMORY}
 WRITE('ELEMENT 1,500 '.ELEMENT(1)#,' ',ELEMENT(500)#);
 END.
```

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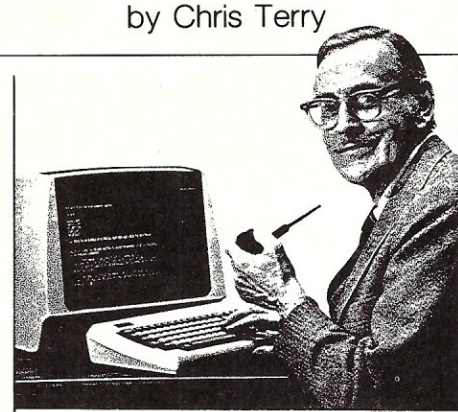
by Chris Terry



Although by far the largest number of public domain programs are system utilities or operating system enhancements of one kind or another, there are nevertheless a significant number of file and database managers available. Some of these are designed to accommodate almost any kind of information you might wish to record; the remainder are special-purpose programs.

General-purpose systems

There are three large systems which deserve special consideration: a database seed program by Dr. Kenneth Bowles (SIG/M Vol. 25); Dan's Information Management System (DIMS, SIG/M Vol. 61); and the Tarbell database system (CPMUG Vol. 28) written in EBasic and set up for inventory control and similar applications.

The **database seed** (written in UCSD Pascal) is a partially completed database manager which formed the basis of team assignments in one of Dr. Bowles's courses. A student team was expected to write specifications for an improvement to the seed program, and to carry out the work during a two-week period after approval of the specifications. Four modules were provided: DBUNIT, a library of primitive software tools to simplify writing database handlers for a variety of purposes; SCUNIT, a screen control unit; STARTER, containing the main logic; and DBTEST, which duplicates the interface portions of the other three units and facilitates the testing of changes. It should be emphasized that this contribution is a *teaching tool*, not a fully operative database manager; much work would have to be done to adapt it to a particular purpose. Equally, any such adaptation would bring an enormous amount of learning about databases in general.

DIMS, on the other hand, is a fully functioning, versatile file manager that allows the creation of 128-byte records with up to 15 fields, or 256-byte records with up to 30 fields. It is written in MBasic version 5.2, but with certain modifications can be run with version 4.x. In its current form it uses dynamic array dimensioning, and therefore cannot be compiled. In addition to the normal facilities for adding, deleting, changing, and listing or printing records, transient programs are provided for sorting the whole file or a range of records on any combination of fields, selecting records containing up to 10 selected words or phrases in various fields, or skipping records containing those words.

Extensive formatting facilities are provided for both the screen display and the printed output; fields can be hidden altogether or displayed at a particular column, and field names used for prompting in the basic format can be displayed or suppressed in the formatted display. The only restriction I have found is that fields to be displayed on the same line must be entered in approximately that order; you cannot, for example, create a double-column printout in the following format:

```
1. CUSTNAME    4. AGENCYNAME
2. CUSTADDR    5. AGENCYADDR
3. CUSTCITY    6. AGENCYCITY
```

To obtain such a display, the entry order would have to be CUSTNAME, AGENCYNAME, CUSTADDR, AGENCYADDR...etc., which is not always convenient. This, however, is a very minor disadvantage. One excellent feature is the ability to write a DIMS file to a standard sequential file and then bring the data back to another DIMS file with a different field structure. Thus, if you want to change the structure of your file, existing data can be loaded into the new file with very little trouble.

If the file contains names and addresses, these fields can be written out as mailing labels in one of three forms. The current version formats the labels one-up, but it would not be difficult to adapt the label printer program to use three-up or four-up label sheets.

At *Microsystems*, we have been using the DIMS system for our article log, author file, and various other purposes for several months. I see two outstanding virtues in it: the programs are constructed in very modular fashion, and the documentation is both comprehensive and clear. Thus, changes and enhancements are relatively easy. Further, the system automatically maintains a backup file on a different drive from the main file—you very seldom have to give an explicit backup command.

Dan Dugan, of Dugan Sound Design, in San Francisco, is to be congratulated on a really fine system and deserves thanks from all of us for making it available. If you can't afford dBase II, use DIMS!

The **Tarbell database system** on Vol. 28 of the CPMUG Library was contributed by Don Tarbell and is also available on the Tarbell public domain disk #1 supplied by Tarbell Electronics, Inc. It is written in EBasic and consists of four programs: DBSETUP, for the creation of new file structures and indexes: DBENTRY for the initial entry or addition of items to the end of a file; DBQUERY, for data retrieval and for making changes to existing items; and DBMAIN, a transaction entry program that updates several different files

from a single transaction entry. This is the most specialized of the programs and would require extensive work to modify it for applications other than inventory control. However, it is instructive to read the code, which is well commented.

Mailing list programs

A number of specialized mailing list programs are available, though none of them are as extensive or as flexible as DIMS. The program used by CACHE (Chicago Area Computer Hobbyists' Exchange) for their mailings to members is written in EBasic and first appeared in Vol. 6 of the CPMUG library: an updated version in Vol. 28. A mailing list program set up to facilitate the exchange of QSO reports by ham radio operators appears in CPMUG Vol. 41; this is also written in EBasic. A set of programs to maintain a ham station log and generate mailing labels, written in CBasic, appears in SIG/M Vol. 26, together with another simple mailing list system written in EBasic. Other similar systems appear in SIG/M Vols. 24 (NAD-4), 28 (NAD), and 63 (NAD-3); all of these are written in Pascal-Z, but .COM files are provided. A mailing list system in Cromemco Structured Basic appeared in CPMUG Vol. 80.

Disk catalog

Ward Christensen's CATALOG system for cataloging CP/M files (CPMUG Vol. 40) is a comprehensive file management system that provides a wealth of information. Each floppy disk (or 8MB "drive" on a hard disk) is identified by a directory entry (relating to a zero-length file) of the form "-SYSTEM.001." The FMAP program creates an alphabetically sorted list of all the files on a disk named in this way and can display not only the filenames but also the blocks occupied by each file. A command line option allows this list to be written to a temporary file. The UCAT program (or QCAT for one-drive systems) then reads the temporary file to update the master catalog file, adding filenames which have not previously appeared for that disk and deleting those no longer on the disk. The CAT program accesses the master catalog file, displaying either all filenames and the disks on which they reside, or a range of disks or filenames specified by wildcard characters in the command line. Thus, one can create a complete list of all one's files and find them easily.

The only snag about this excellent system is that there is no provision for annotating the master catalog entries—great care is needed in selecting filenames that are relevant to the contents of the files. If it is essential to have annotations, a commercial version of the system by SRX Systems may be preferred, since the SRX Catalog system allows 60 bytes of text to be added to each entry

Public Domain
continued . . .

in the master file. This, too, has a snag: a master catalog file may not contain more than 255 entries because only the extension number (FOOBAR.123) is significant. The public domain system by Ward Christensen, on the other hand, can handle thousands of disks because -FOOBAR.123 is differentiated from -SYSTEM.123, and disk numbers in any named disk group can run from 001 to 999.

The effect on the user is that the public domain system allows you to group your disks by topic in a single catalog file, but does not provide detailed information about individual files; whereas the commercial system allows you detailed comments on files, but forces you to create a new catalog file for each group of up to 255 disks.

Next time I will take a look at several CP/M enhancement programs.

Book Review

by Don Libes

A User Guide to the UNIX System

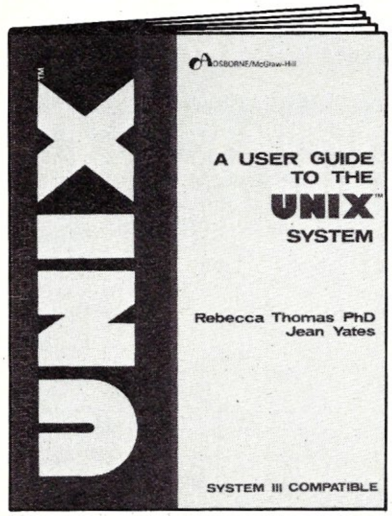
The tradition of UNIX is towards terse and concise information, whether it be from interaction at the terminal or reading the documentation supplied with the system. This is one of the reasons that UNIX has in the past been a system enjoyed solely by experienced computer users.

The *User Guide* will not make UNIX any easier to use; however, it does contain basic (and I mean basic) material that would help a novice learn about the system and computers in general. About half the book is spent explaining how to use the basic tools of UNIX. The other concerns itself with reference material on UNIX—its history, its uses today, and listings of companies selling UNIX and related software or literature.

This juxtaposition of novice material and where to feed one's UNIX habit must be a mistake. As a book salesman, I might be tempted to rip the book in half and sell each half to a novice and an expert. In fact, the *Guide's* "tutorials" are poorly written. As an example, before "ls" and even "cat" are mentioned, directories are explained (page 63):

"A directory is a file containing a list of 16-character lines. Each line corresponds to one file in the directory. The first two characters of a line refer to a number that identifies a specific file. This is called the i-number. The next 14 characters are for the filename."

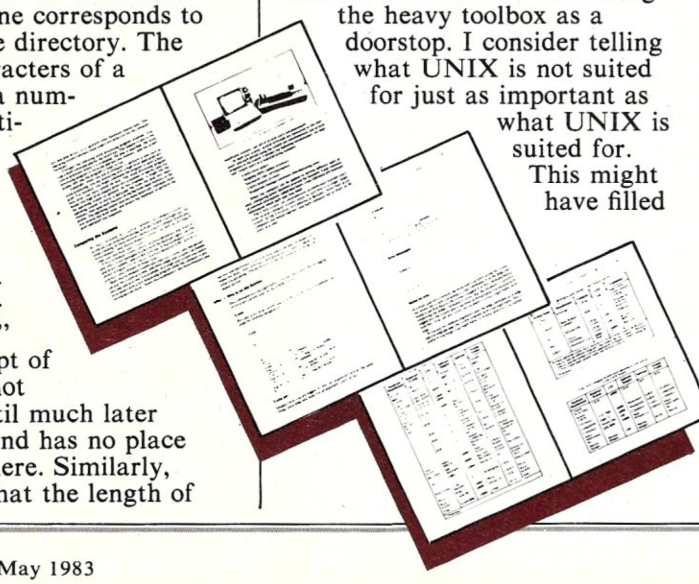
The concept of i-number is not explained until much later in the book and has no place showing up here. Similarly, mentioning that the length of



A User Guide to the UNIX System, by R. Thomas and J. Yates. Osborne/McGraw-Hill, Berkeley, CA, 1982; 510 pages. $15.99, softcover only.

filenames is 14 is also strange, being implementation-dependent. Commands are explained, one after the other, as in a listing. The next command to be explained was "cat" followed by, of all things, "ln"!

In the second half of book, the authors elaborate about suitable uses for UNIX and, in particular, office automation. They fail to mention that using UNIX only to prepare text and send interoffice mail would be analogous to buying an expensive set of tools and then using the heavy toolbox as a doorstop. I consider telling what UNIX is not suited for just as important as what UNIX is suited for. This might have filled a chapter, but was completely absent.



Addresses of companies dealing in UNIX are listed in the last chapter of the book and the appendices. One can easily find names and addresses of companies who sell, for example, a payroll system under UNIX on a Z8000 or whatever else you're interested in. (However, no reviewing is provided upon the quality of these companies.) Of course, this kind of information goes out of date quickly, and one might be better served by one of the many UNIX newsletters available.

Appropriately, this book is titled a *Guide* because it is no more than that. It provides only cursory peeks at what UNIX is and leaves many stones unturned. No mention is made of C or any other of the substantial programming tools. One might guess that the author's only experience with UNIX was editing the book with "Ed" (an old, line-oriented editor) as this received the most space of any topic in the book.

As educational material, I find it does not come close to the quality of the original UNIX documentation. In particular, I recommend that people interested in learning the basics of UNIX read *Unix for Beginners* by Brian W. Kernighan. For people hungry for material with even more depth, try "The UNIX Time-Sharing System", by Dennis M. Ritchie. This paper appeared in the *Communications of the ACM*, Vol. 17, No. 7, July 1974.)

Also available

Les Hancock and Morris Krieger: *The C Primer*, McGraw-Hill, 1983, 235 pp.; $14.95. An excellent introduction to the C language, with many examples.

Thomas Plum: *Learning to Program in C*, Plum Hall Inc. (1 Spruce Ave., Cardiff, NJ 08232), 1983, 372 pp.; $25. A comprehensive textbook, with exercises and examples.

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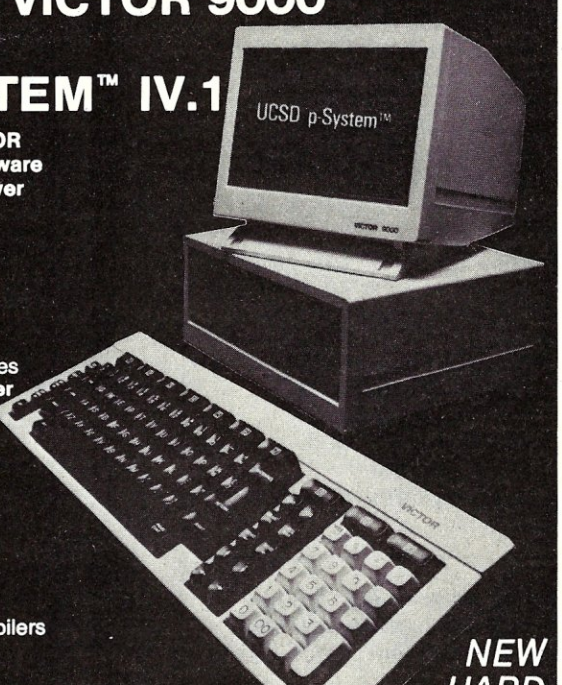

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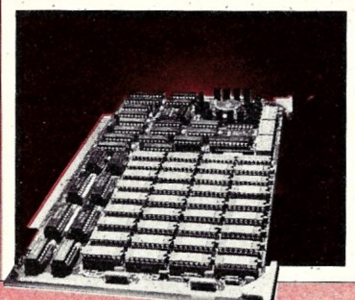

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CIRCLE 304 ON READER SERVICE CARD

Software Directory

Program name: WASH
Hardware system: Any CP/M 1.4 or 2.2 system
Language: Object code
Description: WASH is a CP/M utility to CLEAN up directory listing and file handling. The user just tags file names (shown alphabetically on screen) and the program copies them all to another disk. The same approach applies to ERAsing files (though the program gives you a second chance if you change your mind).

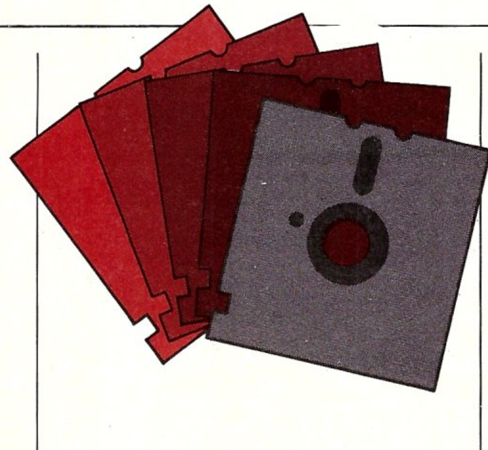
To REName a file only the new name has to be entered. The size of any file and the space remaining on a disk may be displayed. To view a file on the console or list it on the printer, just select the file name and enter the command.

You can move forward or backward through the list to select a specific file from the file name list. A ZIP ahead command moves in a forward direction 10 file names at a time to permit rapid access to a given file.

The program first displays the command menu with selected disk drive file names shown in alphabetic order. It contains error messages such as: Name Already Exists, Directory Full, Not Found, etc.

WASH may be installed for use with any 80 x 24 screen console that has cursor control, or may be used with a scrolling console or hard copy terminal.
When released: November 1982
Price: $49.94 plus $1.50 S&H; CA residents add tax
Included with price: 8″ SSD or 5¼″ soft sectored or North Star SD or DD disk and installation instructions.
Where to purchase it:
Elliam Associates
24000 Bessemer St.
Woodland Hills, CA 91367
(213) 348-4278
CIRCLE #346 ON READER SERVICE CARD

Program name: IM/80 information manager
Hardware system: CP/M-80
Minimum memory size: 64K
Language: Microsoft Basic 5.x



Description: IM/80 consists of programs designed to create, retrieve, edit, post, soft, calculate, and report a randomly accessible database. IM/80 is easily learned and used. The User's Manual contains a tutorial and many examples. A selection of sample configurations such as mail list, inventory record, employee record and more are included.

Database size is limited only by disk storage capacity (32,767 records max.). Databases can be configured with up to 255 characters/field, 511 characters and 511 fields/record. Fields can be string (alpha, numeric, symbols, or combinations), or numeric including integer (−32768 to +32767), single precision (up to 6 digits), and double precision (up to 12 digits).
When released: July 1982
Price: $199.95
Included with price: IM/80 program in both compiled and source code; comprehensive manual.
Where to purchase it:
Advent Products, Inc.
965 North Main St.
Orange, CA 92667
(714) 997-0800
CIRCLE #347 ON READER SERVICE CARD

Program name: ZAS Z-800 software development package
Hardware system: Any CP/M-80 system
Minimum memory size: 48K
Language: C
Description: Version 2 includes a Relocatable Macro Assembler, supporting both segmented and nonsegmented code using standard Zilog instruction syntax. Using 34 directives, ZAS provides unlimited Macro redefinition and nesting, "include files" and nested conditional assembly, and supports external CALR references to allow shorter code without sacrificing modular programming. Program sections can be flexible combined and renamed with included ZLK Task Builder. ZLK, accepting commands from console or a "command file," can be directed to convert program sections into absolute form. Multiple ZLK operations can be used to build complicated overlay programs for the Z-8000. The ZLD family of object code manipulation utilities facilitates downloading, translation to Intel HEX format, and host system memory loading to support dual processor configurations. The ZEX runtime monitor supports any dual processor system with CP/M-80, and is supplied in both source and object form.
When released: Version 2: October 1982
Price: $395
What is included: ZAS (cross assembler), ZLK (task builder), ZLD (object utilities), and ZEX (runtime monitor), with umlimited bug maintenance and free 1-year update service.
Where to purchase it:
Western Wares
P.O. Box C
Norwood, CO 81423
(303) 327-4898
CIRCLE #348 ON READER SERVICE CARD

Program name: RHESUS® Erased-File Recovery System
Hardware system: 8080/Z80 CP/M
Minimum memory size: 20K
Language: Machine code
Description: RHESUS recovers accidentally erased files that have not been overwritten by subsequent disk operations. It works with standard CP/M 2.0 or later systems, including those with hard disks, and is in-

tended for nonprogrammers.
Features of RHESUS include both automatic and user-controlled recovery procedures, directory listings for both erased and active files, maps of recovery alternatives, file dumps in both hex and ASCII for both erased and active files, renaming of both erased and active files, HELP screens, and error messages in plain English.
Release: November 1982
Price: $65.00
Included with price: Software on 8″ SSSD (standard IBM 3740 format) or 5¼″ Micropolis Mod II disk and printed manual.
Where to purchase it:
Olsen Software
P.O. Box 91
Van Nuys, CA 91408
CIRCLE #347 ON READER SERVICE CARD

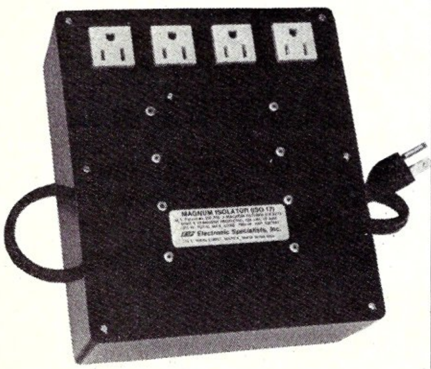
Program name: BackRest
Hardware system: At least one floppy and hard disk
Minimum memory size: 48K
Language: 8080 assembler
Description: BackRest will backup only files that were modified since the last time BackRest was run so only a few floppy disks will be used per backup. A report is created showing what has been done and statistics about hard disk usage and bad files. Exceptions can be described in a control file such as files that should be skipped even if they were modified, or USER areas that should be skipped. Restoration of the entire hard disk, any single USER, or any single file can be requested through the menu-driven system.
When released: December 1983
Price: $99.95
Included with price: Software on 8″ CP/M disk and manual
Where to purchase it:
Stok Software, Inc.
17 West 17th St.
New York, NY 10011
(212) 243-1444
CIRCLE #350 ON READER SERVICE CARD

Program name: Millionaire
(stock market simulation)
Hardware system: 64K, 1 disk drive & terminal
Minimum memory size: 64K
Description: An educational/recreational simulation program creates newspaper headlines and graphs. Stocks perform according to headlines, not random numbers. Games allow margins, puts, calls, and borrowing on new worth. User is charged interest on loans and tax on profits, plus commissions on all transactions.
When released: October 1983
Price: $99.95
Included with price: Disk and manual
Where to purchase it.
Blue Chip Software
19824 Ventura Blvd.,
Suite 125
Woodland Hills, CA
91364
(213) 881-8288
CIRCLE #337 ON READER SERVICE CARD

New Products

Software pollution control

Magnum Isolator, made by Electronic Specialists, Inc., is designed to control severe electrical pollution. Incorporating heavy-duty spike/surge suppression, the Magnum Isolator features four individually quad-Pi filtered AC sockets. Equipment interactions are eliminated and disruptive/damaging power line pollution is controlled. The Magnum Isolator will control pollution for an 1875W load. Each socket can handle a 1000W load. The



model ISO-17 Magnum Isolator eliminates severe AC power line pollution for smooth program operation.

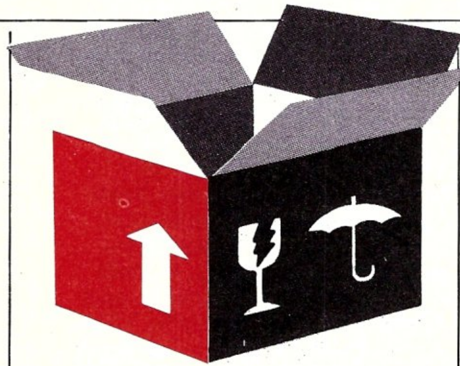
Price: $200.95.

Electronic Specialists, Inc., *171 S. Main St., P.O. Box 389, Natick, MA 01760; (617) 655-1532.*

CIRCLE #338 ON READER SERVICE CARD

FILETRAN for Osborne 1 computer

FILETRAN for the Osborne 1 incorporates a number of new features not found in earlier versions. The most important of these is the addition of the new CP/M-to-CP/M file transfer module. This new capability transfers files from virtually any "alien" CP/M format to the "host" format—in this case, the Osborne 1 disk format. This module takes advantage of the full capabilities of the WD1793 disk controller chip available in the Osborne 1 computer, which includes the standard IBM 3740 and System 34 formats, with variable number of bytes per sector, in both single and double-density modes, and some non-IBM formats. This new module allows automatic input of a variety of logical parameters such as skew factors, number of sectors, CP/M block size, and others which are variable depending on the particular CP/M manufacturer. These variables are contained in an easily updated text file included with the system.



A "wildcard" file transfer feature allows selected groups of files to be transferred with just a single "wildcard" file specification, greatly reducing operator input time.

The "alien" CP/M directory display has the features of the CP/M XDIR function and always displays the total capacity of the disk, the block size used, the file names, the size of each file, and the remaining space available on the disk.

The operator interface takes full advantage of the Osborne 1 screen enhancement features to make the visual displays clear and informative. Data routing options allow the user to route data to the CRT, the line printer, or both. A new disk contents display allows the HEX/ASCII side-by-side display to be presented on a file basis.

The manual now includes a new section that discusses the incompatibilities between Level II Basic and MBasic 5.x, and suggests methods by which these incompatibilities may be easily removed. Included in this new section is a simple, one-line function that transforms the Level II Basic "PRINT@" statement into its equivalent for MBasic 5.x.

Price: $99. FILTRAN Operations Manual, $20.

Business Micro Products, *311½ 8th St., Suite 400, Glenwood Springs, CO 81691; (303) 945-8166 or (800) 547-5995 ext. 8080.*

CIRCLE #339 ON READER SERVICE CARD

Error-correcting S-100 hard disk controller

The Advanced Digital Corp. Model HDC-1001 is an S-100 based controller capable of operating up to four 5¼" or 8" hard disk drives.

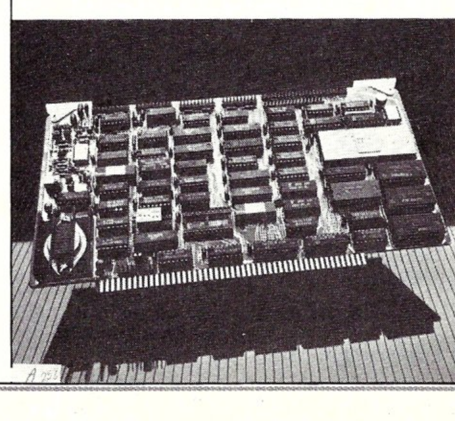
A unique error-correcting capability includes a 32-bit computer-generated polynomial to detect and correct errors (up to 8-bit single-burst correction; multiple-burst detection; and programmable correction/detection span).

The Model HDC-1001 is completely S-100/IEEE-696 compatible and provides control for up to four drives and up to 8 R/W heads. It has built-in data separation and features data rates of up to 5 MB/sec, 256 sector addressing range, CRC generation/verification in ID fields, unlimited sector interleave capability, automatic retries on all errors and automatic restore and reseek on seek error. It comes with a CP/M BIOS disk.

Price: $500.

Advanced Digital Corp., *12700 B Knott Ave., Garden Grove, CA 926411 (714) 891-4004.*

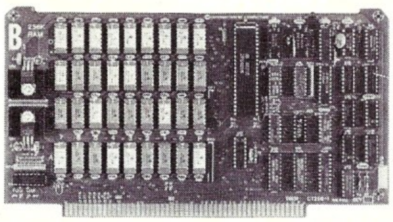
CIRCLE #340 ON READER SERVICE CARD



New Products continued . . .

64K to 1MB S-100 DRAM memory board

The Compu/time CT256-I is an IEEE-696 S-100 dynamic RAM memory board with parity generation that can be configured from 64K to 1MB of RAM. Using 64K x 1 DRAM ICs, the maximum memory capacity of the board is 256K. However, jumpers exist which allow the configuration to be extended to 1MB.



Designed for 8-bit microprocessors, on-board memory management allows addressing a full MB of RAM for systems generating only a 16-bit address. Also supported are the 24-bit addressing lines, Phantom and Error Trap options. Memory mapping can be performed on either 16K or 64K boundaries. A parity generation and detection scheme uses a Parity Latch and LED error indicator, interrupt on parity error, Error Trap on parity error or under software control. Parity errors can be examined on an input port.

The dynamic RAM refresh is controlled by the DP8409 DRAM controller chip. With the use of this IC, refresh cycles are performed transparently to system operation. As such, the dynamic RAM refresh can also be enabled during processor wait states or reset via a jumper option. An M1 wait state generator is available.

A unique feature of this memory board is the use of mapping registers. These mapping registers are organized as 4 words of 6 bits and are accessed through I/O ports. Depending upon the I/O port selected and the data value, the user can access up to a full MB of memory per board. Also, because of this board's configurability, a maximum of 3 CT256-I's may be used per system. This means that an 8-bit microprocessor could have access to 3MB of memory.

Prices: Kit, 64K, $400; 128K, $500; 192K, $600; 256K, $700. A&T: 64K, $450; 128K, $550; 192K, $650; 256K, $750.

GSR Computers, *60-10 69th St., Maspeth, NY 11378.*
CIRCLE #341 ON READER SERVICE CARD

Hard disk subsystems

Pragmatic Designs has introduced three hard disk subsystems for OEMs and systems integrators. While usable with many different disk controllers, the units are designed specifically for use in CompuPro computer systems equipped with CompuPro Disk II hard disk controller.

The PD-10M (10MB) and PD-20M (20MB) are based on the Fujitsu 2300 series 8″ hard disk drives. The units are powered by a heavy-duty power supply, housed in a heavy-gauge steel chassis, and painted to match the CompuPro enclosures. Standard 19″ rack-mounted units are also available. Units are fully assembled, tested, burned in, retested and formatted, and include all necessary cables and instructions. One-year warantee. Also available to CompuPro computer system users are the PD-20MS and PD-40MS—fully configured systems including disk drive subsystem, CSC CompuPro Disk II controller, all cabling, CP/M 2.2 and CP/M-86. CompuPro's MP/M 8-16 is available as an option.

Prices: PD-10M, $3,895; PD-10M, $4,295; PD-10MS, $5695. Rack mount is an additional $75 per unit.

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The AMUSIGRAF system is offered as an affordable package which includes the following:

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- -TMS 9918A data manual
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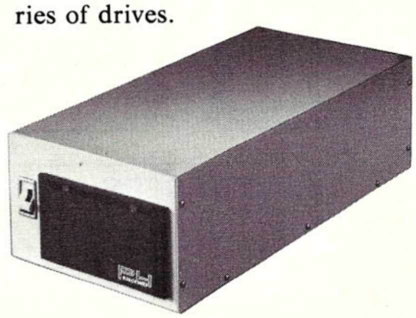

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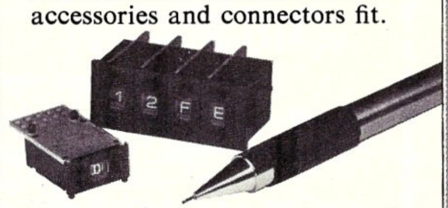

PICO-D-301-AK-2 is priced at $5.78 for 100 pcs. **Alco Electronic Products, Inc.,** 1551 Osgood St., North Andover, MA 01845; (617) 685-4371.
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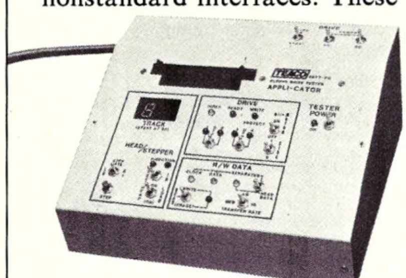

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